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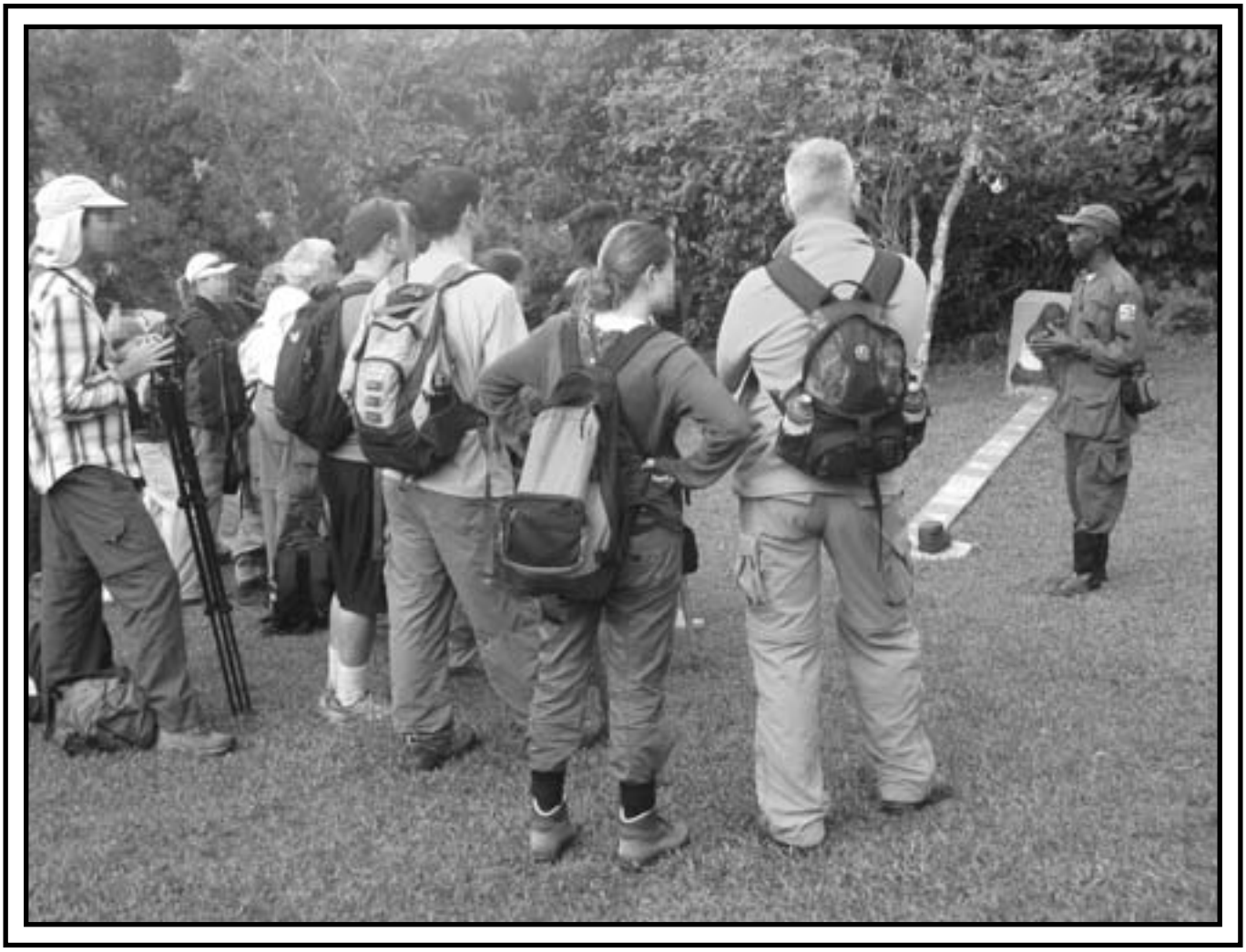

Great Ape Conservation in the Burhinyi Forest

Can we Maintain the 7-metre Gorilla Tracking Regulation?

The Gorillas of the Ebo Forest – Community-led Conservation

Differences between Gorilla Subspecies

BERGGORILLA & REGENWALD DIREKTHILFE

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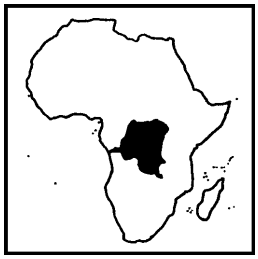

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Report of the Extensive Patrols in Maïko National Park, December 2011

As part of the monitoring activities taking place In Maïko National Park during the festive period, between Christmas 2011 and the New Year, extensive patrols were carried out over 40 days in all three sectors of the park: the northern, the central and the southern sector. Before the patrol staff went into the field, sensitization meetings were organised between the Park Administration and the *Frankfurt Zoological Society* (FZS), and with the various stakeholders, to prepare the ground. The patrol had the following objectives:

– to sensitize all stakeholders to the re-launching of monitoring activities in the centre of the park,
– to persuade the communities to resume protection activities and to increase the size of the controlled areas,
– to document and collect biological data and data on the threats the park is facing, and
– to prepare a report, including a map showing the areas covered by the patrols.

During the second half of June 2012, four patrols were conducted in the three sectors: one in the northern sector, one in the central sector and two in the southern sector. The patrols stayed in the forest for 10 days, sleeping in tents during that time. For this purpose, the teams were equipped with a number of Law Enforcement and Monitoring chits, a GPS, a camera and camping equipment.

Results

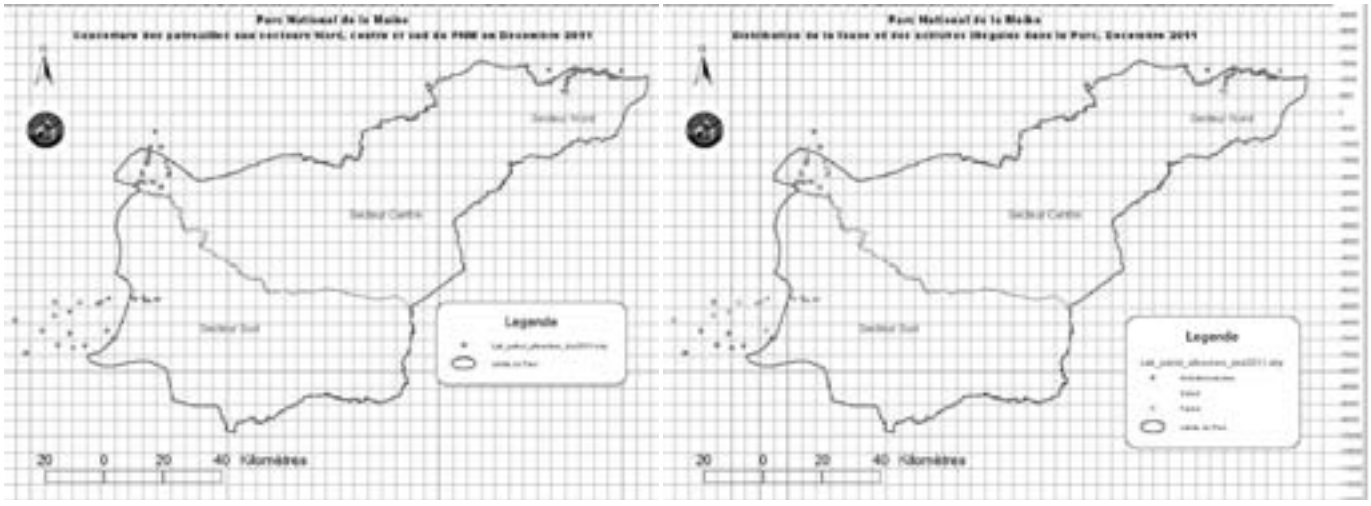
The patrols made interesting observations on the fauna and the threats facing the fauna, in all the areas covered. A total of 63 rangers participated in the patrols which covered 38 quadrats of 5 km^2 in the park and the buffer zone.

Human activities discovered during patrols: Major threats to the integrity of the national park are the presence of armed bands and the exploitation of minerals (gold and cassiterite) within the park and its buffer zone. The latter activity usually involves the installation of semi-permanent mining infrastructure inside or near the park – which results in a plethora of illegal activities such as poaching using traps, guns and automatic rifles. This has resulted in a flourishing trade in trophies, bushmeat and live animals to the detriment of the fauna and causing habitat destruction and water pollution.

A ranger destroys a snare that was found in the park.

Photo: ICCN

Observations of animals and corresponding threats: Animals were observed directly, or their presence was recorded indirectly through tracks, dung, nests, vocalisations, burrows, etc. In a forest ecosystem like Maïko, data on the occurrence of large



Left: patrol coverage; right: the occurrence of animals (lighter dots) and human activities (dark dots) as observed by the patrols in December 2011

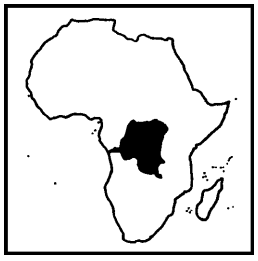


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Table 1: ***Various indicators of human activity that were observed by the patrols in the park and its buffer zone***

Sector	Northern			Central			Southern			Total
Type	On-going	Abandoned	Dismantled	On-going	Abandoned	Dismantled	On-going	Abandoned	Dismantled	
Mining camps/mines	4	3		1	3		3	5		19
Poaching camps	1	11		2		1		1		16
Fishing camps		5			2			1		8
Settlements/fields							3			3
Traps			3			5			5	13
Man-made tracks	1			2			1			4

mammals are usually obtained from their tracks, dung and nests. Of the key species, elephants and chimpanzees were observed in the northern and central sectors, while signs of okapi were found in the northern and southern sectors. Signs of hippopotamus and buffalo were found frequently in all three sectors. No signs of gorillas were found in the areas covered by the patrols.

Unfortunately, there are not enough data on the distribution of species and human activities to permit statistical analysis. However, as is clear in the southern sector, the more permanent settlements and mining camps there are, the less often you see signs of animals.

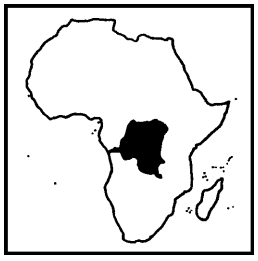
Limitations and Recommendation

The continued presence of armed bands within the park poses a major challenge to the continuation of monitoring activities and to the ecological survival of the park in general. Based on the results of this extensive FZS-led patrol the following observations can be made:

- The fact that no patrols have been organised for over one year has given the ICCN and its partners the reputation of not implementing conservation activities. This has worried more than one village community and the local political stakeholders.
- The launch of such a concerted patrolling effort during the festive period has demonstrated that the rangers have the will and energy to resume patrols as one of their essential tasks. This has convinced the local stakeholders that the activities planned for 2012 will be conducted with the same intensity, and serves as a reminder to insurgents.
- A survey of patrol posts carried out on the Penealuta road during the same month documented a wish among villages for the rangers to

Table 2: ***Threats observed, actions taken and results achieved during the sector patrols in December 2011***

Type of threat	Action taken and results achieved	Confiscated objects
Poachers	1 encounter in the central sector	elephant tails, one metal saw, one spear, 10 nylon nets, one saucepan
Trapping	30 traps dismantled	– 18 wire snares – 158 nylon cords – 1 nylon reel – 29 hooks – 4 spades – 2 machetes
Poaching camps	12 poaching camps discovered	
	1 active fishing camp discovered	
	8 abandoned fishing camps discovered	
Exploitation of minerals	7 active sites where gold is exploited identified	
	8 abandoned sites where gold used to be exploited identified	
Settlements within the park	some fields of food crops identified	
	1 man-made track in the interior of the park identified	
Man-made track	this is being monitored	



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Arrested poachers

Photo: ICCN

return to their patrol posts. This is expected to deter the poaching that is currently being carried out by elements of the Congolese armed forces operating in this sector. The population is aware of the importance of active protection of the park – despite the limitations of operational activities.

– Calculations to determine the total time spent on patrol and GPS analysis of distances covered have not yet been finalized – thus these data are not given in this report. A training course on data analysis should be delivered in the near future.

We recommend the continuation of patrolling activities, specifically four patrols of 10 days each with a total of 63 rangers participating and covering the three sectors. Another lengthy interruption in patrolling activities could negate the effort and resources applied to date. We urge the partners of Maïko National Park to support implementation of the park's management programme.

Dieudonné Boji Mungu-Akonkwa

Maïko rangers

Photo: ICCN

We would like to express our sincere thanks to FZS who provided the rangers' rations during the 10 days on patrol, and generally for implementing this activity with funds provided by Berggorilla & Regenwald Direkthilfe. We sincerely thank those local authorities whom we contacted in order to resume protection activities. In particular, we commend those brave Maïko rangers who have resumed patrols with great motivation even after their work had been suspended for over one year.

Great Ape Conservation in Non-protected Areas: Case of the Burhinyi Community Forest

The Burhinyi Community Forest, located in the South Kivu province of eastern Democratic Republic of the Congo (DRC), is one of several patches of tropical forest located between the Kahuzi-Biega National Park and the Itombwe Natural Reserve. Both are natural homes of numerous endemic, endangered and protected species of animals, birds and plants, including the eastern lowland gorilla, *Gorilla beringei graueri*, and the chimpanzee, *Pan troglodytes schweinfurthii*. The location of the Burhinyi Chiefdom is 27° 33' to 28° 46' E and 2° 54' 03"– 2° 54' S. The communities in that area are Bashi and Barega; the forest is located in Mwenga territory.

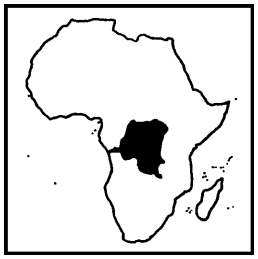
Recent field expeditions conducted in the Burhinyi Community Forest have confirmed that groups of gorillas and chimpanzees inhabit this non-protected forest, which is "managed" by local communities according to traditional views and uses focused on natural resource exploitation. These communities exploit forest resources and engage in slash-and-burn agriculture to survive, a situation exacerbated over the past 15 years as they have become increasingly impoverished by ongoing armed conflict in the region.

Given the penury of data regarding the Burhinyi Community Forest and the great apes inhabiting it, as well as the vulnerability of the forest to human pressure and the plethora of threats to its great ape population, *Strong Roots*, a Congolese nongovernmental organization, organized a research expedition to the forest in March 2012, following previous meetings with local and traditional authorities in the Chiefdom of Burhinyi. The objective of this expedition – conducted by a team of socioeconomic surveyors trained in development and sociology, primatologists, and botanists – was three-fold: first, to gather definitive evidence of great apes' presence and preliminary information about their habitat; second, to better understand the socioeconomic context of communities living in and around the forest; and third, to ascertain the ways in which communities exploit the forest and their views concerning its conservation.

Protection of Great Apes and Traditional Conservation Approaches

The presence of gorillas and chimpanzees in the Burhinyi Community Forest has been confirmed by two independent groups of researchers. During the course of recent field research focusing on rodents conducted by the Centre de Recherche en Sciences Naturelles (CRSN) de Lwiro in collaboration with the Chicago Field Museum, 26 chimpanzee nests were identified. The March 2012 research expedition led by *Strong Roots* also identified and photographed chimpanzee nests as well as three gorilla nests (one terrestrial and two arboreal) and collected gorilla droppings.

There is no formal conservation policy that governs exploitation of the Burhinyi Community Forest, with the



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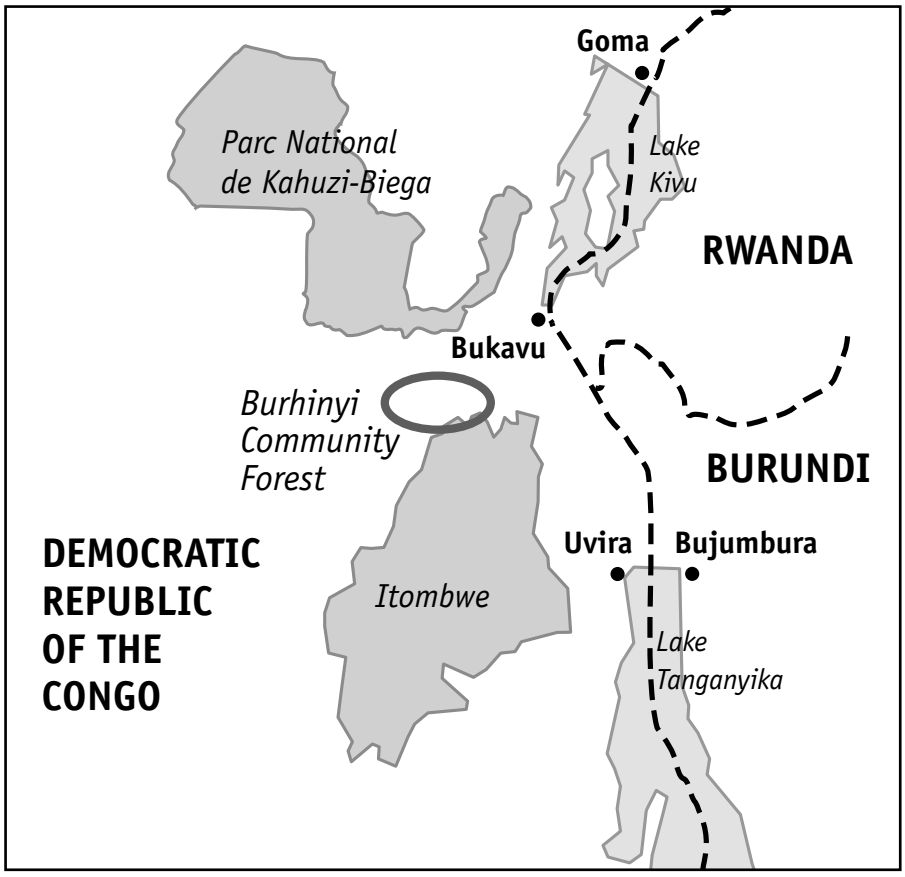
important exception of a ban on hunting great apes and baboons imposed by the traditional ruler of the chiefdom, known as a "Mwami", in 2010 and designation of a sacred area in the forest where access is forbidden without the consent of traditional authorities. Gorillas are also reported to inhabit this sacred area, known as Rwaga Mountain. When community members were asked how they traditionally protect the forest, several measures were cited, including not cutting down trees in a "disorganized fashion" (trees should only be cut if they will be exploited in their entirety), not clearing forest land by burning, and not hunting pregnant animals, among others.

While local initiatives for protecting the forest exist, they fall short of comprehensively protecting great apes and their habitat. Despite the purported traditional prohibition on clearing forest land by burning, researchers found widespread evidence of this practice to clear land for new homes and farms, particularly in the densest sections of the forest. Most alarming, community members in the groupement of Cirere reported having killed 50 gorillas prior to the hunting ban imposed by the current Mwami because they had become so numerous that they were believed to represent a threat to the population.

Thus, at the same time that local communities possess important traditional knowledge relevant to biodiversity conservation, anthropogenic pressure also poses serious threats to many species, including those totally protected by national and international law, such as great apes. This is due to two principal reasons:

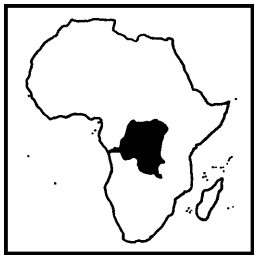
1. Communities living in and around the Burhinyi Community Forest lack sufficient knowledge regarding its long-term conservation. They do not believe that household-level exploitation, such as gathering firewood or hunting, poses a threat to the forest, given its vastness.
2. The socioeconomic context of forest communities is characterized by a high level of poverty and a high level of dependency on natural resources for survival. This translates into threats to great apes and their forest habitat such as exploitation of timber and non timber forest products, charcoal production, hunting of bushmeat, artisanal mining, and clearing forestland for farming and human settlement.



Socioeconomic Context of Forest Communities

According to a multidimensional poverty index based on socioeconomic indicators in six areas (demography, education, housing, health, and food/economic security), the rate of poverty in communities living in and around the Burhinyi Community Forest is 57%, with 19% of households living in severe poverty. The high poverty level of forest communities has a direct impact on the types and degree of human pressure that the forest and its great ape population confront, as illustrated by three aspects of the socioeconomic context: livelihoods, health, and education.

Nearly all livelihood activities in forest communities depend upon exploitation of forest resources, and the high population growth rate (average household size is 7.1 persons) means that this will take an increasingly large toll on great apes and their habitat in the decades to come. Agriculture and animal husbandry are the two most



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important livelihood activities and are practiced by 96% and 69% of households, respectively. The wide practice of agriculture poses a particular risk to the forest and its great ape population because farmers engage in slash-and burn tactics. Other livelihood activities include exploitation of timber and non timber forest products, hunting, artisanal mining, and craft production.

Lack of access to both health care and education are critical problems in forest communities. 45% of households surveyed have one or more members who are chronically ill, and the rate of child mortality is 23%. 49% of household heads surveyed have never attended school. Furthermore, 53% of households have one or more school-age children who are not enrolled in school, and 30% of households have three or more school-age children who are not enrolled. The high disease burden augments household poverty at the same time as anthropozoonoses pose an epidemiological threat to great ape populations that share their forest habitat with surrounding communities. The low level of education further perpetuates poverty and thus increases the long-term likelihood of irrational exploitation of forest resources to meet household needs and the associated risks to great apes.

Protection of Great Apes and Role of the "Community Forest" Approach

While the objective of the Congolese government is to extend the size of protected areas to up to 15% of the national territory by 2020, recent research on Protected Areas Management Policies in the Democratic Republic of the Congo has found that this objective is hindered by conflicts between protected area managers and the surrounding local and indigenous communities. These conflicts exist in large part as a result of the inappropriate approaches used by the government to establish existing protected areas. In the case of Burhinyi, when asked about the role that the government should play in protecting their forest, community members were emphatic that it should not impose "integral conservation" of the forest – their sole livelihood source – by establishing a national park or a forest reserve. They insisted that conservation of the forest should remain the prerogative of local leaders and communities who have "managed" this forest since the time of their ancestors and that the role of the government or other external actors should be limited to providing targeted assistance to help them protect their forest.

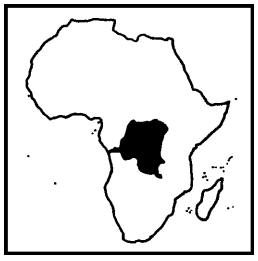
Given the lessons learned from the establishment of existing protected areas and the viewpoints of forest communities such as those in Burhinyi, the "Community Forest" approach is the most feasible manner to extend the size of protected areas in Congo and better protect great apes living in forests currently designated as non-protected. This approach implicates communities in the design and daily management of the forests on which they rely for subsistence. The main limitation of this approach is that legislation does not yet exist in Congo to establish or regulate community forests, with the exception of a few sentences that reference forests on which communities rely for subsistence in the Forest and Mining codes. Lack of skills, knowledge and limited community empowerment in the field of conservation and great ape protection are additional obstacles that must be addressed for the "Community Forest" approach to be realistic and successful.

Future Plans

There is an urgent need to undertake comprehensive biological surveys, further assess the impact of human activities on fauna and flora, and develop an appropriate community-based conservation strategy for the Burhinyi Community Forest. *Strong Roots* has released a Concept Note calling on stakeholders to contribute to the long-term conservation of the forest and its great apes; key activities proposed to achieve this aim are forest mapping, estimating the abundance of the great ape population, and designing a comprehensive forest conservation strategy in collaboration with and to be implemented by local communities, including a Great Ape Monitoring Team to collect data on a daily basis and a Community-Based Conservation Committee that will work to assure the long-term preservation of the forest. These activities will be complemented by animal husbandry and community health projects, as well as Environmental Education activities catered to local communities and schools. This initiative will provide the forest-dependent communities

Originally it was assumed that the eastern gorilla orphan Ihirwe (see Gorilla Journal 43) is a mountain gorilla, but a genetic assessment now confirmed that she is a Grauer's gorilla. She will join the other Grauer's gorilla orphans at the GRACE sanctuary.

Photo: Jan Ramer



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of Burhinyi with the knowledge and skills necessary to engage in rational management of forest resources, as well as economic alternatives to the abusive exploitation of these resources

The Burhinyi Community Forest is the first non-protected area in the South Kivu Province where local communities are intending to apply scientifically-grounded conservation policies in concert with traditional knowledge and practices in order to protect great apes. The intent of this pilot project is to assure the long-term preservation of the Burhinyi Community Forest and its great ape population using a community-based conservation model that can be replicated in other non-protected forests in the Congo Basin region. This project will also provide the DRC government with incentives and tools to create relevant legislation for Community Forest management and achieve its 2020 objective of extending the size of protected areas to 15% of the national territory.

Dominique Bikaba, Diane Cowel, Bertin Murhabale and Ntamwira Niranda

This research has been realized thanks to a grant from the Indigenous Leaders Conservation Fellowship Program awarded to Dominique Bikaba by Conservation International. We are particularly indebted to Mwami Chirhulwire II Richard and all the local authorities who participated and mobilized their populations for the meetings and surveys that permitted us to collect this information. We are also grateful to Papy Cimalamungo and David Mushagalusa for contributing to this research.

Oil Exploration in the Virunga National Park

The British oil company SOCO International has received permits to go ahead with oil exploration in the Virunga National Park. The company obtained approval for aero-surveys, which involve flying over Lake Edward. They stated that any activities beyond this would only be conducted with approval of the government and in consultation with stakeholders.

Orders signed by the Congolese ministries appear to give SOCO authorisation to carry out a range of oil exploration activities in the park. The company could also extend the exploration to on-the ground seismic surveys. This approval was given despite a commitment in March 2011 by the Congolese Environment Minister to suspend oil exploration in the park pending the result of a Strategic Environmental Assessment. The assessment, funded by the EU and other international donors, is expected to be complete in late 2012.

The Mikeno Sector, where the mountain gorillas live, is not involved in these activities.

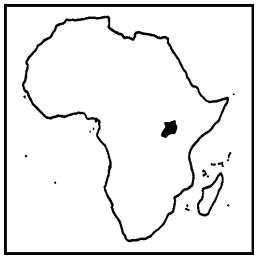
Heavy Fighting in the Mikeno Sector

Bosco Ntaganda is wanted by the International Criminal Court for alleged war crimes. He was Laurent Nkunda's second in command in the Congolese rebel group National Congress for the Defence of the People (CNDP). In early 2009, he broke with Nkunda, and since then, he has served as a General in the Congolese army. Ntaganda left the army at the end of March 2012 when he heard rumours that he was to be arrested by the Congolese police. After this, several hundred mutineers left the army. They are former members of the CNDP and had been integrated into the national army under a 2009 peace deal. These mutineers call themselves M23 and are led by Sultani Makenga; Ntaganda stated that he had no link with them. Rwanda is accused to back the rebels but denies it.

At the end of April the M23 started to attack the Congolese army in Masisi. On May 8th, the M23 with reportedly around 1,500 men entered the Mikeno Sector of the Virunga National Park, where the mountain gorillas live. Battles between the rebels and the army continued with mortars and heavy machine gun fire, even in and around the park's patrol posts. UN combat helicopters fired missiles into the presumed rebel positions. The sector was closed for tourism, the ranger post at Bikenge was severely damaged and the rangers were evacuated from Bukima. In the meantime the heavy fighting has continued, more ranger posts have been damaged and looted. In mid-June the M23 took control of the Bunagana border post and the road to Uganda. The situation did not improve until June 27th.

More details and news in the blog of www.gorilla.cd
(see also UN Security Council reference on page 27)

A different rebel group (Mai Mai) attacked the headquarters of the Okapi Wildlife Reserve in Epulu on June 24th. 6 people were killed, 13 okapis were killed and one injured, all ICCN and OCP buildings and offices were damaged or burned, equipment and medical supplies were stolen.



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Seven Years Later: Can We Maintain the 7-metre Gorilla Tracking Regulation?

The mountain gorilla (*Gorilla beringei beringei*) is listed as Critically Endangered (C1) by the *International Union for the Conservation of Nature* (IUCN). As of Spring 2010, the estimated total number of mountain gorillas worldwide was between 780 and 790 (Palacios et al. 2011). Bwindi Impenetrable National Park (BINP), Uganda contains an estimated half of the world's mountain gorilla population with 31 known gorilla families.

Currently, there is one group habituated for research, 9 groups habituated for tourism, and 21 groups remain wild. Eight people are permitted to track the tourism-habituated gorillas per family group per day and their viewing time is limited to one hour. Two of the 9 tourist groups were opened for mock tourism in spring 2011 and the *Uganda Wildlife Authority* (UWA) plans to provide more tourism-habituated groups for the public in the future (G. Balyesiima, pers. comm.).

Ecotourism has been crucial to the conservation of the mountain gorilla and provides a significant amount of economic revenue to the Democratic Republic of the Congo, Rwanda, and Uganda (Sandbrook & Semple 2006). It is no surprise that gorilla tourism, and great ape tourism in general, are on the rise, though there are inherent risks involved with increasing contact between humans and great apes.

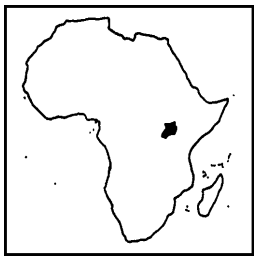
The primary concern for the mountain gorilla is the transmission of fatal diseases. The *Mountain Gorilla Veterinary Project* reviewed causes of mortality for over 100 mountain gorillas, and found that the second greatest cause of mortality, following trauma, was disease, specifically respiratory diseases (Cranfield 2008). It is possible for a single tourist out of the thousands that annually visit the World Heritage Site to pass pathogens (e.g. influenza) to the gorillas (Cranfield et al. 2002). A recent case in Rwanda showed that two wild mountain gorillas died during a respiratory outbreak in 2009. In this case, the human metapneumovirus (HMPV) infection showed a close relationship to South African human isolates, leading experts to believe that it was a result of tourism (Palacios et al. 2011). Ecotourism and other threats to mountain gorilla health will continue to increase (Wilson 1995, TIES 2006).

Two separate studies carried out in 2004 and 2011 at BINP show that the 7-metre distance for gorilla tracking is not maintained. In order to protect these last remaining mountain gorillas, appropriate research and preventative measures, in addition to the 7-metre distance regulation, need to be rigorously implemented (Cranfield 2008, Sandbrook & Semple 2006, Wallis & Lee 1999).

The 2004 study analysed data collected between February and December near Buhoma village in the Mukono parish of BINP (Sandbrook & Semple 2006). Tourists participating in the study tracked the habituated gorilla groups Rushegura, Mubare, and Habinyanja. The study aimed to determine how close tourists come to gorillas during a gorilla tracking viewing, and whether the current regulation of 7 m is adhered to. In total, 361 tourist interviews were conducted, representing 133 independent tourist tracking groups. The mean distance between tourists and gorillas at the time of closest contact was 2.76 m, with no reported events of physical touching. Sandbrook and Semple discovered that juveniles, which are more vulnerable to diseases, had closer distances but shorter time durations near tourists.

Tourists viewing gorillas in Bwindi Impenetrable National Park, Uganda under the 7-metre rule.

Photo: Allison Hanes



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"The results demonstrate that the present rules are failing and that the risk of disease transmission may be greater than previously believed."

The much shorter 2011 study also conducted interviews within BINP borders at the UWA gorilla tracking briefing point and various types of accommodation, within and beside park entrance gates, from the middle of May through the end of June 2011. One interviewee had tracked a newly habituated group while all other 24 interviewees tracked the same groups as 2004 – Rushegura, Mubare, and Habinyanja. Interviews showed that tourists encounter gorillas at distances below the 7-metre rule, or even experience direct contact. The average closest distance the gorillas came to the interviewees was approximately 2.20 m, and 5 had physical contact with a gorilla.

The results of these studies show that the 7-metre rule is clearly not enforced properly, and the proximity between gorillas and tourists is dangerously close. The closer humans are to gorillas the higher are the chances that pathogens can be spread between humans and animals (Macfie & Williamson 2010). Keeping tourists further away would greatly reduce exposure. In a controlled environment without any wind or ventilation factor, sneeze particles can travel 6 m (20 feet), influenza can be transmitted up to 20 metres, and with light wind and ultraviolet conditions airborne organisms, aerosol or dust particles can travel much further (Homsy 1999).

The respiratory syncytial virus can remain infectious via droplets and fomites up to 12 hours (Black 2003). RSV is the leading cause of serious upper and lower respiratory tract infection; in infants and children, it accounts for 125,000 hospitalizations and 450 deaths annually in the United States. No cure exists for it and, like most respiratory viruses, infants or immunocompromised individuals are at more risk for severe morbidity and have a higher risk of mortality. The majority of close interactions and direct contact moments during a tourist trek are with more curious younger gorillas, where gorillas touch the shoes, boots, or bottom of the trousers of tourists.

The 2011 study was not meant to be a duplicate of the 2004 study, but it does show that contact distance and frequency between tourists and gorillas are higher 7 years later. With a much smaller sample size, 5 of 25 interviews (20%) reported events of physical contact with gorillas, compared to 0 of 361 interviews (0%) in 2004 (Sandbrook & Semple 2006).

The risk of disease transmission between tourists and gorillas rises with increasing proximity. Especially since tourist group size and number of habituated groups has increased in the parks and may continue, officials need to find a way to enforce and maintain distance between humans and gorillas during treks (G. Balyesiima, pers. comm.). There are many reasons why the 7-metre distance is hard to maintain, such as poorly trained trackers, lenient trackers, dense forest impeding viewing, and curious juvenile gorillas (Sandbrook & Semple 2006).

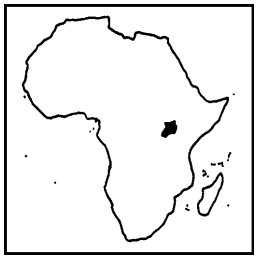
The 7-metre distance has been a controversial regulation for over 7 years. Improved strict enforcement is needed, and efforts to ensure this must be sought more aggressively by giving UWA staff more frequent and bet-

Quotes from Tourists in the 2011 Study

"The visual of 7 metres is really good; one did not need to know the language. It was an effective way of delivering the message, although he could have made it more of a point. I believe that some guides and trackers felt that in order to be nice you are lenient, but being nice does not have to result in breaching the 7-metre distance. A guide can be nice and professional while keeping the distance."

"I do not think the 7-metre rule was followed and this was in part because they wanted to accommodate the tourists but this is where they are wrong. I think the kind of tourists that spend the time, money, and effort to come here are more than willing to follow regulations. That took away from my experience, knowing that rangers were not enforcing their own regulations. It concerned me."

"If it is really important to keep the 7 metres then they should be enforcing it. As a photographer it is really nice to get closer but I am probably not the first to say that you got to do what is best for the animals. It is hard to know since they are not enforcing it, then is it really needed? That was a little confusing to me. If they told me I really had to stay back 7 metres I would do it. I think they need to decide how important this distance is and then really enforce it. They were not serious about the 7 metres and when we were told to move back it was more for us than the gorillas. We approached much more than 7 metres. I could have reached out and touched the gorillas. No one ever asked us if we were sick. I think if we were told you can get the gorillas sick then people would definitely stay back 7 metres. Most people that come out here all the way to see the gorillas care about them and if we were told getting too close could hurt them we would of course step back."



UGANDA

Seven-metre reference at the UWA briefing point in Bwindi

Photo: Allison Hanes

ter quality refresher trainings and by improving education to tourists. The health risks posed by tourists to gorillas, and the regulations, must be made available from the home country of the tourist (e.g. travel agencies, travel health clinics) all the way until the first steps of the trek. "These possibilities now require urgent consideration because if action is not taken there is a risk that the tourists who believe they are supporting gorilla conservation will unwittingly contribute to their further decline." (Sandbrook & Semple 2006) A revamped higher quality educational video must be watched in its entirety before tourists are placed into groups prior to the pre-departure briefings. We cannot depend on the 7-metre distance regulation to protect mountain gorillas from disease transmission.

The difficulty of maintaining the 7-metre distance is indisputable, given so many factors including animal behavior, dense forest conditions, lenient guides, and curious juvenile gorillas. Data show that the 7-metre rule is still being transgressed, and that people and gorillas are on occasions in even closer proximity to one another than in the past. Additional preventative measures on top of enforcing the 7-metre gorilla viewing distance are vital in the protection of the mountain gorilla. Protocols and recommendations will need to be monitored closely by staff and appropriate alterations made in order to protect the remaining Virunga Volcanoes and Bwindi Impenetrable National Park mountain gorilla populations.

Allison C. Hanes

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Curious juvenile of the Rushegura gorilla family

Photo: Allison Hanes

CROSS RIVER

New Regional Action Plan for the Conservation of Cross River Gorillas Underway

Marking of World Environment Day by school conservation clubs

Photo: WCS

In 2007 IUCN published a five-year (2007–2011) regional Action Plan for the conservation of the Cross River gorilla *Gorilla gorilla diehli* (Oates et al. 2007) outlining recommended actions that stakeholders believed if implemented would make a significant difference to the survival of the Cross River gorilla. Over the last five years the Action Plan guided efforts to improve the conservation status of the population. To ensure that future conservation strategies and actions are up-to-date with, and effectively address current threats and conservation challenges a review and revision of the existing Action Plan was necessary. From 22–24 February 2012 international scientists, conservation managers, representatives of funding institutions, government officials of the two range states – Nigeria and Cameroon – and other stakeholders met in Limbe, Cameroon to review the 2007 plan and develop a new one for the next five years (2012–2016). The workshop, organized by the Wildlife Conservation Society (WCS) with funding from the U.S. Fish and Wildlife Service (USFWS) and United Nations Environment Programme – Convention on Migratory Species (UNEP-CMS), was attended by over 40 participants representing international and local conservation organizations, government agencies, and institutions including WCS, USFWS, World Wide Fund for Nature (WWF), International Union for Conservation of Nature (IUCN), Ministry of Forests and Wildlife of Cameroon (MINFOF), Federal Ministry of Environment of Nigeria (FME), Nigeria National Parks Service (NNPS), North Carolina Zoological Park (NC Zoo), UNEP-CMS, Fauna and Flora International (FFI), Media Impact, the Last Great Ape Organization (LAGA), San Diego Zoo and Pandrillus among other NGOs, community-based organizations, and government institutions.

The specific objectives of the workshop were:

- to review the implementation and impacts of the 2007 Action Plan on the conservation of Cross River gorillas,
- to present recent research results relevant to planning for Cross River gorilla conservation,
- to conduct multi-stakeholder planning for the development of a new Action Plan for 2012–2016,
- to enhance the new plan with a structure for understanding and tracking the effectiveness of actions proposed for Cross River gorilla conservation,
- to agree on the structure, process and key roles for finalising, reviewing, producing, and distributing the 2012–2016 Action Plan, and
- to identify data gaps and future research needs.

Implementation and Impact of the 2007 Plan

Overall, a high level of success was achieved in the implementation of actions recommended in the 2007 Action Plan. These recommendations fall under two categories. The first categoriy are those that were taken across the Cross River gorillas' range and site-specific ones. Among the most effective implemented range-wide strategies and actions are:

1. Adoption of a landscape-based management approach involving effective cooperation between conservation managers across the border. Facilitating greater cooperation between implementing government institutions and NGOs on both sides of the border including stronger transboundary collaboration for protection, monitoring and research efforts in the Cross River National Park–Takamanda National Park area.

CROSS RIVER

2. Expansion of efforts to raise awareness among the people about the value of conservation in general and about the uniqueness of the Cross River gorilla in particular. These efforts resulted in increased local support and improvements in state wildlife legislation.
3. Increased engagement of communities in Cross River gorilla conservation efforts, encouraging increased community support and participation. For example, support for the establishment of a community conservation initiative in the Mbe Mountains in Nigeria and the setting up of a Gorilla Guardians programme in Cameroon (Nicholas 2009) both contributed significantly to gorilla protection in unprotected sites.
4. Building local capacity for gorilla research and conservation. Local capacity building was encouraged and supported in recognition of its benefit and necessity for long-term conservation of Cross River gorillas. The need for greater commitment to building local capacity for gorilla conservation in the region was stressed and has been recommended for continuation in the new plan.
5. Continued research to better understand the population biology and ecology of the Cross River gorillas, including surveys of poorly-known areas, the monitoring of known populations, and more intensive genetic sampling. Since the launch of the 2007 Action Plan there has been an increase in research focusing on Cross River gorillas including three current PhD research projects. Monitoring of known populations has been enhanced by the introduction of a Cybertracker system (hand-held computer and research software), helping to standardize data collection and management. Increased survey effort yielded new records of gorilla presence in areas outside their previously known range, thus expanding the known range of the Cross River gorilla by over 50 percent (Bergl et al. 2011).

Site-specific actions recommended in the 2007 plan that were successfully implemented and effective include improvement of protected area infrastructure and law enforcement, upgrading of the protection status of certain sites, and development of community-based land-use plans.

Cross River gorilla Action Plan workshop session

Photo: Sean Southey

Workshop Outcomes and the Future of the Cross River Gorilla

Based on an intensive review of the 2007 Action Plan and examination of recent research results participants at the workshop have formulated a set of priority actions that would be implemented over the next five years to improve the conservation outlook of the Cross River gorilla. Successful implementation of the new set of recommended actions and ultimately the conservation of Cross River gorillas depends on the commitment of all stakeholders – local, national and international. With stronger will and commitment of the governments of both range countries, increased community support, and sustained donor support it is hoped that implementation of the actions recommended in the revised Action Plan will have significant impact on the survival of Cross River gorillas. At the end of the highly fruitful meeting participants dispersed with a better understanding of the threats and challenges impacting the survival of Cross River gorillas, but also with a reinforced vision for the future for these gorillas, a future where Cross River gorillas are better understood, better protected, more abundant, and able to move freely across their landscape.

Inaoyom Imong and Chris Jameson

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GORILLAS

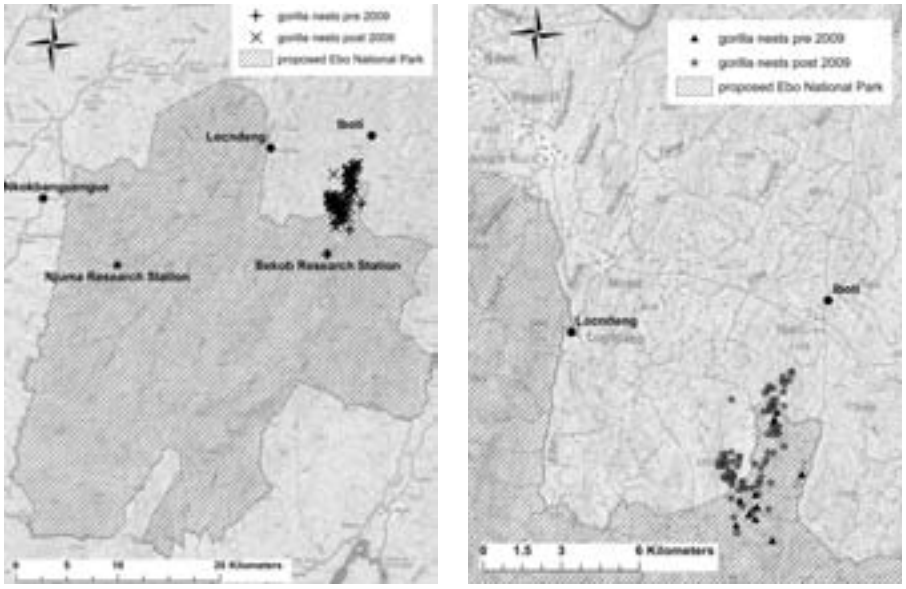
The Gorillas of the Ebo Forest – Developing Community-led Conservation Initiatives

An isolated population of gorillas lives in the Ebo forest, Cameroon, between the Cross River gorillas and the western lowland gorillas south of the Sanaga river. These gorillas are a relict and intermediate population of what might once have been a much more continuous distribution of gorillas over this region. The Ebo forest is one of the most important remaining tracts of closed-canopy forest between the Cross and Sanaga rivers and contains one of the most functionally intact populations of forest mammals in this region. It has been highlighted as an "exceptional priority site" in the Nigeria-Cameroon chimpanzee regional conservation action plan (http://www.primate-sg.org/action.plans.htm).

The Ebo Forest Research Project (EFRP), part of the Zoological Society of San Diego's Central Africa Program, has been managing permanently-manned research stations in the Ebo forest since 2005. Today, two stations, on the west and east sides of the forest, act as bases for deterring hunting activities, monitoring the threats to wildlife, monitoring primate populations themselves, and as bases for scientific studies on primate and other species.

We know that the gorillas only exist in a relatively small (c. 25 km^2) area of forest in the north-east of Ebo, within 5 km of the villages of Iboti and Locndeng. This part of the forest is only partially contained within the boundaries of the proposed Ebo National Park, and partly within what is due to be classified as the "Yingui Council forest". It is not clear why the gorillas have chosen to live in this area when the central part of the Ebo forest would seem to be more appropriate, and a more targeted study is needed to elucidate the factors determining the distribution of gorillas.

Our research efforts have focused on determining the distribution (using nests and other signs) and feeding ecology of Ebo gorillas using faeces, as well as enabling genetic analysis from faecal samples. Between January 2010 and September 2011, we recorded 666 gorilla nests within 107 nest groups, ranging in number between 1 and 33 nests. Since 2009, more gorilla signs have been observed outside the proposed Ebo National Park boundary, and only a few kilometres from Iboti and Locndeng villages. Between January 2010 and January 2011, 199 faeces were collected for feeding ecology studies and samples were taken from 43 fresh faeces for future genetic analyses. During this period, gorillas were observed opportunistically on only four occasions.



Left: The proposed Ebo National Park with the Ebo Forest Research Project research stations and gorilla distribution; right: gorilla signs in relation to villages and the proposed national park boundary

Maps: Bethan Morgan

As a result of our studies to date, we believe there to be fewer than 25 individual Ebo gorillas remaining, and our best estimate is 15–25 animals. Tracking the gorillas is currently not possible, due to the rockiness of the forest and the lack of tracking knowledge. We are also reluctant to exert undue pressure on the remaining gorillas, and prefer to gather information from secondary sources, such as nest sites and faecal samples.

From the initial establishment of our research station in April 2005, the EFRP has been working closely with communities, who were initially hostile to our presence and activities but have gradually begun to understand our work and start to respect and collaborate with us. We engage local community members as porters, monitoring staff, and team leaders. From 2010, we began seeking ways for traditional rulers in villages adjacent to the Ebo forest to be actively involved in the conservation of this forest. This culminated in the first ever meeting of traditional authorities from villages around the Ebo forest, which was held at the Limbe Wildlife Centre in June 2011. During the three-day workshop, which was attended by 20 traditional rulers and three village elites,

the biological riches and threats faced by the Ebo forest were explored, and the role traditional authorities currently play and could play in biodiversity conservation were discussed, as well as the Cameroon Wildlife Law. By the conclusion of the workshop, it was clear that the traditional rulers had became increasingly committed to conserving their rich heritage. They promised to

1. support the creation of the Ebo National Park,
2. fight hunting and the bushmeat trade in their respective villages,
3. carry out a census of shotguns and their holders in their villages and forward the list to the governmental administration,
4. classify all primate species as 'Class A' animals (and therefore regard them as totally protected species).

Copies of gorilla information posters which were produced with funds from *Berggorilla & Regenwald Direkthilfe* in 2010 were distributed to the traditional authorities at the meeting, and later in the villages. At the request of the traditional authorities, a series of sensitisation meetings were organised in all villages around the Ebo forest between November and December 2011. These sensitisation meetings, which were attended by around 1000 community members, were chaired and facilitated by the traditional rulers themselves. At the end of the meetings, the traditional rulers and communities resolved, among other things, that the decree creating the Ebo National Park should be signed by the Prime Minister without further delay and that if necessary they would meet the Prime Minister to push through the Ebo National Park dossiers, and that they would create anti-poaching committees in each village to check all illegal hunting activities.

One other recommendation of Ebo traditional authorities is the promotion of sustainable alternative income and protein sources in their communities where the mainstay economic activity is bushmeat hunting and trade. Based on needs expressed by the two communities (Iboti and Locndeng) the EFRP has been supporting and working with local common initiative groups to establish poultry, piggery and cocoa farming in small demonstration projects. In each village, groups were given either high yielding cocoa pods and 2000 polythene bags to start a cocoa nursery, one male and three female piglets or 100 chicks. We are carefully monitoring the success of these projects, both in terms of the health and reproduction of the animals and cocoa, but also by monitoring attitudes and activities of members of the common initiative groups, who include hunters. To date, the cocoa and piggery projects seem to be thriving, and the pigs have adapted

Support for the Clubs des Amis des Gorilles in the Ebo Forest

In the vicinity of the Ebo forest, Bethan Morgan is starting to develop "Clubs des Amis des Gorilles" in each of the villages closest to the gorillas to promote community participation, responsibility and pride in the Ebo gorillas. We decided to fund these Clubs with US$ 5,000 for the second half of 2012 – or even more, if we succeed in raising more funds! This support will be used for the following activities:

* sensitisation meetings
* monthly disbursements to the meetings of the Clubs des Amis des Gorilles (for supporting monitoring, banner production, stationery and other items)
* monitoring team boots, raincoats, compasses, watches
* developing and printing forms and membership cards
* fuel for meetings, gorilla monitoring
* T-shirts "Club des Amis des Gorilles"
* quarterly newsletter production and printing
* football tournament (trophy, prizes, shirts, footballs)

Bank Account:
Account number 353 344 315
Stadtsparkasse Muelheim, Germany
Bank code number 362 500 00
IBAN DE06 3625 0000 0353 3443 15
SWIFT-BIC SPMHDE3E
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Postscheckkonto 40-461685-7
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Help us to support the conservation of the Ebo gorillas together with the local population!

Address:
Berggorilla & Regenwald Direkthilfe
c/o Rolf Brunner
Lerchenstr. 5
45473 Muelheim, Germany

well to the local food conditions. Conversely, the poultry project has already failed. We and the communities are already learning valuable lessons, and we foresee that these small demonstration projects have the potential to ameliorate some aspects of day-to-day life in the villages, while emphasising the need for the impetus and development of these initiatives to come from the village itself, not the EFRP.

In addition to this small-scale livelihood initiative, the EFRP in consultation with local communities has devised a new strategy for gorilla conservation: Club des Amis des Gorilles (CAG, Gorilla Guardian Clubs) in the villages closest to the small gorilla population. Whilst still at the preparatory and consultation stage, these clubs will have the overall goal of conserving the high biodiversity of the forest, but will target flagship species, particularly gorillas, chimpanzees, drills and Preuss's red colobus, each of which have a deep cultural history and tradition with the communities. This is particularly important given the current unprotected status of the Ebo forest, and the fact that there are currently no Ministry of Forestry and Wildlife officers posted to this large area, and therefore no systematic law enforcement efforts on the ground.

We envisage that once the CAG goes fully operational in each community, members will voluntarily adhere to the club rules and each will have a membership card. The club will meet regularly to update members on gorilla conservation issues. Three-week cycles of community-based monitoring of gorilla range and human threats will be carried out by two club members (hunter/ex-hunters) and at least one EFRP staff member. During monitoring, information will be collected on indirect signs of gorillas, including nest number, locality, constructions and faeces, with GPS readings, photographs and age class determination (in order to develop a map of Ebo gorilla localities). The monitoring teams will also collect data on all signs of human influence in the gorilla range, to monitor the level of threats over time.

Eventually, we hope to achieve a consensus on the way in which the communities can further protect the gorillas, such as by establishing and enforcing a "no-go" area for hunters encompassing the gorilla range, which will be possible through the development of participatory mapping developed in the coming years. Such large conservation commitments by communities will be impelled through informal three-weekly meetings at the community level, as well as general assembly meetings held quarterly.

We also intend to promote pride in the Ebo gorillas in the communities adjacent to the gorilla range, and have a number of ideas to develop this important aspect of conservation. We plan to reserve a section of our quarterly newsletter *Ebo Forest News* for news from the "Club des Amis des Gorilles", hold an annual "Coupe des Gorilles" football tournament between many villages in the Yingui area, and develop an annual Club des Amis des Gorilles calendar with photographs from the project.

One other piece of news hot off the press is that the Ebo gorillas will be included in the next IUCN-endorsed Conservation Action Plan for Cross River gorillas, which is currently being drafted. The Ebo gorillas will be assessed separately from the Cross River gorilla sub-populations on the Cameroon–Nigeria transboundary region, but including the Ebo gorillas within this Conservation Action Plan is appropriate given the small and isolated nature of the population. We hope that these efforts will also help national and international awareness-raising of the existence and threats faced by the Ebo gorillas, and efforts underway to conserve them.

Ekwoge Enang Abwe and Bethan Morgan

The Ebo Forest Research Project works in conjunction with the Government of Cameroon (MINFOF and MINRESI) and with WWF and WCS. This work is possible due to support from the Zoological Society of San Diego, Offield Family Foundation, USFWS Great Ape Conservation Fund, the Arcus Foundation and the Margot Marsh Biodiversity Foundation, to whom we are extremely grateful. We also thank Berggorilla & Regenwald Direkthilfe for supporting the production of village-specific Ebo gorilla posters.

His Majesty the Paramount Chief of Ndokbiakat (the Ebo region) addressing delegates at the first Ebo Chief's meeting, in June 2011

Photo: ZSSD/Abwe Abwe

GORILLAS

Buffer Zone and Human–Wildlife Conflict Management

Human–wildlife conflict is a major conservation and management issue wherever people and wildlife coexist. It can take many forms, including the destruction of crops and property, and competition for natural resources. Commonly the people worst affected by conflict are rural farmers. In the Virunga-Bwindi region, habitat destruction and human population growth mean that the mountain gorilla and other forest animals, such as bush pigs, elephants and buffaloes, are increasingly coming into contact with people, often leading to conflicts. For mountain gorillas, interactions with local people are a source of stress, can result in the transmission of human diseases, and can lead to direct physical attacks, disabilities such as loss of limbs from snares, and even death.

In the Volcanoes National Park, Rwanda, gorillas were almost never recorded as doing significant damage, but over the last few years, the situation has somehow changed, with many more incidents involving gorillas debarking eucalyptus trees and going further outside the park, and a noticeable increase in elephants exiting the park, while buffaloes are still the main cause of crop-raiding.

This trend, an increase of human–wildlife incidents over the years, is also observed in the Mikeno sector of Virunga National Park, Congo. Consequently, animals like buffaloes and elephants, but also gorillas, can potentially impact communities up to several kilometres from the park boundary. People are regularly injured by buffaloes or elephants, and fatal accidents have also been reported. Regarding the mountain gorillas in Congo, the Rugendo group was historically the only group that was reported outside the forest, and it has continued its habit of spending large amounts of time outside the park. Other gorilla groups or lone silverbacks are also now increasingly frequenting maize and banana fields on community land.

Some communities around the Mgahinga Gorilla National Park are experiencing severe problems with buffaloes and elephants outside the park. There is only one habituated gorilla group, Nyakagezi, that frequents the park on a part-time basis, and this group has never been reported outside the park.

Around Bwindi Impenetrable National Park, crop raiding by wildlife is an issue that contributes to hostility between the park and local communities. Even if gorillas come only third on the overall list of problem animals, their high profile gives them a particular weight in the perception of local communities. Habitat loss can partly explain why ranging patterns of some gorilla groups straddle the current park boundary. Most experts however suggest that gorilla habituation for tourism as well as increased protection have been the main factors explaining the increasingly high numbers of exits of gorilla groups to community land. A total of 9 habituated groups are known to have come out of the forest, or on the boundary, over the last 10 years. The "worst offenders" are Nkuringo, Habinyanja, Rushegura and Mubare groups.

Human–Wildlife Conflict Management

In Bwindi, the Human–Gorilla (HUGO) Conflict Resolution program was established in 1998 to prevent or mitigate the effects of conflicts between mountain gorillas and the human population living close to Bwindi Impenetrable National Park. The main activity to immediately address gorilla crop-raiding was a co-ordinated effort at chasing gorillas back inside the forest whenever they leave the park. The pilot program started with two Gorilla Monitoring Response Teams (GMRTs). They are made up of trained local volunteers chosen by their communities, supervised by a *Uganda Wildlife Authority* (UWA) ranger. The team leaders, also called HUGO supervisors, are UWA rangers, who monitor gorilla movements with GPS data, and report to the Park Warden in Buhoma. Whenever gorillas are detected outside of the park, GMRT members are mobilised to chase gorillas back into the park. The chasing activities were designed as a short term remedy to the conflict, but the broader HUGO program also included the initial activities of the UWA veterinary unit to address disease risks, which later included community health/hygiene sensitisation programs in human–gorilla conflict parishes.

An analysis in 1999 established that there were favourable results from continuous chasing. The other benefits identified during the analysis were that communities now understood that UWA was willing to respond to their concerns. Subsequent to the analysis, a third GMRT was started in 2000 and attempts at modifying land use patterns in areas frequented by gorillas especially in Nkuringo were made through land purchase between 2002 and 2004. In 2010, there were 7 HUGO groups on the Buhoma side, and in 2007, 3 HUGO groups were created on the south-east flank of BINP. On the Nkuringo side, the first HUGO group was created in 1998, and a second group in 2007.

The HUGO programme was extended to the Mikeno sector in 2001, and 3 groups of 10 people each were put in place in Jomba, Bikenge and Bukima. There is little information on the effectiveness and the impact of the HUGO teams in Congo, as all the data disappeared when the Rumangabo station was ransacked and looted by rebel groups in 2008.

The very first buffalo wall that was erected around the forest was at Mga-

hinga Gorilla National Park, immediately after its official gazettement as a national park in 1991. The first objective was to serve as physical demarcation, together with concrete pyramid markers. The second objective was to prevent large mammals, particularly buffaloes and elephants, exiting the park and causing damage on community land. Today the total boundary length in Uganda is ca. 16 km.

Construction of the buffalo wall around Volcanoes National Park in Rwanda started in 2002 and it was completed by 2007 (76 km). Around the Mikeno sector of Virunga National Park, the construction of the wall also began in 2002, and a total of 52 km was completed by mid-2007. A subsequent evaluation of the wall around the Mikeno sector gave evidence that not only had the wall helped in reducing crop raiding, especially from buffaloes, but it was also limiting encroachment of the park.

Buffer Zone Management

Buffer zones are blocks of land located between natural forests and cultivated areas that are managed to discourage wildlife from crossing between them. In its broadest sense, a buffer zone should be an area where land-use practices and land management are designed to reduce or prevent human–wildlife conflict. Before land-use changes were implemented at Nkuringo, there was no deterrent to habituated gorillas, which typically ranged up to 1 km beyond the park boundaries. A piece of land that incorporated the range of the Nkuringo group and extends approximately 350 m from the park boundary and stretches 12 km along the boundary was bought by UWA from the local community. The buffer zone has been divided into a "community exclusive use sub-zone", which is the outermost 12 km by 150 m, and an "actively managed sub-zone" which borders the park (12 km by 200 m).

Lessons Learned

Lesson 1: Human–Wildlife conflict has to be viewed in the broader context of cost-benefit analysis. Communities living near protected areas have to bear multiple costs: loss of access to the natural resources in the forest, exposure to crop-raiding animals, and even physical threats to property or human lives. On the other hand, modern conservation concepts have been advocating for many years the sharing of benefits with the communities living near protected areas. Ideally, the costs should be kept as low as possible and the benefits higher.

Lesson 2: Solutions aimed at preventing or mitigating human–wildlife conflicts have to be carefully and continuously assessed in the long run, through sustained monitoring systems. Very little has been done in terms of monitoring the outcome and impact of the various strategies aiming at preventing or mitigating the human–wildlife conflicts throughout the region. Because of this lack of quantitative datasets it is extremely difficult to make informed decisions and to properly assess what works and what does not, or what the general trends are over time.

Lesson 3: Solutions designed by humans are constantly challenged by adaptable wildlife. This requires constant vigilance and adaptable solutions by humans, but also basic and sustainable maintenance systems. A striking observation made during this study is that, once a human–wildlife conflict solution has been implemented, its impact lasts for a certain time and then fades away, sometimes to be completely obliterated. This can be attributed either to a lack of maintenance and follow-up of the solution, or to counter-solutions found by wildlife species, or, most likely, a combination of both.

Lesson 4: Land-use practices around protected areas are usually overlooked but could bring about significant changes in decreasing conflicts. With the exception of the Nkuringo buffer zone, community land starts where protected area ends, with no transition whatsoever. While designing barriers such as stone walls or trenches can have some impact, the issue of land use in the immediate vicinity of the forest is probably even more crucial to consider. The main obstacles are livelihood considerations and traditional resistance.

Lesson 5: "Participation" of local communities can be envisaged at different levels, but only certain types of participation have a real meaning and a chance of success. Communities around Nkuringo seem to have generally lost their motivation in the management of the buffer zone. As some respondents put it, they feel they are in a "wheelbarrow which is pushed around by other people". Poor communities which are on the borderline of meeting their livelihood requirements show very high expectations when offered potential solutions, at least in the beginning.

Lesson 6: Leadership among local communities has to be properly assessed and secured, and incentives revisited. Usual incentives, such as equipment or cash, do not necessarily offer guarantees of success, but proper leadership motivated by the interest of the community offers better prospects.

Lesson 7: Once identified and agreed upon, buffer zone objectives have to be thoroughly implemented. Based on community accounts, particularly the "frontline" populations living next to the Nkuringo buffer zone boundary, the level of crop-raiding has not decreased and many even claim that it has worsened. The gorillas are still spending a lot of time outside the park and even on community land outside the buffer zone. The most striking observation is that the inner zone,

which was supposed to be "actively manipulated so as to prevent the regeneration of natural forest", has in fact been left to regenerate. This secondary vegetation represents excellent habitat for several wildlife species, particularly gorillas. The outer zone, in many areas, is starting to resemble the inner zone, because attempts to cultivate buffer crops have failed and the vegetation is growing. The unfortunate conclusion is that, in the minds of many community members and critics, the park has been effectively extended.

Lesson 8: It is important to listen to communities before embarking on experimental buffer zone programmes. Since 2005, the Nkuringo buffer zone has seen a number of attempts at establishing buffer crops that would achieve the double objective of preventing wildlife from crossing the area and of providing the local communities with income-generating opportunities. None of these attempts has really worked, either for commercial or marketing reasons, or because of technical challenges. Both the communities in Nkuringo and the local government officials have always suggested tea as a good solution for the area. The Nkuringo region is perfectly suitable for tea plantations, although this solution would require some significant investments.

Lesson 9: Land purchase for conservation is a very complex issue that requires time for proper assessment. Nowhere in Uganda has the acquisition of land for conservation been more active than in Bwindi. The first plots of land were bought from private landowners, mainly farmers, in the Buhoma area in the 1990s. In the case of land purchase in Nkuringo, communities were consulted, and preparation for land acquisition took several years, during which plans for land-use were discussed at all levels. Assessing the value and merit of land acquisition is a delicate undertaking which at least requires the validation of the principles and objectives at the origin of the operation.

Recommendations

- Implement past recommendations
- Identify appropriate solutions for the sustainability of the HUGO programme
- Re-establish and maintain monitoring programs at all levels
- Look for innovative strategies in addressing human-wildlife conflict issues
- Consider tea plantations as ultimately the only viable and effective solution for the buffer zone in Nkuringo

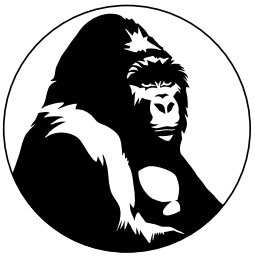
Summary of:
Kalpers, J., Gray, M., Asuma, S., Rutagarama, E., Makambo, W. & Rurangwa, E. (2011): Buffer Zone and Human–Wildlife Conflict Management. Pp. 105–137 in: Gray, M. & Rutagarama, E. (eds.) 20 Years of IGCP: Lessons Learned in Mountain Gorilla Conservation. Kigali (IGCP)

Transboundary Collaboration in Mayombe

The Mayombe forest, part of the Guineo-Congolian biome, forms the southwestern part of the tropical rainforest in the Congo Basin, and the southern margin of the distribution of a large variety of species of flora and fauna in Central Africa. The transboundary area of the forest is shared by Gabon, the Republic of Congo, Angola (Cabinda Enclave) and the Democratic Republic of the Congo. Following decades of still unresolved political and economic instability, and as a result of high population densities, the Mayombe Forest (at least 2,000 km^2) and its ecosystem services are subjected to a high rate of degradation, mainly through heavy logging and poaching in all four countries. The forest is a biome of species of outstanding universal interest, such as two species of great apes: chimpanzee and western lowland gorilla.

Although the Mayombe Forest contains important biodiversity and provides critical ecosystem services, most of the forest is unprotected in law or practice. Three protected areas form part of the Mayombe Forest in the Republic of Congo: the Dimonika Biosphere Reserve, the Mont Bamba Forest Reserve and the Coukouati Reserve. The only protected area in the Mayombe forest in D. R. Congo is the Luki Forest Reserve. The only designated conservation area in Angola is the Cacongo Forest Reserve, which was established in 1930 for forestry purposes, but a plan to gazette a national park in Cabinda is well advanced.

The idea of looking at the conservation of the Mayombe ecosystem from a transboundary perspective was first advanced by the Government of Angola and UNDP in 2002. This idea received momentum in 2009 when UNEP and IUCN with financial support from Norway started to work with Angola, Congo and D. R. Congo to establish a transboundary protected area in the Mayombe landscape. An initial intervention from July 2009 to June 2010 helped reinitiate a dialog and arrive at political consensus among the three states. Several baseline studies were initiated to improve knowledge of the political, socioeconomic and environmental context in the three countries. The main results from this initial phase are as follows: (1) the tripartite agreement signed by the three ministers in charge of forests in D. R. Congo, the Republic of Congo and Angola to establish a transboundary "platform", (2) the endorsement of the initiative and (3) the signature of the Cabinda declaration by the three ministers. Since then, the different organs (regional committee, national committees) have met, and



GORILLAS

accompanied the implementation of a number of scoping studies on potential landscape corridors, legal framework for a transboundary biosphere reserve, and socio-economic situation. The results of these technical studies were consolidated in a draft transboundary plan. The technical work was validated at an expert meeting in January 2012 in Luanda. The ministers met the following day and committed core funding to the interim secretariat which is based in Pointe Noire, Congo. Next steps will be the formal adoption of the transboundary plan and fundraising for the implementation of the transboundary plan. The meeting in Luanda was attended by Gabon and there are deliberations on how to include Gabon in the process.

Johannes Refisch

Differences between Gorilla Species and Subspecies

Present Gorilla Taxonomy

A species is a population (or group of populations), distinguished by the possession of one or more consistent heritable differences from other such populations. A subspecies is a geographic segment of a species, distinguished by the possession at high frequencies, but not as much as 100%, of one or more heritable differences from other such segments.

Most experts today accept two gorilla species, the eastern and the western gorilla, each with two subspecies. This taxonomy is also used in the IUCN *Red List of Threatened Species*.

Western gorilla, *Gorilla gorilla*
- Western lowland gorilla, *Gorilla gorilla gorilla* (Cameroon, Gabon, Equatorial Guinea, Cabinda, Congo Republic, Democratic Republic of the Congo, Central African Republic)
- Cross River gorilla, *Gorilla gorilla diehli* (Cross River area, on the border between Nigeria and Cameroon)

Eastern gorilla, *Gorilla beringei*
- Grauer's (or eastern lowland) gorilla, *Gorilla beringei graueri* (eastern D. R. Congo)
- Mountain gorilla, *Gorilla beringei beringei* (Virunga volcanoes and Bwindi forest)

But often it is also important to have a look at differences in certain populations to see the complete diversity of a species. The following brief review summarizes what we know about gorillas.

Gorilla Speciation

By far the most usual way in which new species form is when populations become isolated from one another. The two gorilla species are separated by about 900 km of forest, and the reason for this gap is the changing climate in Africa in the past. During the Plio-Pleistocene, lower temperatures and greater aridity changed the area covered by forests periodically. About 2.8 million years ago, ice sheets in the temperate zones became large enough to influence climate at tropical latitudes; local climate in Africa went through cooler and more arid, and warmer and wetter periods, respectively. Species that were adapted to tropical climates and life in forests, like gorillas, survived in forest refugia during the arid phases of the Pleistocene. When the climate had stabilized again, migration and dispersal recommenced linking previous refugia. The gorillas dispersed into the regrowing forests, but rivers prevented the western and eastern gorillas from coming into contact again.

Isolation of populations is also the origin of subspecies. It usually develops slowly while some degree of gene flow may continue; this means that some individuals (in gorillas usually lone silverbacks) travel between populations until the distance between the populations becomes too large. Consequently, the differences between populations vary according to the length of time they have been isolated, and it is not easy to decide at what point they can be called different subspecies. The science to search for hints and to justify decisions about categories is called taxonomy.

Methods in Taxonomy

The traditional method that has been used to describe and differentiate taxa is to observe differences in colour and colour pattern, size and shape, and other bodily features, and take measurements. Bones, especially the skull, are the parts most frequently measured. But the methods have changed considerably since the scientific description of the first gorillas; on the one hand various statistical tests have been developed to compare measurements, and on the other hand, completely new methods of study have emerged – especially genetics.

Morphology: It is not easy to decide which differences are most important in taxonomy. In theory, any difference is useful, as long as it is heritable. Some evolutionary changes may have cascading effects, and lead to many more changes – for example, the bipedality of humans is the reason for many morphological differences between apes and humans, not just in locomotor anatomy. A more intractable problem is that it is often difficult to know for certain which differences actually are heritable. For example, it is known that gorillas, like many animals, grow more quickly and mature earlier in captivity than in the wild, and may end up larger – they may weigh more and females more often develop a sagittal crest.

Ecological conditions, for example food composition, may cause morphological adaptations that are not fixed genetically but develop during ontogeny. Certain kinds of food require a

certain jaw form and a certain musculature; it is often difficult to discern what is genetically fixed and what was shaped by the food consumed over the years of development: for example, gorillas in mountainous regions often have strongly everted jaw angles, and it is suspected that this is simply a response to the pull of the masseter muscle because of a fibrous diet, but it is very difficult to prove one way or the other. It is therefore important to examine carefully how skull features vary, for example in association with terrestrial/arboreal differences; examination of growth allometries can show how adult differences are produced and can help us to understand how postnatal development can aid in our functional interpretation of morphologies.

In his early studies, Colin P. Groves found that Grauer's gorillas are intermediate between Virunga gorillas and western gorillas in many respects. Regarding dental and craniomandibular features, however, Grauer's gorillas do not appear to be morphologically intermediate between western and mountain gorillas, as might be predicted by dietary expectations given their feeding ecology. This shows that although differences between populations may sometimes be attributed to environmental influence, in many cases this cannot be the only explanation. In some cases morphological differences may reflect purely environmentally produced differences ("phenotypic plasticity"), although they may of course be due to genetic adaptations; even if there is little doubt that many of the gross morphological differences between gorilla taxa truly are heritable, differences in DNA sequences may be a more reliable indication for evolutionary developments.

Genetics: The present gorilla taxonomy was influenced considerably by studies examining genetic distance between gorilla populations. Many geneticists have asked how much genetic difference, or how much time since separation, is required to consider two populations different species, and there have been needless disagreements over this, but increasingly geneticists have argued that there is no reason to adopt different standards when looking at DNA from those that we use when looking at morphology; as we noted above, a species is distinguished by the possession of one or more consistent heritable differences from other species, and there is no difference in principle between fixed DNA base pair differences and consistent morphological ones.

In general, of course, conclusions from genetic studies have helped considerably to understand the evolution of gorillas. When two populations separate, the two sub-populations usually have different frequencies of certain gene variants or alleles that may be a result of genetic drift or of different selective forces. The distribution of these gene types (haplotypes) may be important for taxonomy.

Differences between Eastern and Western Gorillas

External Characters: Eastern and western gorillas are distinct in colour: black in the east, grayer and browner in the west. The saddle of silverback males extends to the thighs in western gorillas and is restricted to the back in eastern gorillas, except in old age. In western silverbacks part of the back often is almost completely bare. In western gorillas the hair is short and sparse on the brows, and the colour is often brightly reddish on the crown.

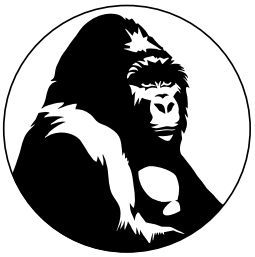
Another difference is the form of the nose. The nostril shape in *Gorilla beringei* is angular, in *Gorilla gorilla* it is rounded and padded at the sides, often called the "squashed tomato" nose shape. In eastern gorillas the nostril breadth is narrow, in western gorillas it is flared. A "lip" above the septum is present in western gorillas, while it is weak or absent in eastern gorillas. The nose in general spreads further down the upper lip in western gorillas.

The feet of western gorillas are quite distinct from those of eastern gorillas; the big toe has a smaller angle of abduction in eastern than in western gorillas, slightly more humanlike; western gorillas show an abduction angle more similar to chimpanzees.

Morphology: Eastern gorillas have shorter limbs compared to the length of the trunk, and a shorter and broader hand, though we need more measurements to be sure that they hold especially for some populations of *Gorilla beringei graueri*. There are some differences in the skull, such as the generally longer, narrower skull and, in particular, the long palate of eastern gorillas, and this is an especially marked difference between the two. More differences are: eastern gorillas have much larger cheekteeth, rather smaller incisors, and rather more sexual dimorphism in molar size than western gorillas, as well as more sexual dimorphism in the upper canines. In western gorillas the teeth are relatively small. These traits are associated with a more folivorous diet in eastern gorillas, although the meaning of the greater degree of sexual dimorphism in canine size is not clear.

The distinctive medial cuneiform anatomy that distinguishes eastern from western gorillas probably represents a longstanding adaptive divergence between the two lineages. It is explained functionally by increased terrestriality in eastern gorillas. If the more terrestrial adaptations present in the medial cuneiform of modern eastern gorillas are apomorphic (meaning "evolutionarily derived") within the genus, then these features probably evolved after gorillas first expanded into more montane environments, which may have occurred well before the last glacial period (before 0.1 million years).

Genetics: When certain parts (loci)



of mitochondrial DNA (mtDNA) are compared, the amount of nucleotide sequence divergence between eastern and western gorillas is very nearly the same as that between chimpanzees and bonobos. In nuclear DNA, there are fewer nucleotide substitutions than between the two *Pan* species. The reason for this difference between mtDNA and nuclear DNA may be that gorilla males travel much farther than *Pan* males, so that more difference can accumulate between different populations in mtDNA, which is purely maternally inherited, than in nDNA, which is derived half from the male line.

The initial population divergence of western and eastern gorillas might have occurred 0.9–1.75 million years ago, but some gene flow in both directions seems to have persisted until as recently as 78,000 years ago.

Eastern Gorillas: Differences of Subspecies/Populations

External Characters: Mountain gorillas are distinguished by the much stouter and more stocky build, much thicker pelage and shining black, long, shaggy hair. The hair of mountain gorillas is especially long and shaggy on the scalp (the supraorbital torus, the heavy bar of bone above the eyes, is also covered with shaggy hair). Virunga gorillas have a more developed beard than Grauer's gorillas. Grauer's gorillas may have brownish hair on the top of the head while mountain gorillas' hairs are all black. Although in Grauer's gorillas the hairs are generally shorter, especially on the scalp and around the face, they are very long on the arms in silverback males.

The nostril shape in Virunga gorillas is angular, in Grauer's gorillas, and at least some of those in Bwindi, more rounded; the outline above the nostril in Virunga gorillas is clear, in some Bwindi and in Grauer's gorilla it is not. The upper lip padding in mountain gorillas (including those in Bwindi) is weak, in Grauer's gorillas the lip is strongly, diffusely padded, making it convex in lateral view when the mouth is closed, and this padding extends about two thirds down the lip.

In Virunga gorillas the lateral toes are often webbed in between the digits and the great toe is less divergent, more adducted to the sole. The big toe is alsoshorter in Grauer's gorillas than in mountain gorillas, and the heel-to-big-toe-tip is only 84% of heel-to-second-tip. Several features of the medial cuneiform distinguish Grauer's from mountain gorillas; this has been studied recently by the noted comparative anatomist Matt Tocheri. The distinguishing characteristics of these two taxa appear unrelated to differences in the ability to abduct the big toe and to the frequency of arboreality.

The Skeleton: Mountain gorillas have a very large facial skeleton, wider than in Grauer's gorillas which have a noticeably narrow face which can be detected externally as well as on the skull; the ascending ramus (the ascending branch of the lower jaw) is higher in mountain gorillas, especially in females; the jaw angles are strongly flared in adults while they are not flared in Grauer's gorillas, although this could be phenotypic plasticity, as we suggested above. The long palate, which distinguishes all eastern gorillas from western gorillas, is extreme in mountain gorillas, which also have extremely large molar and premolar teeth. In Grauer's gorilla the whole skull is smaller, the humerus is longer and the clavicle shorter.

Morphological differences in the scapula, in limb proportions, hands and feet reflect the greater adaptation of *G. b. beringei* to terrestrial life, especially the Virunga gorillas.

Genetics: Mitochondrial DNA studies showed that 15 unique eastern gorilla haplotypes fall into two distinct clades: one includes all the analyzed Bwindi and Virungas gorillas, the other one the individuals from Tshiaberimu, Kahuzi-Biega (mountain and lowland sector) and the captive Grauer's gorillas. No haplotypes were shared between *Gorilla beringei graueri* and *G. b. beringei*, nor were any haplotypes seen previously in western lowland gorillas found in any of the eastern gorillas. Within the subspecies all populations shared haplotypes with others, indicating recent gene flow.

Genetic data suggest that mountain and Grauer's gorillas split 380,000 years ago. Population expansions (or bottlenecks) for both subspecies are estimated to have occurred around 25,100 and 22,100 years ago after the last glacial maximum.

So far it has not been possible to determine significant molecular and morphological differences among the Grauer's gorilla populations. Grauer's gorillas show substantial morphological signatures of hybridization, and this, combined with molecular evidence for migration of individuals from further west, strongly suggest that this region – or part of it – is a former zone of introgression.

The differences between *Gorilla beringei beringei* and *Gorilla beringei graueri* seem very marked, and as we have seen they even appear to be absolute as far as mtDNA is concerned. But caution is required before we start claiming that they differ 100%, therefore they must be distinct species: importantly, some *graueri* populations approach *beringei* morphologically, so the morphological differences at least seem to be found in a majority of individuals, but not all of them; while as far as mtDNA is concerned, not all populations of Grauer's gorilla have been sampled, and until a complete sampling has been done, we cannot be certain that 100% of individuals can be distinguished. Unfortunately, some populations of *graueri* no longer exist, such as those on the mountains west of Lake Edward (with the exception of a

very small population on Mt. Tshiaberimu itself), while others are very poorly known, such as those on the Itombwe mountains. Maybe DNA can be extracted from museum specimens, and so fill in the gap – then we will know more exactly whether mountain and Grauer's gorillas are truly units, distinct species, or whether (as at present classified) they do overlap in heritable characters and so are subspecies within the same species.

Differences between Montane and Lowland Forest Gorillas

Even if it is not clear which of the differences are adaptations to the extreme heights in the Virungas, these comparisons are interesting. Altitude strongly influences the availability and distribution of food. In general temperature decreases and wind speed tends to increase with altitude, and moisture from fog is very high. This results in marked differences in plant structure and availability, with canopy height and species diversity being greatest at lower elevations. Plants that provide fruit and lianas occur at greater densities and diversities in lowland forests. When fruits are scarce, gorillas travel less and consume primarily low-quality terrestrial herbaceous foods.

In the Virungas, most gorilla foods are constantly available, and this results in short daily path lengths and relatively large, stable groups with low levels of within-group feeding competition. Their ability to adapt to this diet may have enabled gorillas, rather than chimpanzees, to live in highland forest, at least in this area (chimpanzees are found in highland forest elsewhere, for example on the Rwenzoris). Lowland gorillas are more frugivorous than mountain gorillas, but fruiting trees show large seasonal variation in fruit availability. This leads to both longer path lengths and more arboreal behaviour. When fruits are available in large quantities, lowland gorillas travel large distances to search for this preferred food.

Differences in resource availability combined with reduced folivory could also have direct effects on western gorilla development. Western lowland gorillas have slower life histories than mountain gorillas. In Bwindi, their development resembles more the lowland gorilla development than that of Virunga gorillas; although they live on mountains too, the altitude is lower and the gorillas consume more fruits than in the Virungas. Other factors that may lead to slower development are stronger seasonality in the habitat and lower herb density.

Although in eastern gorillas the clearest split is between mountain and Grauer's gorillas, the Mt. Tshiaberimu population seems to have a special position within *Gorilla beringei graueri*. It is not clear whether their life on a high mountain is the reason for this. The Mt. Tshiaberimu gorillas approach the mountain gorillas in many respects, such as flaring jaw angles and a more adducted great toe. In some respects they are morphologically transitional between the gorilla populations of Virunga and Utu (the lowlands east of the Lualaba River, including the lowland sector of the Kahuzi-Biega National Park), while the Mt. Kahuzi gorillas show some features like Tshiaberimu and Virunga and some like Utu, and the Itombwe gorillas are more like the lower altitude groups.

Differences between Populations: Virunga and Bwindi Gorillas

Externally, Virunga and Bwindi gorillas are rather easy to tell apart – especially the nose of Bwindi gorillas looks more like a Grauer's gorilla nose than that of a Virunga gorilla, except for the usually shorter, less padded upper lip. The Virunga gorillas tend to be slightly larger in overall size than the Bwindi gorillas. These body size differences correlate well with the observed differences in diet, and the different altitudes and temperatures in the two areas also correspond to body size differences and explain some of the differences between the two populations: forms with larger body size and shorter limbs generally are better able to conserve heat and endure the cold than forms with a smaller body size and longer limbs.

The body hair is short and blackish in Bwindi gorillas, with brownish tint in sunlight; Virunga gorillas have long, shaggy, jet-black hair, especially long on the arms. The facial hair in Bwindi gorillas is short and does not hide the ears, they have no beard, they have sparse hair on their brows and adult males have some white hair on their face, while Virunga gorillas have long facial hair that hides the ears and forms a beard or whiskers on the face. The brows are hairy in Virunga gorillas.

In Bwindi gorillas the bare skin below the eyes shows very fine wrinkling; in Virunga gorillas it is heavily wrinkled, which results in a characteristic "nose print". The nose has no dorsal cleft in Bwindi gorillas; Virunga gorillas show a strong dorso-nasal cleft, the nostrils are relatively large.

The feet in the two populations are also different. In Bwindi gorillas the big toe cleft reaches the first metatarsal head (the metatarsals are the bones that support the toes; they are enclosed within the sole of the foot) and deeper than the level of the second metatarsal head. In Virunga gorillas the big toe cleft does not reach as far as the base of the toe itself, and is level with the base of the second toe. In some morphological indexes Bwindi gorillas are even more similar to western lowland gorillas: the foot breadth index in *Gorilla gorilla gorilla* averages 28, in Virunga gorillas 32 and in Bwindi gorillas 28.9. For the big toe cleft index the numbers are 63, 75, and 63.2, respectively.

Bwindi gorillas have longer faces, which may or may not have a biome-

Skulls of gorillas from Virunga, Itombwe and Gabon – note the different molar and premolar sizes
Photos: Hendrik Turni (2), Wikipedia

chanical explanation. They also have lower and narrower ascending rami, shorter mandibles than the Virunga gorillas and some other differences in the mandible. There are minimal differences between the two mountain gorilla populations in skull measurements.

This variation cannot yet be fully explained by functional morphology related to diet, although some of the skull and tooth differences do probably correspond to dietary differences. As already mentioned, gorillas in Bwindi appear to develop more slowly than Virunga gorillas, which may also be associated with differences in their diet. Clearly, there is no simple picture relating to dietary toughness and masticatory adaptations that can be presented in gorillas at this time. One must also keep in mind that the morphological differences may not all have biomechanical explanations, but instead may be due to genetic drift, because both populations are rather small, and it is possible that some of them may be due to phenotypic plasticity (as we explained above) rather than genetic at all.

Bwindi and Virunga gorillas were in recent reproductive contact, which explains their genetic similarity despite differences in anatomy; perhaps the two populations have undergone rapid morphological divergence since their separation, or possibly there always was selection for differences between them because of the different altitudes at which they live.

Western Gorillas: Differences of Subspecies/Populations

External Characters: There are only a few photos of wild Cross River gorillas taken from a distance, and only one adult female of this subspecies lives in captivity – at least, only one who is known to be a Cross River gorilla with certainty. Not much is known about the ecology, group structure, behaviour and life history of Cross River gorillas, although it is clear that they are living at medium-high altitudes, well above the altitudes where most other western gorillas live. There are not sufficient data, and comparisons of the two western gorilla subspecies are therefore very difficult.

Rothschild noted in 1908 that the skin of a Cross River gorilla showed a beard as long and thick as that of the Virunga gorilla. Unfortunately, there is very little material, and there has been no study that shows whether a beard is a general characteristic trait of Cross River gorillas. Some zoo gorillas have beards, but as their exact origin is not clear, it is possible that some western lowland gorillas have beards too.

The captive Cross River gorilla female in Limbe has comparably light body hair, but there is not enough information for a general comparison of the two subspecies. Western gorilla females in captivity show a wide variety of body colours.

Cross River gorilla feet, as far as our insufficient information goes, are shorter than those of western lowland gorillas, which suggests a greater degree of terrestriality.

Morphology: A striking difference between most Cross River gorillas and other gorillas is the broad, low nuchal surface of the skull (the area where the postural muscles are attached at the back of the skull). The greatest skull length, cranial length and face height in Cross River gorillas are shorter than in western lowland gorillas, but relatively broader. In males the palate is shorter and narrower, and in many males the sagittal crest is poorly developed.

The cheek teeth tend to have a smaller surface area than do other western gorillas. This may suggest that their diet is less abrasive and requires less dental processing.

Genetics: The mitochondrial DNA of all Cross River gorillas is the same as that of the gorillas of Ebo forest and of many in the main forests of the Cameroon Plateau region. Some 17,800 years ago, western lowland and Cross River gorillas diverged but substantial gene flow (~ 4 individuals per generation) between the two western gorilla subspecies probably ceased only about 420 years ago. Although only mtDNA has been studied, the very fact that Cross River gorillas do not differ from some populations of

G. g. gorilla indicates that the separation between them cannot be very deep, so despite the fact that *G. g. diehli* is derived from a subset of western lowland gorillas the habitat differences are clearly so intense that there has been strong selection in the Cross River population in the face of this strong gene flow.

As shown by genetic data, marked decline of Cross River gorilla population size began only about a hundred years subsequent to their separation from other western gorillas – that would be about 1700 A.D., probably following human population increase and agricultural expansion in the region. In contrast, the population size of western lowland gorillas increased after the divergence from the Cross River gorillas, probably due to the changing climate conditions since the late Pleistocene that led to repeated expansion and contraction of forest, as well as by more recent increased human impact on it.

Diversity within a Subspecies: Western Lowland Gorillas

Western lowland gorillas are by far the most numerous and the most diverse subspecies. Major river courses have played an important role in shaping boundaries of regional genetic groups, notably the Sangha River, the Ogooué River, and the Sanaga River. The Ivindo/Ayina River may have also influenced postglacial expansion of the remaining gorillas by directing the southern extension into northeastern Gabon. As far as their skulls are concerned, gorillas from the hinterland of Cameroon (the Cameroon Plateau) tend to be large with a broad skull; those from the coast of Cameroon and Gabon are smaller, with narrower skulls; those from the swampy Sangha River region are large like the Cameroon hinterland population but with shorter faces and smaller jaws. None of these differences will identify anything like a majority of individuals, and there is no question of recognising different subspecies within western lowland gorillas.

Study of mtDNA shows that there is some regional differentiation, but again it is only an average. One haplotype is confined to the Cameroon coast; a second haplotype characterises all gorillas from southern Gabon and neighbouring parts of the Congo Republic, and also occurs (more rarely) in northern Gabon; a third is found in the hinterland of Cameroon and northern Gabon; a fourth characterises all gorillas from east of the Sangha, and some from south-eastern Cameroon and northern Gabon; and a fifth is found all through Cameroon, and is the only one found in Ebo forest and among *G. g. diehli.*

Special Populations: Ebo and Bondo Gorillas

Very little is known about the small gorilla population in the Ebo forest that lies between the Cross River and the western lowland gorilla distribution areas. There are no photos and no individuals in captivity. The single skull that has become available does not resemble that of Cross River gorillas, but is most like skulls from the Cameroon Plateau; genetically, they share the same mitochondrial haplotype that is common in Cameroon Plateau gorillas (and is also the only one to be found in Cross River gorillas). Until we get more information, such as Y-chromosome or autosomal DNA, the affinities of this population will remain obscure.

The existence, until the early years of the 20th century, of gorillas in the district around Bondo and the Itimbiri River, in the northern D. R. Congo, is disputed by some people, but the evidence seems reasonable that they really did survive there until that period. In both cranial morphology and mtDNA they resemble western lowland gorillas. Whether they were isolated in that small region, or whether there had been, until shortly beforehand, intermediate populations stretching west of the Ubangi River joining them with other western lowland populations, is unclear. Evidently they will have been separated from the nearest populations of *Gorilla beringei* by unsuitable habitat, probably the vast *Gilbertiodendron* forests of the Ituri district, but genetic data indicate that there had been intermittent gene exchange between the two gorilla species even until the Late Pleistocene.

Conclusions

As we mentioned in *Gorilla Journal* 30 (2005), there was a proliferation of species and subspecies described in the late 19th and early 20th centuries, but study of more abundant cranial material, in particular, from the 1960s onward has put this into perspective and shown that most of the differences are on average only: two species, *Gorilla gorilla* and *Gorilla beringei*, are clearly very different, not on average but 100%, and the genetic data that are available so far fully support their classification as distinct species. Within *G. beringei* there are two very well-distinguished subspecies, but we need to know more about them, particularly about the variation from place to place within both of them, before we can confirm whether they are “merely” subspecies or fully distinct species in the sense of being Units of Biodiversity. Within *G. gorilla*, the Cross River population is clearly distinct morphologically, and rates as a distinct subspecies, even though it shares its mtDNA haplotype with neighbouring populations of western lowland gorillas. Morphology and genetics combine to show a complex pattern of interrelationships among populations within *G. g. gorilla.*

Angela Meder and Colin P. Groves

Unfortunately there is no space for the references here; you find them in the web version of the article. Or write to meder@berggorilla.org

READING

Ofir Drori and David McDannald
The Last Great Ape: A Journey Through Africa and a Fight for the Heart of the Continent. New York (Pegasus Books) 2012. 282 pages, 62 colour photos. Hardcover, US$ 27.95. ISBN 978-1-60598-327-1.

This book is not primarily a documentary work on the activities of the NGO LAGA – it is a rather an autobiographical account of Ofir Drori's enthusiasm for Africa. Starting with his infancy, Ofir draws the reader into his adventurous life, his desire to go to Africa and meet wild animals. During his first visit as a very young man, his curiosity brings him in contact with animals and humans and increases his love for this continent despite all the problems he faces. As soon as he can he returns; and after some dramatic experiences he decides to found an organisation that supports law enforcement in Cameroon: LAGA. This had never been done before.

Ofir Drori describes his good and bad experiences with apes, authorities, criminals, volunteers, colleagues and various Cameroonian people, and he explains the difficulties that he encountered and could overcome only with hard work and his firm conviction. Only very few people have the power to do what he did, and his successes give hope that corruption and ignorance can be overcome with perseverence.

Angela Meder

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John G. Ewen, Doug P. Armstrong, Kevin A. Parker, Philip J. Seddon
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New on the Internet

The **A.P.E.S. database** has a new website now: the A.P.E.S. portal – apesportal.eva.mpg.de – that contains much more information.

Evan Bowen-Jones
Tackling Human-wildlife Conflict: A prerequisite for linking conservation and poverty alleviation. A decision-makers guide to financial and institutional mechanisms. PCLG Discussion Paper no 06. IIED, April 2012. 26 pages. http://povertyandconservation.info/sites/default/files/PCLG%20HWC%20discussion%20paper_0.pdf

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Finances

Income in 2011	
Subscriptions	17,920.62 Euro
Donations	43,763.22 Euro
Currency differences	270.00 Euro
Sales	1,659.80 Euro
Refund from meeting	60.00 Euro
Interest	3.00 Euro
Total	***63,576.64 Euro***
Expenses in 2011	
Administration	1,559.55 Euro
Gorilla Journal	2,912.91 Euro
Items for sale	1,189.56 Euro
Postage	1,779.65 Euro
Fees	120.00 Euro
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Maïko	
Equipment	5,000.00 Euro
Organisation meeting	10,509.52 Euro
Patrols	11,491.50 Euro
Sarambwe	
Food for patrols	4,201.20 Euro
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School tree nurseries	3,653.26 Euro
Bwindi	
Gorilla census	5,000.00 Euro
ITFC employees	8,000.00 Euro
Cross River area, Nigeria	
Equipment eco-guards	7,089.18 Euro
Conservat. education	3,000.00 Euro
Total	***70,706.33 Euro***

Our Donors

From November 2011 to April 2012 we received major donations by Beate Backenköhler, Christoph Baumann, Ingrid Broecker, Danish students Apeldoorn, Angelika Dickmann, Elisabeth Engel, Marianne Famula, Jürgen Friedrich, Stefanie Göckmann, Susan Götsch, Sandra Grahl (w&w Informatik IT Betrieb), Colin Groves, Heide Gruben, Peter Günther, Regina Härdi, Jörg Hess, Cathrin Hoffmann, Marieberthe Hoffmann-Falk, Marianne Holtkötter, Werner Huetz, Helga Innerhofer, Kevin und Claudia Kähler, Götz Kauschka, Hartmann Knorr, Frank Lehwalder, Hans Mayer, Hannelore Merker, Milwaukee County Zoo, Manfred Paul, Klaus Preissl, Helga Rave, Birgit Reime, SAP AG, Marco Schmid, Eva Schweikart, Frank Seibicke, S.O.Net AG, Anja and Heiner Stelter, Christian Ströbele, Juliane Ströbele-Gregor, Heinz Norbert Strünker, Nina Sündermann, Stefan Wenzel, Wigwam-Tours, Heinz Zaruba, Mark Philipp Zelenka and Manfred Zimmer. Christian Erni and Christoph Schubert invited gorilla expert Jörg Hess to give a presentation at their joint birthday party and asked the guests for donations to save the gorillas. They transferred these donations to us.

Many thanks to all of them, and to the other donors as well! We are grateful for your support, and we hope that you will continue to support us.

Relationships of African Apes and Humans

According to the general view, the lineage leading to gorillas split from the one leading to humans and chimpanzees before the latter two lineages separated. But it was obvious that it is not that simple. Now a new genetic study presents explanations for the inconsistencies. Aylwyn Scally and colleagues found that the standard evolutionary tree fits to most genes, but not to all of them; 30% of the gorilla genome is more similar to either humans or chimpanzees than these two are to each other. This could be explained by so-called incomplete lineage sorting, which means that during or after the separation of a particular lineage, certain gene variants are found in only one of the resulting lineages or are lost over time – so these parts of the genome become more similar to the sister lineage of the earlier split. Another mechanism to explain these difficulties may be gene flow. Even after the lineages between gorillas and shortly afterwards between humans and chimpanzees were separate, individuals may still have occasionally reproduced with members of the other lineages.

Considering the new genetic data, the authors calculated new time frames for the evolution of the African apes. They found that the human–chimpanzee and human–chimpanzee–gorilla speciation events were approximately 6 and 10 million years ago, respectively. Regarding the two gorilla species, their estimate is that they split 1.75 million years ago, but there was still genetic exchange afterwards.

Original article: Scally, A. et al. (2012) Insights into hominid evolution from the gorilla genome sequence. Nature 483, 169–175

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