

Climate Change: Threatening one of the Most Endangered Great Apes

1. Mountain Gorillas in Rwanda

Gorilla tourism is Rwanda's third largest revenue earner after tea and coffee production. In 2007, tourism earned over US\$ 42 million for the country, \$7 million of which was for gorilla permits alone (Rose 2009). Gorilla tourism in Rwanda, as well as coffee and tea production, is highly dependent on ecosystem services provided by the afro-montane forest.

According to Wilson & Reeder (2005), there are two species of Gorilla. The eastern species includes both the eastern lowland *G. beringei graueri* and the two mountain populations of *G. b. beringei*. One of the mountain populations can be found in the Volcanoes National Park of Rwanda, which forms part of the extinct volcanoes of the Virunga Massif along the borders of the Democratic Republic of the Congo (Virunga National Park), and Uganda (Mgahinga Gorilla National Park) (see Figure 1 below). The other population of mountain gorilla is in the Bwindi Impenetrable National Park, in southwest Uganda on the border with the Democratic Republic of the Congo (UNEP/CMS 2008).

Gorilla population trend is traced back as far as the late 1950s. In 1959-1960, gorilla population was estimated to be 450. Since that time however, the species began declining in number. Between 1971-1973, the population was known to be 275 and 268 between 1976-1978. In 1981, the population had reduced to 254. From that time, the species population steadily increased in number. In 1982, the gorilla population was believed to be 294 and estimated to be 399 in 2000 (MINITERE 2003).

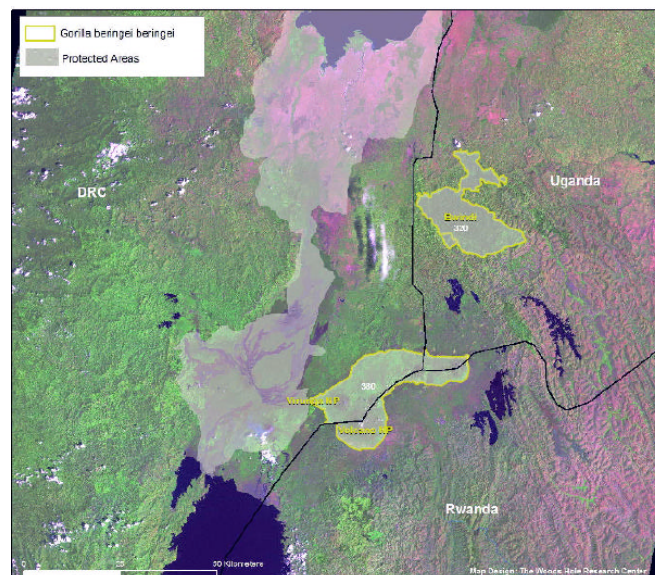


Figure 1. Distribution of *Gorilla b. beringei* population. Source: UNEP/CMS 2008.

Virungas mountain gorillas live in high-altitude montane forests with a dense herb layer and abundance of fruit. They range up to 3,400 m in altitude with occasional forays even higher (UNEP/CMS 2008). These gorillas have a home range of between 5 and 30 km²

(UNEP/WCMC & WWF 2001), which may include daily foraging movements across country borders. The area of habitat occupied by the Virungas mountain gorillas is approximately 450 km² (UNEP/CMS 2008). A census of the Virunga Volcanoes mountain gorilla population carried out in 2003 shows a 17% increase in population size since 1989, reaching a total number of 380 gorillas. Due to its very small population level and a series of threats affecting their habitat, mountain gorillas face an extremely high risk of extinction in the wild. The mountain gorilla is listed as Critically Endangered on the IUCN Red List of Endangered Species (IUCN 2008).

2. Main Threats to Mountain Gorillas

The major threats affecting mountain gorilla populations are 1) habitat loss and or modification, 2) forest encroachment and unsustainable use of natural resources, and 3) war and/or political unrest (Muruthi et al. 2000).

Outbreak of fighting in Rwanda during the early 1990s resulted in a stream of refugees moving into gorilla habitat in the Virunga Volcanoes. Indeed, approximately 50% of Rwanda's civilian populations were displaced during this conflict, of which 860,000 refugees were concentrated in the Virungas region (Dudley et al. 2002). In 1996 a war started between the armed forces of the Democratic Republic of the Congo (DRC) and a rebel movement backed by Angola, Rwanda and Uganda. Subsequently, fighting broke out again in 1998 between Rwandan and Ugandan troops and the DRC army. The displacement of refugees during these armed conflicts led to uncontrolled firewood harvesting, increased poaching in the Virunga Volcanoes region and disruption of natural animal migration patterns (UNEP/WCMC 2003). According to Kalpers et al. (2003), between 12 and 17 gorillas are known to have died between 1992 and 2000 in the Virungas region as a direct result of military activity.

Concern for the protection and management of nature in the area, especially with regards to recurring encroachments, deforestation, poaching, population growth, and the refugee-related problems that arose due to civil unrest in Rwanda, led to the decision of placing national parks in the Virungas region on the World Heritage in Danger List in 1994 (UNESCO 1994).

To date mountain gorillas in the Virungas region remain severely affected. The region continues to be unstable, militia groups are still active in the region and there are frequent reports of poaching, deforestation and illegal gold mining in the park (UNEP-WCMC 2003). The ongoing conflict remains a threat to the Virungas gorillas and the protected areas: it has caused the death of several guards in the last two years, it has made protection of the area extremely difficult and dangerous, and it has been the reason of at least 9 gorillas death in 2007.

In addition to violent conflict, gorilla habitat in the Virungas region is being degraded by mining, agriculture and charcoal production. Subsistence agriculture dominates local economic land use in the region. The fertile volcanic soils support the highest human rural population density in Africa, of up to 700 people/km². This has resulted in great pressure to convert natural habitats to farmland, over-fishing, illegal cattle grazing, and hunting (CBFP/CARPE 2005). It is expected that the rapidly increasing population in the region and the political instability will continue affecting mountain gorillas in the next 30-40 years (UNEP/CMS 2008). Forest conversion and fragmentation is anticipated from agricultural expansion, unsustainable firewood harvest for heating and cooking,

increasing exploitation of forest products by refugees and locals, and illegal cattle production.

3. The Future with Climate Change

As is true with most mountainous regions in Africa, the montane forest system in the Virungas region is isolated from other similar ecosystems by great areas of lowland habitats. Isolation has produced a high level of endemism with many local species of plants and animals restricted to single mountain ranges such as the mountain gorilla (UNEP/CMS 2008). Altitude, age, soil, rainfall, and distance from the coast all contribute to the unique environment. The current climate of these mountains is much wetter than the surrounding lands, with perhumid (rain every month) conditions and rainfall up to 3,000 mm per year (UNEP/CMS 2008). These conditions make montane forests in the Virungas region the main water-tanks for the surrounding population.

The effects of climate change on montane forests of the Congo River Basin are not fully understood. In Rwanda, from 150 hydro-meteorological stations in 1994 only one is functional at present. This hinders accurate weather forecast and calibration of global and regional climate models. It is likely that intensity of extreme rainfall events will increase by the end of the century, but there is no consensus between the models on the likely changes in the severity of the dry events. Temperature will increase and observed trends show a change in the seasonal pattern of rainfall (Rose 2009).

According to the Congo Basin Forest Partnership (CBFP) and the Central African Program for the Environment (CARPE) (2005), endemic species such as the mountain gorilla are highly at risk from minor climatic changes. Since they are confined to relatively small habitats within a high altitudinal range, changes to the habitat can have severely impact the gorilla population. Even if direct effects of climate change are not evident in the montane forests that form the habitat for Virungas gorillas, increased inter-annual variability and extreme climate events are likely to have indirect effects by affecting the surrounding communities that depend on natural resources for their food security and other needs. For instance, changes in the rainfall pattern, increased inter-annual variability and more intense rainfall events are likely to exacerbate soil erosion problems in the region and put pressure on both subsistence systems and cash crops (i.e. tea and coffee) produced in lower slopes around the montane forests. Coping strategies to respond to these changing conditions could lead to intensifying exploitation of forest resources and the conversion of more forest into farmlands resulting in greater fragmentation of the landscape. Forest degradation and fragmentation may jeopardize the mountain gorilla population, if habitat changes to such an extent that it may no longer be suitable for the gorilla's survival (CBFP/CARPE 2005).

Changes in the mountain gorilla habitat would not only lead to this species extinction, but could also negatively impact livelihoods of the surrounding human population. Agricultural systems are highly dependent on the ecosystem services provided by montane forests (e.g regulation of rainfall run-off, soil retention capacity, water supply, etc). If these ecosystem services are disrupted, livelihoods are likely to be more vulnerable to soil erosion, water shortage, flooding, and other climate related risks that are likely going to be exacerbated by climate change (McNaughton 2008). In the worst case scenario, crop failure due to changing conditions and lack of crucial natural and social support and buffer systems could lead to a complete collapse of the local economy in the region (Rose 2009).

4. Adapting to Uncertainties

Significant uncertainties with regard to potential impacts of climate change on ecological and socio-economic systems in the Virungas region require a flexible approach. Several initiatives are taking place in the region to enhance the protection of the national parks and reduce the threats to the mountain gorilla population, whilst still benefiting the local communities in the area. The Rwanda Environment Management Agency (REMA) is conducting research to better understand the effects of climate change in the region and the role of environmental protection to reduce future climate risks. REMA is working in collaboration with the Meteorological Directorate and the Ministry of Agriculture. Other coalitions include the African Wildlife Foundation (AWF) and the World Wide Fund for Nature (WWF) which are leading the International Gorilla Conservation Programme (IGCP) that covers the entire mountain gorilla range in Rwanda, Uganda and DRC, working closely with the respective protected area authorities. The IGCP supports the development of a regional mountain gorilla conservation policy, but also works to reduce local community dependence on park resources, minimise human-gorilla conflict and support a more equitable distribution of the benefits from gorilla tourism. Several other initiatives (e.g. Great Apes Survival project, CMS Gorilla Assessment, Concerted Action) are combining efforts for the protection of the gorilla habitat against a background of multiple stresses, violence and economic disintegration in the region (UNEP/CMS 2008).



Photo courtesy Rwanda Tourism

Gorilla and Great Ape tourism is the single most important asset over which Rwanda has over absolute comparative advantage when compared to Kenya and Tanzania. However, considering the regional distribution, Rwanda needs to have closer collaboration with Uganda and the Democratic Republic of the Congo in order to harmonise and coordinate gorilla tourism in the region, notably in relation to tariffs, standards and animal health issues (Moyini and Uwimbabazi 2000).

One way of combining conservation measures and economic benefits is by supporting the development of payment for ecosystem services (PES) schemes in the region. Despite tourism being an important revenue for the country, ecotourism in the Virungas is still under-developed and has great potential to grow, particularly if considering that ecotourism is among the fastest growing industries in the world. Ecotourism has been

widely used to generate resources for conservation and when developed well, it is one of the best ways to involve local communities in conservation activities, while sharing with them the economic benefits generated from the presence of great apes and a healthy ecosystem (UNEP/CMS 2008).

Payment for ecosystem services could also consider carbon markets. With a new scheme for Reducing Emissions from Deforestation and Degradation (REDD) entering into force after the post 2012 regime, global carbon finance will offer a promising opportunity for mitigating climate change and conserving forests. In the meanwhile, the best setting for implementing REDD activities in the region could be studied, allowing for sound monitoring of reduced CO₂ emissions from deforestation and pro-poor mechanisms that ensure equitable distribution of benefits while supporting climate adaptation strategies at the local and regional levels (REDD++).

Where conservation activities are impossible or undesirable, it may be possible to ensure that users integrate biological diversity and flagship species into their workplans through effective impact assessment and compensation legislation, i.e. applying to the natural heritage a form of the “Polluter Pays Principle” (UNEP/CMS 2008). Other methods may exist to involve logging corporations in heritage conservation such as “Business and Biodiversity Offsets Programmes (BBOP)”. Under the BBOP scheme companies would quantify their impacts on biodiversity and seek to offset them through activities that advance conservation goals at the landscape scale. The aim is to ensure “no net loss,” and preferably a net gain in biodiversity. This approach has the potential to contribute to conservation and deliver livelihood benefits for local communities while also generating economic benefits.

In June 2008, the Gorilla Conservation Agreement came into effect as a legal framework that will reinforce and integrate conservation efforts in the region. To date, it has been signed by six of the ten gorilla range states. The Agreement will be implemented via a regional Action Plan. As part of the Action Plan, range state authorities and international partners are requested to:

- Establish additional protected areas and ensure connectivity: networks of connected protected areas through biological corridors that help conserve species and habitats, and maintain ecosystem services;
- Enforce protection in protected areas: based on the idea that well managed areas should not suffer encroachment and deforestation;
- Establish buffer zones around protected areas;
- Improve ecosystem management in forest concessions and promote sustainable agricultural practices;
- Create awareness among the local population of the value of ecosystem services and biodiversity, and improve forest monitoring schemes;
- Enhance regional and international collaboration on forest conservation;

Some of these costs have been estimated by MINITERE (2003) in dealing with the cost of conserving and protecting the gorilla population in Rwanda (See Table 1.). In general terms, it has been calculated that approximately \$910,000 should be invested in the protection of the Volcanoes National Park to achieve the objectives established under the Rwanda's National Great Apes Survival Plan 2003-2008. However, the specific

costs of implementing such measures have not been estimated yet. But it could be assumed that these are the minimal requirements to ensure a viable gorilla population in a context of multiple threats including political instability and conflict. This goes without mentioning that future climate risks may exacerbate this challenge and increase conservation costs, which will need to consider new uncertainties and pressures affecting the rural population. Flexible approaches are needed to deal with changing conditions and multiple future scenarios. This includes building the capacity and the incentives to increase options that are economically attractive for the local population and can reduce pressure on the natural capital. This pathway has the potential to support synergies and break the cycle of destruction that the Virungas region is undergoing and which could lead not only to the extinction of gorillas and other endemic species, but the failure of the local economy in the future.

Table 1. Costs for Protecting the Volcanoes National Park in Rwanda.

| Projects | Time Frame (Years) | Economic Cost |
|--|---------------------------|----------------------|
| Objective: Protect and conserve PNV | | |
| Improve coordination and awareness of law enforcement (regional, national and international) between agencies (parks, police, customs, Interpol) | 5 | Over \$50,000 |
| Create buffer zones around PNV | 5 | Over \$50,000 |
| Formalize trans-boundary collaboration | 5 | Over \$50,000 |
| PNV management plan | 1 | US\$ 10,000-50,000, |
| Sustainable finance plan | 2 | US\$ 10,000-50,000, |
| Objective: Increase conservation sensitivity at the local and political level | | |
| Promote an environmental education program, and public sensitisation (schoolchildren, etc.) | On-going | Over \$50,000 |
| Organize conferences and debates to collaborate with national political authorities and military | On-going | US\$ 10,000-50,000, |
| Objective: Increase benefits to and from the local community | | |
| Create community conservation plan | 1 | US\$ 10,000-50,000, |
| Promote fire-efficient stoves | 1 | Under US\$ 10,000 |
| Collection of water within the park using pipes and organize rainwater collection system for the dry season | 5 | Over \$50,000 |
| Develop small livestock farming (goats, sheep) | 2 | US\$ 10,000-50,000, |
| Develop agro forestry | 5 | Over \$50,000 |
| Develop traditional medicine around PNV | 5 | Under US\$ 10,000 |
| Environnemental economic study of PNV | 1 | Under US\$ 10,000 |
| Objective: Increase research and monitoring | | |
| Census of gorillas and large mammals | 3 months | Over \$50,000 |
| Increased understanding of gorilla ecosystem | 1 | Over \$50,000 |

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|--|---|---------------------|
| Investigate carrying capacity of gorilla habitat, climate change and vegetation monitoring | 2 | Over \$50,000 |
| Gorilla health monitoring | 2 | US\$ 10,000-50,000, |
| Environmental impact assessment on water resource management in and around PNV | 1 | Over \$50,000 |
| Capacity building of resident scientists | 5 | Over \$50,000 |
| Objective: Improve health standards and minimize disease transmission | | |
| Create a community health fund for PNV neighbouring population | 1 | US\$ 10,000-50,000, |
| Support for veterinary care for farmers living near PNV | 2 | US\$ 10,000-50,000, |
| Insert conservation in the local health curriculum | 5 | US\$ 10,000-50,000, |
| Refuse collection throughout park and removal of alien species | 1 | Under US\$ 10,000 |
| Objective: Increase tourism revenue | | |
| Diversify and develop tourism products | 5 | Over \$50,000 |
| Improve tourism infrastructure | 5 | Over \$50,000 |
| Ecotourism development plan for PNV and Virunga region | 1 | Over \$50,000 |

Adapted from MINITERE 2003.

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