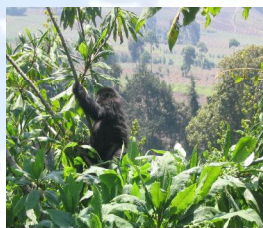


Promoting Environmental Security and Poverty Alleviation in Virunga-Bwindi, Great Lakes Africa



Prototype EnviroSecurity Assessments

Great Lakes Region of Africa Part 1: Case Study

Jeanna Hyde Hecker

Promoting Environmental Security and Poverty Alleviation in Virunga-Bwindi, Great Lakes Africa

Jeanna Hyde Hecker, EnviroSense

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Commissioned by the Institute for Environmental Security

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1 Introduction

Environmental security is the availability of environmental services for man and nature. The availability is reduced when there is environmental destruction. Environmental destruction leads to scarcity and scarcity triggers conflict which can develop into violence. Thus, environmental security is vital to human security and well being. Conflict or violence can also be caused by the availability of abundant rather than scarce environmental goods or natural resources. The situation could also be reversed in that, for reasons other than scarcity or abundance of environmental services and goods there is conflict or violence. This conflict or violence can then lead to environmental destruction - as wars often do - and as a result there is scarcity which results in conflict and the cycle continues.

The study area lies in the Albertine Rift in the countries of the Democratic Republic of Congo (DRC), Rwanda and Uganda. The focus is on the four protected areas, Virunga National Park (ViNP); Volcanoes National Park (VNP); and, Mgahinga Gorilla National Park (MGNP) and Bwindi Impenetrable Forest National Park (BINP), respectively, as well as the surrounding areas. Together this area including the four parks is often referred to as the Virunga-Bwindi region. This study area was selected because it is an ecologically unique and globally important ecosystem. It has high levels of floral and faunal endemism, biodiversity and species richness. It is mountainous and acts as one of the headwater catchment systems for the overlapping Great Lakes region. It is comprised of afro-montane vegetation which is habitat to the last populations of mountain gorilla on earth. These gorillas, a flagship species, attract tourism and conservation revenues into the area. Three of the parks also present the opportunity for peace building among the three nations as the parks lie adjacent to each other along the three countries' international boundaries. Together they are overlapped by one ecoregion and can be managed effectively only if they are treated as one seamless unit. The multiple importance of the region have led conservation organizations to rate the montane forests of the Albertine rift as highest priority for conservation in Africa (Hamilton, 1996, cited in Lanjouw et al., 2004).

While the area may seem greatly endowed with wonders and opportunities there are just as well manifold difficulties. The region has one of the densest populations and is predominantly subsistence agriculture. People are poor and traditionally, they do not practice sustainable use of the natural resources. In certain areas people have been known to resent the protected areas. In addition, the region has a past of civil unrest and political instability. The genocide of 1994, for instance, has resulted in a new Rwanda that aims at zero tolerance for corruption and an unrelenting determination to make itself the example of Central Africa. The effects of violence, however, still remain. Internally displaced people (IDP's) and refugees who were settled in the protected areas caused widespread destruction still seen today in, for instance, the former Gishwati Forest Reserve now dereserved as it has lost about one half its forests. Also, losing so many lives meant losing many professionals and other members necessary to fulfil the roles of the society.

This study area demonstrates the situation of having conflict and violence - motivated not only by the abundance of environmental goods but also by other factors later discussed. Environmental destruction resulting from conflict is propagated by high population growth rates and the choice of land use leading to scarcity of environmental services and goods. This in turn, can lead to more conflict and violence if not addressed.

The study attempts to describe the problems in the area and identify causal relationships among them in order to generate a comprehensive understanding of the situation. Before recommendations are made stakeholders are identified and an analysis of areas for mitigation is carried out.

2 Background

To understand the importance of the Virunga-Bwindi region, the biophysical and social aspects of the greater environment, the Albertine Rift, is described.

2.1 Location

The Albertine Rift, a part of the Great Rift Valley, extends along the five countries of the Democratic Republic of Congo (DRC), Uganda, Rwanda, Burundi and Tanzania.

2.2 Volcanics and fertile soils

According to Blom and Bowie (2001), the Albertine Rift was formed from uplifted Pre-Cambrian basement rocks and recent volcanic activity. The rift is made up of mountain chains originating on the Lendu Plateau in northern Uganda and DRC (Bober et al., 2001, cited in Blom & Bowie, 2001); the Ruwenzori Mountains of southern Uganda and eastern DRC; and, some isolated massifs on the shores of Lake Tanganyika. The highest peak in the region, 5110m, is in the Ruwenzori Mountains. Associated volcanic activities which resulted in the overflow of volcanic materials give rise to the characteristically rich fertile soils.

2.3 Lakes

The lakes in the rift were formed from continental movement which created cracks in the earth's crust (Blom & Bowie, 2001; UNEP, 2004). The rift lakes are Lake Albert, Lake Edward, Lake Kivu, and Lake Tanganyika. There are other lakes in the East African Rift Valley, namely Lake Turkana, Lake Victoria and Lake Malawi. Lakes Tanganyika, Lake Victoria and Lake Malawi are known as the Great Lakes of Africa (UNEP, 2004). They play a vital role in the maintenance of life and biodiversity in the region. Lake Edward, for instance, is one of the world's most productive and along with the other lakes their fisheries provide one of the main sources of revenue for the surrounding communities (Plumptre, 2003). Fundamentally, lakes also contribute water to the atmosphere through evaporation. This water eventually is precipitated from the atmosphere not only over the

lakes, but also in other areas that may not have nearby water sources thus, continuing the hydrological cycle.

2.4 Water tower

Mountains are known as headwater catchment systems, that is, rivers originate from them. In humid areas up to 60% while in semi-arid and arid areas up to 95% of the fresh water in watersheds are captured by mountains (*Mountains of the World: Water Towers for the 21st Century*, 1998). This occurs in spite of the proportionally smaller area covered by the mountains compared to the rest of the lowland watershed area. This is possible, however, as rainfall increases with altitude, (from 5 mm/100 m to 750 mm/100 m elevation, depending on the climatic zone and maximum amount obtained between 1500 and 4000 m altitude) (*Mountains of the World: Water Towers for the 21st Century*, 1998).

The same characteristics which enable mountains to provide invaluable services to human and nature make them vulnerable or give rise to vulnerable characteristics. High altitudes, large amounts of rainfall and often steep slopes are the conditions which promote soil erosion. One natural measure that reduces soil erosion rates in these vulnerable areas, however, is vegetation cover. The afro-montane forests not only dampen the impact of rainfall onto the soil but their root systems hold the soil together and in place, preventing soil erosion and land slides. The afro-montane vegetation cover also reduces evaporation rates by providing shade to the bare earth. As these forests are found in the higher altitudes there is a low transpiration rate. This combination of higher altitudes, more rainfall amounts and lower transpiration rates in the mountains produce a surplus of fresh water which can be used in the lowland areas where a negative water balance is generated (*Mountains of the World: Water Towers for the 21st Century*, 1998).

Mountain catchments are also important in the role they play as upstream locations. Whatever occurs upstream will have an effect downstream. Kagera river basin which covers all of Rwanda provides 7% of the influent water to Lake Victoria, the second largest lake in the world. Lake Victoria in turn provides water to the wider Nile basin (UNEP, 2004), which covers about 3 million km² in ten African countries (Kameri-Mbote, 2004), which drains into the Mediterranean. According to UNEP (2004), it is believed that in the late 1980's (UNEP, 2004), water hyacinths invaded Lake Victoria via the Kagera River (Twongo, 1996 cited in UNEP, 2004), spreading to about 3 ha per day. As a result the invasion and proliferation of water hyacinth in the Lake had led to reduced oxygen levels and, consequently, to reduced floral and faunal diversity. The presence of the water hyacinths have also disrupted fishing activities, transportation and threatened the operations of lake shore installations such as hydroelectric power plants (Twongo 1996, Kudhongania et al. 1996, cited in UNEP, 2004).

2.5 Climate

Although the rift lies in the tropics of Africa, the climate can be varying and uncharacteristically tropical due to the region's geology. The higher mountainous regions experience temperate climates and average rainfall between 1,200 to 2,200 mm per year (Blom & Bowie, 2001).

2.6 Flora

The ecoregion is dominated by montane rainforest (White, 1983, cited in Blom & Bowie, 2001), with marginal fringes of the Guineo-Congolian rainforest on the lower slopes (down from 500-800m) in the west and forest/savannah habitats in the east running along Uganda, Rwanda and Burundi (Blom & Bowie, 2001).

2.7 Fauna

The area contains 52% of all bird species and 39% of all mammal species on the African continent (Plumptre, 2003). The last population of mountain gorillas (*Gorilla beringei beringei*), formerly named *Gorilla gorilla beringei* (Lanjouw et al., 2004), is also found here. With approximately 700 individuals remaining they are classified as an endangered species. Mountain gorillas have managed to attract global attention and this has direct and indirect benefits for their protection. Income from donors and tourism has been used for their habitat protection as well as community projects to reduce community overexploitation of the habitat.

2.8 Region rich in Biodiversity and Endemism

The Albertine Rift Mountains ecoregion is considered the most vertebrate species rich region in Africa (Plumptre, 2003) with “exceptional faunal and moderate floral endemism” (Blom & Bowie, 2001). These invaluable ecological characteristics can be attributed mainly to two reasons. Firstly, it is believed that the Albertine Rift mountains, acted as a glacial refugium for flora and fauna during the Pleistocene Period (Kalpers, 2001; Lanjouw et al., 2004). Secondly, the altitudinal variations give rise to various natural habitats (Blom & Bowie, 2001) and hence also to numerous transition zones.

	Species richness	Endemic species	Threatened species
Mammals	402	34	35
Birds	1,061	41	25
Reptiles	175	16	2
Amphibians	118	34	16
Butterflies		117	
Fish		366 +	
Plants	5,793	567	40

Table 1. The total number of species, number of endemic species, and threatened species for the five taxa in the Albertine Rift (Plumptre, 2003).

2.9 Densest African population

(Lanjouw et al., 2004)

The areas surrounding the afro-montane and medium altitude forests shared by Rwanda, Uganda and DRC are densely populated, with countrywide per capita rural population densities averaging 300 persons per km² (IGCP, 1997). These population densities increase around protected areas in the region due to the rich natural resources and soil. For example, in Rwanda, population densities around VNP exceed 400 persons per km², and in some rural areas attain 820 people per km² (Waller, 1996). Population estimates for those living adjacent to protected areas in the regions are: 675,000 around ViNP-south (DRC); 8,700 around MGNP, 93,000 around the BINP (Uganda); and 134,000 around the PNV (Rwanda), bringing the total population living around the program area to 910,700 (IGCP, 1997). With an average regional population growth rate of over three percent, the total population living around protected areas in the area will grow to well over one million in less than three years (IGCP, 1996).

3 Study Areas Description and Importance

Due to the conservation value and presence of the world's last mountain gorilla populations, two "forest blocks" of the Albertine Rift were selected for this study. One forest block, although being one ecological unit, is intersected by international boundaries of three countries: DRC, Rwanda and Uganda, consequently, there are three different national parks. These three parks, Virunga National Park, Volcanoes National Park and Mgahinga Gorilla National Park, respectively, lie on the Virunga Massif and collectively are called the Virunga Volcanoes Region (VVR) or the Virunga Conservation Area (VCA). The second forest block lies about 30km north of the VCA in Uganda, and is the Bwindi Impenetrable Forest National Park.

Political status on environmental conservation

(Lanjouw et al., 2004)

In the three countries, political support for sustainable environmental management, as well as conservation of the afro-montane habitat, has strengthened over the years. The consciousness that resources are limited, and that human livelihoods are interlinked with environment has increased. This has been due, in part, to examples of unsustainable use and the impact it has had on soil, water and farmer's ability to grow food crops. In addition, the realisation that natural resources can be of economic value (e.g. in tourism) has also strengthened the national governments' support for conservation. This consciousness has greatly facilitated the work of the protected area authorities, and conservation organisations struggling to protect important natural areas and wildlife.

Virungas

The VCA in total is approximately 450 km², with altitudinal variations of around 2300 m to the 4511 m tall Karisimbi Volcano (Kalpers, 2001). The climate is cool, humid with high levels of annual rainfall (Lanjouw et al., 2004).

3.1 DRC: Virunga National Park

3.1.1 Description

Virunga National Park in DRC, was established in 1925, designated as a World Heritage Site in 1979 and as a World Heritage Site in Danger in 1994. It encompasses a remarkable variety of ecosystems: high altitude forests and mountainous habitats, low-altitude forests, lava fields, plains and savannas, lakes and wetlands. These ecosystems harbour exceptional biological diversity. The park was initially created to protect the mountain gorilla but today it also shelters a small population of eastern lowland gorillas (*Gorilla beringei graueri*) and many endemic species of plants and animals.

ViNP covers 8,000 km², and its administrative subdivision includes sectors in the south - Mikeno and Nyamulagira, Rumangabo station; centre - Rwindi station; east - Lulimbi station; and, north - Mutsora station (Kalpers, 1996).

The Mikeno sector is the portion of ViNP that forms the Congolese component of the Virunga Massif and the dormant volcanoes; and, is thus contiguous to VNP (Rwanda) and MGNP (Uganda). Mikeno is the largest component of the Virunga Volcanoes, both in terms of biodiversity and of surface area (approximately 250 km², or more than half the total area of the Virunga Massif). It contains also the largest area of afro-montane forest. It is the only component to have conserved its lower reaches, which play an important role in the seasonal movements of a number of animal species: buffalos, elephants and, especially, gorillas (Kalpers, 2001).

Until the recent crisis in the region, the Mikeno sector of the park was the primary source of income for the protected area authorities, generating funds through tourism for the protection of all the parks in the country. Most of the funds came from tourists visiting the five groups of habituated gorillas in their natural habitat (Lanjouw et al., 2004).

3.2 Rwanda: Volcanoes National Park

3.2.1 Description

(Kalpers, 2001)

Volcanoes National Park (VNP) covers approximately 160 km² and represents the Rwandan component of the Virunga Volcanoes (Butynski, Kalina, 1998).

In relation to the initial size of the forest, between 1958 and 1979 VNP lost approximately 55 percent of its natural habitat, mainly as a result of the demand for land for growing pyrethrum (Harroy, 1981 in Bouché, 1998)(Bouché, 1998). When tourism proved to be a boost to the local economy and a source of hard currency (WWF, IUCN, 1985), the steady shrinking of VNP's surface area stopped. But this new influx of cash came too late to prevent the loss of an important portion of the Rwandan Virungas. By the time Rwanda discovered ecotourism, the lowest vegetative zone (below 2,500 meters), the Neoboutonia zone that is so important to such animals as gorillas, had already disappeared almost entirely. VNP is located in the most densely populated region of Rwanda and, like these regions, is confronted with the most extreme demographic pressure in all of Africa.

3.2.2 Hydrology

The park has a certain number of permanent lakes, for instance, Bisoke, Ngezi, Mararo but no permanent river, although torrents run all the year except at the height of the dry season (Office Rwandais Du Tourisme et des Parcs Nationaux, 2004). Marshes occupy certain saddles between the volcanoes. The vegetation cover and porous basement volcanic material play a very important role in the regulation of water. Water run-off occurs mainly underground and small springs are found in the immediate vicinity and especially at the edge of lava fields located up to 15 km within the park boundaries (Office Rwandais Du Tourisme et des Parcs Nationaux, 2004). It has been estimated that although VNP is only approximately 0.5% the land surface area of Rwanda, it contributes about 10% of the entire water catchment function for Rwanda (Weber, 1979 cited in Plumtre & Williamson, 2001).

3.2.3 Population

According to the General Census of the Population and Habitat (RPGH) August 30, 2002 census, Ruhengeri and Gisenyi are the most inhabited provinces in the country of Rwanda with respectively 885 309 and 853 985 inhabitants (Office Rwandais Du Tourisme et des Parcs Nationaux, 2004).

District/Ville	Population (RGPH, 1991)	Population (RGPH, 2002)
Buhoma	80 169	89 210
Bukamba	88 177	118 466
Kinigi	55 244	62 798
Mutobo	81 621	95 922
Ville de Ruhengeri	53 467	71 511
Mutura	-	112 934
Total	550	841

Table 2. Population changes in the districts surrounding the PNV (Office Rwandais Du Tourisme et des Parcs Nationaux, 2004).

District/Ville Population	Population 30/08/2002	Total Surface (Km ²)	Inhabitable Surface (Km ²)	Physical Population Density	Physiological Population Density
Buhoma	89 210	154.5	144.1	577.4	619.1
Bukamba	118 466	185.1	145.8	640	812.6
Kinigi	62 798	162	110.1	387.7	570.2
Mutobo	97 180	189.3	141.8	513.3	685.2
Ville de	71 511	63.2	63.2	1131.3	1131.3
Ruhengeri	122 934	201.7	167.3	609.3	734.9
Mutura					
Total/Average	550 841	955.8	772.3	643.1	758.8

Table 3. Population densities according to the total surface and the inhabitable surface land area (Office Rwandais Du Tourisme et des Parcs Nationaux, 2004).

According to a socioeconomic study undertaken jointly by CARE International, PICG and WCS (2003) the majority of the populations located around the mountain forests of Uganda, Rwanda and DRC are very young (less than 20) and the percentage of women is higher than that of the men (Office Rwandais Du Tourisme et des Parcs Nationaux, 2004).

3.3 Uganda: Mgahinga Gorilla National Park and Bwindi Impenetrable National Park

3.3.1 Socioeconomic

In relative terms, it appears that people living around Bwindi, Echuya and Mgahinga are wealthier than those surveyed in Rwanda and DRC. They own more goods such as radios, bicycles and motorbikes, they own more land and livestock, they can afford tin roofs and they can afford to send more children to secondary school. This difference may be, in part, a result of the political conflicts that have occurred over the past 10 years in Rwanda and more recently in eastern DRC. Uganda's conflicts finished in the mid 1980s and the country has been relatively stable in this region since then (Plumptre, 2004).

3.3.2 Description: Mgahinga Gorilla National Park

Mgahinga Gorilla National Park (MGNP), in Uganda, is the smallest component of the Virunga Volcanoes (34 km²) and the part that suffered the most before 1991. Intense human activity in such a small area has turned MGNP into the least biodiverse component of the Virunga Volcanoes. It entirely lacks a Neoboutonia zone (Werikhe, 1991). Since 1951, MGNP has undergone several modifications in status and size, culminating, in 1991, in its classification as a national park (Butynski, Kalina, 1993; Uganda National Parks, 1996) (Kalpers, 2001).

3.3.3 Description: Bwindi Impenetrable National Park

Bwindi Impenetrable Forest National Park (BINP) in Uganda acquired the status of National Park also in 1991. BINP, like ViNP in DRC, is also designated as a World Heritage Site in Danger (Lanjouw et al., 2004).

3.3.4 Hydrology

(Gurrieri, Gritzner, & Chaveas, 2005)

The geologic setting of Bwindi Impenetrable National Park (BINP) is completely different from that of the Virunga Volcanoes area. Bwindi is extremely rugged, ...and the rocks are generally of low permeability and transmit water mainly through large fault structures. As a consequence infiltration is limited, aquifers are limited, and much of the rainfall runs off in streams. Bwindi has a comparatively dense stream network with perennial streams present within and near the boundaries of the park. As such, intrusion into the park by people gathering water is much less of a problem than in the Virunga Volcanoes region.

BINP is a major water catchment area and the source of many rivers that flow north, west and south. The major rivers drain into Lake Edward... BINP is therefore critical to the hydrological balance of the region. The area has experienced a long history of intensive logging, encroachment for agriculture, mining, poaching, fishing and wild fires. Although fishing is banned in BINP rivers, illegal fishing still takes place and the fish fauna remains relatively unknown.

4 Analysis of situation

4.1 Overview of Problems

In the literature and from a team visit to Rwanda and the VCA there were a number of problems prevalent in the region. Problems were linked to traditions, population size, economy, land use and governance all of which lead to environmental destruction. Below is a description and context of each of the main problems identified.

4.1.1 Sustainable use of resources not a tradition

The Albertine rift was once covered by afro-montane forests but with growing population pressure much of the region was deforested. The Virungas and Bwindi are few of the forested areas still remaining. These areas, even prior to the armed conflicts of the 1990's, were experiencing other environmental threats such as lack of alternatives for fuelwood (IGCP, 1996, cited in Kalpers, 2001); feeble environmental legislation; weak institutional mechanisms; inappropriate agricultural practices; the degradation of the environment inside protected areas, posing a threat to biodiversity; and, inadequate approaches to environmental education and awareness-raising (Kalpers, 2001). In the

Virunga massif one of the lower altitude vegetation type, preferred by the mountain gorilla was almost completely cleared in both Uganda and Rwanda (Kalpers, 2001).

According to Kalpers (2001), the DRC side of the VCA - the Virunga National Park (ViNP), was already experiencing problems before the 1991 armed conflicts. The country was having a socioeconomic and political crisis for a number of years. There the parastatal agency, Institut Zaïrois pour la Conservation de la Nature (ICZN) (now Institut Congolais pour la Conservation de la Nature, ICCN), responsible for park management and conservation was lacking the technical and logistical resources necessary to enforce park rules. Without the ICZN presence in the field the populations living adjacent to the park hunted, cut wood and bamboo, and fished in and around Lake Edward (Kalpers, 2001). All these activities while traditional were illegal (as they were exploiting the resources of the national park). Adding to the problems in the area, military groups based in the area were extorting the local people. In September 1991 heightened socio-political tensions drove away most of the biodiversity conservation development projects (Kalpers, 2001).

Human pressure on the protected areas of Rwanda were already high even before the war (Kanyamibwa, 1998). The VNP area is located in the most densely populated region of the country and according to Kalpers (2001), models developed in 1991 predicted that over the following 20 years, protected areas would decrease significantly and there would be a loss of biodiversity.

In Uganda, people living near the MGNP had resentment toward the park even as far back as the 1950's. They felt the land could be used as farm lands instead of a protected area. Similar to the other two protected areas, there was great human pressure on the MGNP. People living adjacent to the park exploited it for wood and bamboo, agricultural land, poaching of animals, apiculture and medicinal plants (Kalpers, 2001). In addition to the high population density adjacent to the park, park management was ineffective. Before 1991 the park was both a game reserve and forest reserve with two separate administrative bodies. Between 1951 and 1991 local people encroached on and farmed about 9 km² of park land giving it back to the government only when the park's status was changed to national park and negotiations began. Initiatives have been carried out in attempt to improve the local attitude toward the park. Income from tourism has been the most effective (Kalpers, 2001).

4.1.2 Political and ethnic differences within the population

DRC

Sparsely populated in relation to its area, DRC is home to a vast potential of natural resources and mineral wealth. Nevertheless, DRC is one of the poorest countries in the world, with per capita annual income of about \$98 in 2003. This is the result of years of mismanagement, corruption, and war (Bureau of African Affairs, 2005a).

Many commentators have remarked that conflict in DRC has been partly driven by the trade in natural resources. The UN Expert Panel reports on the illegal exploitation of

natural resources in DRC in April and November, and in May and October , all came to the clear conclusion that greed over DRC's natural resources has played a significant role in prolonging the conflict (Global Witness, 2004). The first Panel report stated:

“The conflict in the Democratic Republic of the Congo has become mainly about access, control and trade of five key mineral resources: coltan, diamonds, copper, cobalt and gold. The wealth of the country is appealing and hard to resist in the context of lawlessness and the weakness of the central authority (UN Security Council, Report of the Panel of Experts, 2001, cited in Global Witness, 2004).

“While this is true, it is important to place the plunder of the DRC's natural resources in historical, economic, political and social context. Particularly in northeast DRC, the economics of conflict are intertwined with tribal and ethnic hatred, disputes over access to land, profound social disintegration, high unemployment and poverty, as well as the involvement of different foreign rebel groups and armies from Burundi, Rwanda and Uganda. As such, it is more accurate to describe the violence in eastern DRC as being motivated by a mixture of security and economic anxiety (Vlassenroot, K. and H. Romkema, 2002, cited in Global Witness, 2004).

Rwanda

Ethnic and political differences within the population can be viewed as one factor contributing to the problems in Rwanda. According to Kanyamibwa (1998), ethnic divisions occurred before and during the colonial period with serious fighting starting after the 1959 revolution. It was in October 1990, however, when the first large scale fighting occurred (Kanyamibwa, 1998). From April to July 1994, was the Rwandan 100 days genocide, which is considered one of the largest human tragedies of the 20th century (Kanyamibwa, 1998).

As a result of the ethnic and political clashes over the years Rwanda and neighbouring countries have suffered in many ways some perhaps more measurable than others. While battles before the 1990's are believed to have less impact on the environment due to the low impact weaponry used it is believed that more environmental destruction were done after that time with bombs and machine guns and other weapons used in the 1990's (Kanyamibwa, 1998). Regarding the genocide, however, more of the environmental destruction occurred after the war than during (Kalpers, 2001). Many were killed whether professionals of conservation fields, teachers, parents or children that participated in the civil structure of daily life. Many have been internally displaced or became refugees in neighbouring countries relying on the natural resources of protected area ecosystems for their survival. As a result there was environmental destruction – deforestation, soil erosion, wildlife exploitation and water pollution, at a large scale.

Rebel Activities

Still today there are rebel groups in DRC that rely on the resources of the ViNP and use it as a cover to cross the border illegally into Rwanda. The presence, movements or attacks by rebel groups contribute to the environmental destruction and make it unsafe for park guards to protect the park (Lanjouw et al., 2004). In addition, rebel activities or threats make the parks less attractive for tourism.

Uganda

Uganda's economy has great potential. Endowed with significant natural resources, including ample fertile land, regular rainfall, and mineral deposits, it appeared poised for rapid economic growth and development at independence. However, chronic political instability and erratic economic management produced a record of persistent economic decline that left Uganda among the world's poorest and least-developed countries (Bureau of African Affairs, 2005b).

Since assuming power, the government dominated by the political grouping created by Museveni and his followers, the National Resistance Movement (NRM or the "Movement"), has largely put an end to the human rights abuses of earlier governments, initiated substantial economic liberalization and general press freedom, and instituted economic reforms in accord with the International Monetary Fund (IMF), World Bank, and donor governments (Bureau of African Affairs, 2005b).

4.1.3 IDP and Refugees

After the genocide approximately 2 million people fled Rwanda to neighbouring countries, in what was considered historically the largest movement of people over a few days time (Kalpers, 2001). By the end of 1994 there were about 720,000 refugees from Rwanda in about 5 refugee sites near the VNP. All the refugees fled to this region of DRC with hope to find water, food and firewood in the park's forest (Kalpers, 2001). The refugees demand on the park was so much that in December 1994 WHC classified the park as world heritage site in danger (UNESCO, 1995 cited in Kalpers, 2001).

In Uganda, the vicious and cult-like Lord's Resistance Army (LRA) continues to murder and kidnap civilians, however, in the north and east. Although the LRA does not threaten the stability of the government, LRA violence has displaced 1.4 million people and created a humanitarian crisis (Bureau of African Affairs, 2005b).

4.1.4 Post Traumatic Stress Disorder

People who are victims of or have loved ones who are victims or even perpetrators of traumatic events such as violence that accompany civil wars or genocides can experience Post Traumatic Stress Disorder (PTSD). Problems associated with PTSD are, for

instance, biological – fatigue, exhaustion, startled response; emotional – anxiety, grief, depression, numbing, fear; cognitive – flashbacks; behavioural – substance abuse, aggression toward others; social and their psychological consequences – poverty, no jobs or way to support oneself; and, spiritual – loss of meaning and hope (http://www.heal-reconcile-rwanda.org/lec_trau.htm).

The sense of vulnerability and the perception of the world and other people as dangerous increase the likelihood that, without corrective experiences, former victims will become perpetrators. They are likely to be especially sensitive to new threat. When conflict with another group arises, it may be more difficult for them to take the perspective of the other and consider the other's needs. In response to new threat or conflict, they may strike out, believing that they need to defend themselves, even when violent self-defense is not necessary, in the process becoming perpetrators (Staub, 1998; Staub&Pearlman, 2001). This self-protective violence seems especially likely when former victims live with and are surrounded by the group at whose hands they suffered such extreme violence and when there is not yet the sense that justice has been done (Staub, Pearlman, Gubin, & Hagengimana, 2005).

There is work being done to facilitate recovery from PTSD for instance by the National Unity and Reconciliation Commission. The commission first approached different groups of people to find out what they needed to achieve reconciliation (Staub et al., 2005).

4.1.5 Environmental Destruction

Deforest

Aid agencies tried to provide for the refugees in DRC but the basic essentials they did not supply, the refugees obtained from the ViNP. Refugees turned to the park for firewood, for construction material and for commercial needs. It has been recorded (Languy, 1995, cited in Kalpers, 2001), that on some days up to 80,000 people would enter the park and manage to cut about 1,000 tons of wood daily (Kalpers, 2001).

Refugee camp sites with security or park protection programs suffered less impact than those without. In the Katale and Kahindo areas, deforestation levels were low and it has been attributed to park protection programs which aid agencies had implemented when the camp site was established (Kalpers, 2001). In the Mugunga and Lac Vert areas there was major deforestation. One main reason for the large extents of deforestation is that people here started selling wood and charcoal to Goma (Languy, 1995 cited in Kalpers, 2001). With no security forces here to stop this, the business grew and deforestation increased for the second year of refugee residence (Kalpers, 2001).

Recently, in May to June 2004 it was reported that approximately 15 km² of bamboo and other vegetation types that make up the habitat of the mountain gorilla as well as endemic wildlife species, were cleared. This deforestation occurred in the Mikenso Sector of the ViNP. According to Muir (2004) the Rwanda authorities declared that the land was

cleared for security reasons – to prevent the rebels from hiding in the forest. While the local chiefs in the community claimed that finally the land would benefit the people. The cleared land has been used for farmland as well as for hunting by an estimated 6,000, mainly Rwandan, people (Muir, 2004).

Soil erosion

Soil erosion is already at a critical level in south-western Uganda, north-western Rwanda and eastern DR Congo. The intensity of land-use in this fertile part of the region led to all forests outside of the national parks and forest reserves to be cleared for agriculture, and people are cultivating their crops on hills of more than 10% slope (Waller, 1996). Soil erosion is an enormous problem in these mountainous regions and in Rwanda; an estimated 11 tons of soil are lost per hectare per year through erosion (Waller, 1996). When, for example, an Internally Displaced Persons camp was established in the Gishwati Forest Reserve in Rwanda after the war in 1994, the deforestation that resulted for the cultivation of crops caused entire slopes to be washed away (ORTPN, pers. comm.). The Gishwati Forest Reserve is no longer considered viable for agriculture, due to erosion (Lanjouw et al., 2004).

Wildlife exploitation

Poaching intensified in the southern sections of ViNP during the 2 years the refugees settled there (Biswas, Tortajada-Quiroz, 1996, cited in Kalpers, 2001). There were mainly two groups of poachers, locals and refugees; and, ex-soldiers staying in the refugee camps. Ex-soldiers usually did not give the catch to the refugee camps rather they sold it to the local Congolese communities that could afford it. Congolese soldiers became very much involved in the poaching scene by establishing a system of supply and marketing of poached animals. Armed groups passing through areas also poached. During this period four gorillas were killed and while it is not believed that the poaching event is directly related to the refugees' presence, it is viewed as a result of the chaos and insecurity prevalent at the time (GTZ, 2000 cited in Kalpers, 2001).

In addition, to poaching there was also the risk of disease transmission from humans or domesticated animals to wild animals. As gorillas are closely related to humans they are susceptible to many human diseases such as tuberculosis, influenza, hepatitis, scabies, and polio (Homsy, 1999, cited in Kalpers, 2001). Domestic animals such as cows, goats, and sheep can also transmit diseases such as foot and mouth disease and bovine tuberculosis to wild ungulates. These wild animals were put at risk when the refugees and cattle fled via the Virunga Volcanoes, staying there for a few weeks, enroute to DRC (Kalpers, 2001).

Water resource

When the Rugezi swamp is dried out by agricultural activities it does not supply enough water to the Bulera and Ruhondo lakes where the hydropower plants are installed ("Dr. Rose Mukankomeje, Personal Communication, 18 July, 2005,"; "Gaspard Ndagijimana, Personal Communication, 13 July, 2005,"). Once there is a reduction in the water supply

this affects the ability of the hydropower plants to provide electricity to the region. In Rwanda, 94% (1997 estimate) electricity comes from hydropower (Small-Scale Hydro Task Force). Kigali, for instance, experiences sporadic blackouts and some that last throughout the day. According to Dr. Rose Mukankomeje, the Director General of the Rwanda Environment Management Authority (Pers. Comm, 18 July, 2005), the quickest solution they could come up with for the blackouts was to purchase expensive petrol generators as backup for electricity generation when the hydropower plants failed. While they were aware that this was a backward step in terms of environmental pollution they had no other immediate choices. Such conditions make it difficult for Rwanda to achieve its goal such as to become the IT hub of the region, to attract other business investors for whom electricity would be a necessity or to benefit from multilateral funds paid for conservation of the environment.

Impact on economy: less tourism

Both the presence of enormous numbers of refugees and the region's unrest seriously lowered the volume of tourism during the entire crisis. But tourist visits to observe gorillas never really stopped. Modest numbers of tourists came to watch the gorillas at Jomba, a ranger outpost near the Ugandan border inside Zaire, later DRC, and an excellent point of entry for tourists into ViNP (Kalpers, 2001).

4.1.6 High population growth rate and high population density

(Lanjouw et al., 2004)

The areas surrounding the afro-montane and medium altitude forests shared by Rwanda, Uganda and DRC are densely populated, with countrywide per capita rural population densities averaging 300 persons per km² (IGCP, 1997). These population densities increase around protected areas in the region due to the rich natural resources and soil. For example, in Rwanda, population densities around VNP exceed 400 persons per km², and in some rural areas attain 820 people per km² (Waller, 1996). Population estimates for those living adjacent to protected areas in the regions are: 675,000 around ViNP-south (DRC); 8,700 around MGNP, 93,000 around the BINP (Uganda); and 134,000 around the PNV (Rwanda), bringing the total population living around the program area to 910,700 (IGCP, 1997). With an average regional population growth rate of over three percent, the total population living around protected areas in the area will grow to well over one million in less than three years (IGCP, 1996).

4.1.7 People farming & exploiting parks for survival

(Lanjouw et al., 2004)

Over 90 percent of the populations surrounding the region's protected areas practice subsistence level agriculture, and many access the protected areas to complement their food and livelihood production strategies (IGCP 1996). The national parks do not have buffer zones between the local communities and the parks' resource base. Detailed

information regarding practices, behaviours and attitudes of various local communities with regards to protected area resources do not currently exist.

Protected Area Authorities in the region, however, often cite that local communities rely on and regularly exploit the protected areas' resources for: water, wood for fuel and construction, bamboo, animals, plants for food and medicinal purposes, and bee-keeping (Bensted-Smith, Infield et al. 1995).

4.1.8 Poverty

Poverty can be defined in many ways, for instance, in terms of income, success in attaining capabilities, or participation opportunities (Lok-Dessallien). In a joint study by CARE, IGCP, WCS certain indicators were measured for 3,907 households (22,812 people) within a distance of 10km from the Virunga- Bwindi protected areas. These indicators are age structure, household size and composition, property and assets (fields, house construction material, livestock, material possessions), crops and cooking fuel (constraints for farming), education, employment, health facilities (Plumptre, 2004).

In relative terms, it appears that people living around Bwindi, Echuya and Mgahinga are wealthier than those surveyed in Rwanda and DRC. They own more goods such as radios, bicycles and motorbikes, they own more land and livestock, they can afford tin roofs and they can afford to send more children to secondary school. This difference may be, in part, a result of the political conflicts that have occurred over the past 10 years in Rwanda and more recently in eastern DRC. Uganda's conflicts finished in the mid 1980s and the country has been relatively stable in this region since then (Plumptre, 2004).

4.1.9 Political Status on environmental conservation

All three countries have a growing understanding and appreciation for the importance of environmental conservation. They realize environmental health is linked to human well being and that environmental services or goods can generate revenues through, for instance, tourism (Lanjouw et al., 2004). While the three countries have embarked on a process of obtaining transboundary management of the VCA at the highest levels, this state of having the three parks managed virtually as one has not been completed as yet. Having this transboundary management implemented will ensure greater protection and optimally coordinated environmentally conscious activities for revenue generation.

4.1.10 Foreign Aid

Donors such as the United Nations High Commissioner for Refugees (UNHCR), United Nations International Children's Education Fund (UNICEF), and World Food Program have focused efforts, especially in the aftermath of the 1994 war, most commonly on social issues such as health care, and education. These are undoubtedly issues that need attention but these organizations have no mandate to focus on environmental issues or to

address long term concerns (Kalpers and Lanjouw 1999 cited in Lanjouw et al., 2004). While many of these humanitarian organizations have supported environmental concerns due to the recognizable link between environment and human welfare, their support have not been long term (Lanjouw et al., 2004).

4.2 Problem Linkages

The problems in the region are manifold and complex. The problem linkage described here and demonstrated in Figure 1., is a simplified version of the situation and it aims at giving a clear understanding through cause and effect relationships. There might be other factors not included here that may lead to some of the problems listed or depending on the reader's interest a different core problem could be identified which could also lead to a rearrangement of the problems. The linkages are based on a literature review of related documents and input from the local counterparts. They are used in further analysis of what the region needs.

As the IES' objective is to promote environmental security it recognizes the core problem in the study area as environmental destruction. That includes, for instance, cutting of trees to be used as firewood or as building material, clearing forests for agricultural activities and hunting wildlife in the national parks.

Primary causes of environmental destruction in the region are traditions and a tendency toward tribalism as opposed to nationalism. While traditions are primary causes they can also lead directly to environmental destruction. One of the traditions referred to in this case is the unsustainable use of natural resources. Other traditions are, for instance, family size and the vocation of the majority of people – subsistence farming. So many people are farmers because that is what they know to do. Until they are provided with the opportunity to do something other than farming or to learn untraditional but better ways of farming in the existing conditions, there will continue to be demands for more land and consequently, more environmental degradation.

Together traditions and tribalism determine what type of governance or guidance is present in the country. Governance includes different parameters such as knowledge in different fields; the duration or period of governing as experience and wisdom is gained over time; available finance; and, how equally opportunities are distributed country wide. Without technical knowledge, for instance, what else can be planted or how can agricultural practices be improved, or without sufficient funds, it is not possible to pay agricultural extension officers to go out and teach farmers effective methods or to supply the poor with drinking water much less install irrigation systems. As a result, people are farming the traditional way at a time where there are more people and less fertile soils. Low farm yields keep 90% of the population near the parks in poverty. As poverty is often linked with high population growth rates, this has been fitted in at this level of the problem tree. It is presumed that even if it is traditional to have large family sizes if people are not in poverty and can afford such things as education, the family sizes and growth rate of the population will decline. On the other hand, if people are able to

generate sufficient income to afford education and to provide for their families all year round without major difficulties no matter the family size then perhaps reducing the family size is not an issue. There are many countries with as large a population density as the countries in this case study, the main difference is that the density exists in cities where people do other jobs besides farming, and have access to education, health care, and other basic necessities.

The more people there are as traditional farmers the more demand there will be for agricultural land. In the region, perhaps more so for Rwanda, the farm size per family has already been reduced beyond practicality due to the great demand. More people on a limited area lead to an increased population density and together with limited yields and a dependence on the national parks to supplement their diets further environmental destruction becomes inevitable.

This lack of good governance or guidance in the form of not being able to provide irrigation alternatives, not educating sufficient farming communities or not effectively enforcing the law on destruction of wetlands, leads to unsustainable use of natural wetlands for agriculture. Once there is a reduction in the water supply this affects the ability of the hydropower plants to provide electricity to the region. In Rwanda, 94% (1997 estimate) of electricity comes from hydropower (Small-Scale Hydro Task Force). To mitigate the unreliability of the hydropower plant the government resorted to using petrol generators. This is a backward step in terms of environmental conservation.

Inadequate governance in addition, can result in rebel group formulation and activities. Rebel activities have caused civil unrest, political instability, and one of the most inhumane catastrophic events in the history of humankind, the genocide of 1994. As a result there were thousands of IDP's and refugees settled in protected areas one of which, Gishwati Forest Reserve, had to be dereserved after there was approximately two-thirds of the forest cleared. Also, as is often the case after such violence, there are many people that must recognize and learn to deal with post traumatic stress disorder.

Due to the loss of thousands of lives just over 10 years ago and the IDP's and refugees situation there is a pressing need for trained professionals in various fields, such as conservation and environmental protection; and, research and implementation of alternative ideas to agriculture. Without trained professionals it is difficult for the region to uphold laws and conventions which they have ratified and agreed to whether at national, regional or international levels. Also, these countries in some cases are already breaking agreements due to the environmental destruction that currently exist. This can lead to conflicts at different scales, and loss of opportunity for acquiring funds from international donors. These are funds which could be used to protect the environment and alleviate poverty. Other effects of environmental destruction are the destruction of mountain gorilla habitat thus leading to less tourism revenues. Together, less tourism revenues, less opportunities to receive international funds and no hydropower leads to more poverty and the cycle of environmental destruction, poverty and potential violence continues.

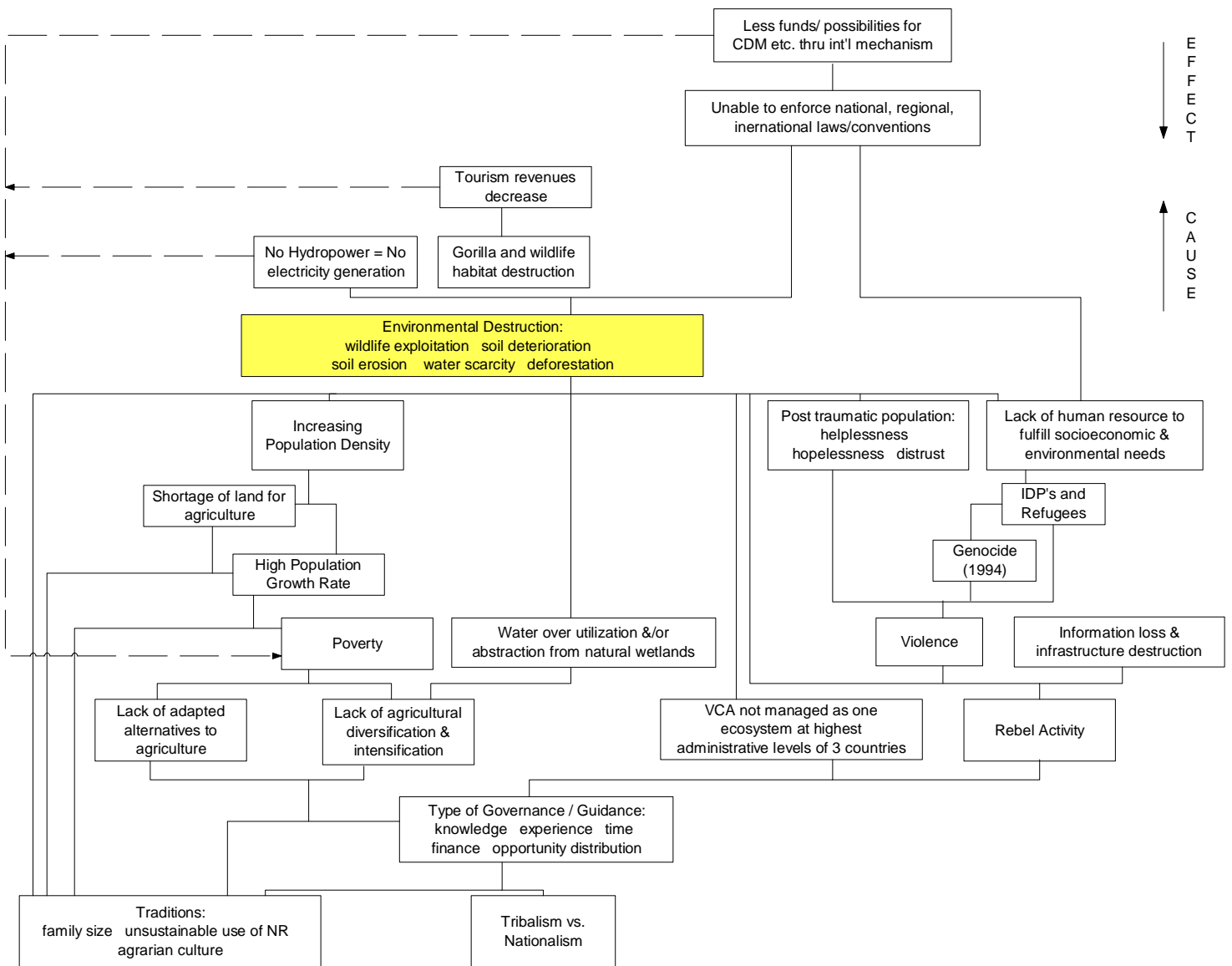


Figure 1. Problem tree (cycle) showing cause and effect relationships among the problems identified in the region

4.3 Stakeholders

4.3.1 Stakeholder Identification

In order to address the problems appropriately it is important to have an understanding of each group’s concerns. As there are many different stakeholders in the region, in some instances categories were developed to make consideration of as many stakeholder groups feasible for this study.

1. Protected area and wildlife authorities in the region

a) Office Rwandais du Tourisme et des Parcs Nationaux (ORTPN)

The Office Rwandais du Tourisme et des Parcs Nationaux (ORTPN) was created in 1973 as the national authority managing Rwanda's parks and tourism sector....With the recent restructuring, ORTPN's parent Ministry shiftedto two new supervising ministries: the new Ministry of Commerce, Industry and Tourism and the Ministry of Land, Reinstallation and Environment (MINETER). Aside from this administrative supervision, the ORTPN remains a parastatal organisation and therefore financially and legally autonomous from its parent Ministries. The ORTPN is represented in each park by a Park Warden (Conservateur) and his staff (Lanjouw et al., 2004). Recent, restructuring aimed at improving ORTPN's functions ended 2004 ("Raphael Rurangwa, Personal Communication, 14 July, 2005,").

b.) Institut Congolais pour la Conservation de la Nature (ICCN): Democratic Republic of Congo

The ICCN is the custodian of DR Congo's protected areas. The ICCN is a parastatal body having a relative degree of financial and legal autonomy, but it comes under the overall responsibility of the Ministry of Land Tenure, Environment, Conservation of Nature, Fisheries and Forests (Ministère des Affaires Foncières, Environnement, Conservation de la Nature, Pêche et Forêts)

Throughout the crisis, the Institut Congolais pour la Conservation de la Nature (ICCN) has continued to monitor the park, although certain areas have been restricted due to the security risks associated with the presence of armed groups moving through the forest, and associated insecurity in the region (Lanjouw et al., 2004).

c.) Uganda Wildlife Authority

...The parastatal Uganda Wildlife Authority (UWA), started operations in August 1996. UWA falls under the Ministry of Tourism, Trade and Industry. As in Rwanda, each of the two parks is managed by a Chief Park Warden (Lanjouw et al., 2004).

2. Communities surrounding protected areas

Previously described in section 2.9.

3. Military and civil authorities in the region

The park authorities in all three countries work closely with the local civil and military authorities. The authorities at the different administrative levels (parish/cellule, district/prefecture and commune) work with the Wardens and guards, and many extension and sensitization activities have been jointly implemented (Lanjouw et al., 2004).

4. Programs, NGO's

a.) The International Gorilla Conservation Programme (IGCP)

The IGCP has been working in the Virunga-Bwindi region in Central Africa since 1991. The program is a coalition of the African Wildlife Foundation (AWF), Fauna and Flora International (FFI), and World Wide Fund for Nature (WWF). Prior to the arrival of IGCP, the four parks were managed as separate entities by the national protected area authorities. Yet the Virunga ecological unit spans the borders of the three countries, and the threats to the ecosystem come from all sides of the border (Lanjouw et al., 2004).

4.3.2 Stakeholders Interests

Stakeholders	Interests
1. Park Authorities	
a. ORTPN (Rwanda)	Responsible for law enforcement, protection and surveillance, research and monitoring, education and extension work, tourism, management and administration. The majority of the revenues that accrue to ORTPN come from mountain gorilla tourism in the PNV(Lanjouw et al., 2004).
b. UWA (Uganda)	To safeguard protected areas and biodiversity of Uganda; To increase both participation in and derived benefits of local communities from protected areas and wildlife; To develop national based tourism; To co-ordinate activities with the National Environmental Management Agency (NEMA) (Lanjouw et al., 2004).
c. ICCN (DRC)	Responsible for park management related activities: Tourism, Community Conservation, Law Enforcement, Protection and Surveillance, Research and Monitoring, administration and management (Lanjouw et al., 2004)
2. Local Communities	Over 90 percent practice subsistence level agriculture: need land for crops; want successful harvests To complement their food and livelihood production strategies with resources within parks: wood for fuel and construction; water; hunting; plants for food and medicine (Lanjouw et al., 2004)
3. Poachers	To hunt animals To capture young animals (baby gorillas) for trade on black market (Lanjouw et al., 2004)
4. National Government	To have peace and stability in country To develop Kigali as “Chicago of Africa”(CNN broadcast...) To protect environment -poverty reduction, infrastructure development, privatization of government-owned assets, expansion of the export base, and liberalization of trade(Bureau of African Affairs, 2005b)
5. Local Government	
6. Military	to protect the park wardens and guards and to train them (along with the protected area authorities) to patrol and protect the insecure border areas of the park (Lanjouw et al., 2004).

7. Rebels	To be able to live off natural resources To rebel against governmentspower struggles
8. Programs and NGO's e.g.	
a. IGCP	Conservation of mountain gorillas and regional afro-montane forests in Rwanda, the Democratic Republic of Congo, and Uganda.
b. WCS	To improve conservation in biologically rich region, and train institutes to improve monitoring and capacity for research
c. CARE	Poverty Reduction
d. DFGFI	To conserve gorillas and their habitats in Africa through anti-poaching, regular monitoring, research, education and support of local communities
9. Multilateral Donors	
a. Dutch Government	Various: conservation, poverty reduction
b. US Government	Various: conservation, poverty reduction
c. GTZ	Various: conservation, poverty reduction
d. Swiss	Various: conservation, poverty reduction
10. Global Community	To protect biodiversity and unique ecosystem To protect gorillas (and perhaps even visit them) To discourage environmental changes or destruction in the region that could propagate outward and compound the situation

4.4 Conflicts

From the stakeholder interests table a few conflict situations are visible. The governments, park authorities, environmental organizations and the global community want to protect the parks and their ecosystems but local communities, poachers and rebels want to use the resources from the parks for their livelihood. Also the government of Rwanda needs water to provide people with electricity from hydropower but farmers use it for agriculture. The result is sporadic blackouts due to inadequate functioning of hydropower plants. Conflicts exist between rebel groups and the governments and the local communities.

5 Attention Areas for Mitigation

Based on the problem linkages some problems are selected for attention. These problems are selected because they can be mitigated within a relatively short term to give improvement for the long term, they are identified and supported by local contacts and they match the objectives/priorities of the IES and the Dutch government.

1. Traditions:

Whilst it is not our main goal to interfere in the traditions of the people in the region we recognize that some actions and beliefs crucial to the problems faced stem from traditions, for instance, hunting wildlife whether outside or inside protected areas. There are ongoing efforts geared toward educating people living near to and dependent on the

NP's on how to live sustainably with the parks. This education needs to continue and incorporate more of the people who use park resources.

2. Alternatives to agriculture:

The communities in the area are predominantly agrarian. This is also a tradition and it is necessary to provide education on what other forms of livelihood are possible. Education alone is insufficient; however, opportunities must also be made available for farming communities to adopt agricultural activities.

3. Intensification and diversification of agriculture:

At the moment there is also a limited number of crops that are grown and often only during the rainy season when water is naturally more available. While these crops may provide the basic caloric intake for people they are not sufficient as locals are found hunting, or extracting resources from the parks to supplement their diets or livelihood. Agricultural intensification refers to the application of chemicals in order to increase the yield per area of agricultural land. It includes also the collection of rain water and installation of irrigation systems to make it possible to generate crop yields during dry seasons and thus enable farmers to produce for commercial purposes and not only subsistence. Methods for intensification and diversification will need to be researched, tested, planned, applied and monitored.

4. Energy:

There is a conflict over the water resources. The same water that is used for agriculture and human consumption by local communities is needed to generate hydropower. The possibility of replenishing the adequacy of the hydropower plants in Rwanda should be researched. As hydropower is often viewed as an environmentally safe way of obtaining energy and as the hydropower plants of Rwanda have proven successful in the past the possibility of storing more water should be sought after. Other alternatives for energy such as methane from Lake Kivu should be researched. Alternatives are especially important as it has been speculated that the problem of water shortage for hydropower could stem also from local climate change. Research carried out by a team from the United States Forest Service (USFS) under the request of the IGCP, have done preliminary research on water needs in the region and made recommendations for next steps. Such recommendations can be reviewed and adopted to fit the attention areas identified here especially regarding 3. and 4.

5. Governance:

As a positive outcome of the past turmoil, the people and the present administration of Rwanda have made quite an impression on the rest of the world by demonstrating hard work, dedication, and zero tolerance for corruption at all levels. There are still areas that need attention though. For the prevention of environmental destruction and poverty alleviation there needs to be assistance with financing and training on sustainable

development. Government or non government staffs who are trained in order to carry out their work can in turn train others in the communities where applicable. Once education and alternatives are set in place for local communities there will be need for more consistent law enforcement for park protection in order to reinforce the importance behind environmental conservation.

6. VCA higher level management:

As management of the park is necessary at the higher levels, efforts of collaboration should be encouraged. Local incentives to achieve this are, for instance, the increased and reliable income that can be generated from a more synchronized management or the knowledge that the parks' protection goes beyond vegetation and wildlife protection to long term benefits for the region such as soil conservation in a region of predominantly farmers.

7. IDP's and refugees:

IDP's, like other communities need to be provided with the capacity that allows them to live sustainable lives.

8. Rebels:

Their ongoing threats of invasion and attacks, or solely movements through the national parks are preventing the stability of the region. It retards tourism growth and destroys the environment.

9. Monitoring:

There needs to be monitoring of land use, land cover changes, health and status of the gorilla habitat, and environmental conditions such as soil erosion and water availability.

10. Foreign aid:

There needs to be funds dedicated to long term environmental programs. The link between environment and human welfare has been recognized in the three countries and they have taken measures to support this such as ratifying environmental related conventions but without funds or capacity they cannot implement ("Dr. Rose Mukankomeje, Personal Communication,18 July, 2005,"; "Gaspard Ndagijimana, Personal Communication,13 July, 2005,").

6 Recommendations

The recommendations are based on the understanding of the problem linkages and the areas, thus needing attention. Attention areas that are considered priority have been arranged into categorical order and are listed below.

In order to mitigate environmental destruction enforcing the law and charging people alone is futile. Law enforcement needs to be accompanied by alternatives and education

provided to the communities. Four areas that need attention are governance/ guidance, local community empowerment, energy production and monitoring. The table below outlines the themes under each attention area along with a brief description of how this goal can be achieved. Specific descriptions to achieve some of the goals follow the table.

Attention Area	How to Address
<p>1. Governance/Guidance</p> <ul style="list-style-type: none"> a. Obtaining finances b. Obtaining Education & training c. Law enforcement <ul style="list-style-type: none"> - Park & biodiversity protection - Rebel activities d. VCA transboundary management implemented at highest levels 	<ul style="list-style-type: none"> a. Environmental services valuation & financial mechanisms adoption^I b. Establish relationships with international training institutes^{II} c. With funds obtained in a. and with assistance of remote sensing for monitoring^{III} and with military assistance^{IV} d. Continued cooperation amongst 3 countries^V
<p>2. Local community (former IDP's and refugees also) empowerment</p> <ul style="list-style-type: none"> a. Free Education/Training: <ul style="list-style-type: none"> - on importance of environmental protection and respecting park laws - for youths geared toward non-farming vocation. e.g. business establishment, marketing, finance, conservation, - on methods for improved agricultural yields and diversification in crops - transferring knowledge from international organizations to locals for continuity and local ownership of important activities b. Facilities <ul style="list-style-type: none"> - water for consumption and irrigation - assistance with intensification/diversification of agriculture: fertilizer, seeds, tools - financial assistance for business development - counseling/reconciliation services for treatment of PTSD 	<ul style="list-style-type: none"> a. With funds and training from 1a. & b. above - Funds from 1a. above & joint technical capacities^{VI} - Funds from 1a. above - Funds from 1a. above - Funds from 1a. above & joint technical capacities.
<p>3. Energy Production</p> <ul style="list-style-type: none"> a. Water Resources Management <ul style="list-style-type: none"> - develop irrigation systems for agriculture - maintain water resource needed for hydropower - replant trees: prevent soil erosion and sediment run off into water bodies; and, drying out of soils and streams b. Methane <ul style="list-style-type: none"> - Continue research of feasibility & environmental cost of methane use for power generation c. Fuelwood <ul style="list-style-type: none"> - Replant trees: to avoid NP exploitation 	<ul style="list-style-type: none"> - Funds from 1a. above & joint technical capacities. - Dependent partly on success of irrigation sys. & other improved agriculture methods e.g. soil conservation practices, agroforestry - With funds obtained in 1 a. and with assistance of remote sensing for monitoring b. With funds and training from 1a. & b. above c. With funds obtained in 1 a. and with assistance of remote sensing for monitoring
<p>4. Monitor</p> <ul style="list-style-type: none"> - Geospatial info. compilation of environment and baseline and legal data - Land use & land cover of mitigated areas - All other recommendation programs established in order to ensure that not only direct goals are achieved but also environmental preservation 	<ul style="list-style-type: none"> - Remote sensing and GIS required: With funds and training from 1a. & b. above - assistance of remote sensing for monitoring - Funds from 1a. above, assistance of remote sensing for monitoring & good communication between local executing agencies and program evaluation group

Table 4. Attention area outlined and options on how to address

I. Environmental services valuation & financial mechanisms adaptation

1. For the region to receive funds through environmental related conventions there needs to be first investigations carried out to determine the ecological, hydrological, social, and economical value of the environmental services and goods to the wider region and the global community. In early 2005, through assistance from USAID a United States Forest Service team carried out a preliminary analysis of the hydrology in the region. They found that Bwindi was major headwater catchment area and was critical to the hydrological balance of the region. Such discoveries can prove vital for the environmental security of Bwindi. Unlike the Virungas, the communities in Bwindi do not enter the park for water but they do exploit the other resources there. If the region dependent on Bwindi for other resources could benefit from conservation, the communities could be provided with alternatives and sustainable means of living. For these reasons, analyses such as that of the USDA Forest Service and of the Global Environment Facility (GEF) -funded Global International Waters Assessment should be continued, also with special attention to the relevance for the Nile Basin Initiative.

2. The values of environmental services and goods as well as the threats in the region should be laid down on maps as produced for the UNEP/UNDP/OSCE program on environment and security in Central Asia, the Caucasus and South-East Europe so as to give policy-makers and donors at the various levels, a direct and integrated view of the issues to be addressed. (See map produced for this case-study.)

3. On or in association with the maps the pertinent international legal regimes should be identified, or compiled from existing research, so as to define the responsibilities, obligations and rights of the various actors in and relevant for the region. It is recommended strongly to take the responsibilities and obligations of the countries in the Virunga-Bwindi region under the international environmental conventions seriously and work together as Parties to these *binding* law agreements. There is also great need in these countries to be treated as equal partners and not just as receivers of aid.

4. Whatever the exact legal arrangement, adequate financing for long term monitoring and management is an absolute requirement for the Virunga-Bwindi region to be successful as a peace park, as habitat for unique biodiversity and possibly as a “water tower” for the surrounding regions. Contributing to regional peace, to the protection of globally unique biodiversity and to the protection of a strategic regional watershed, warrants long term funding from regional and global sources. It is therefore recommended to investigate the effectiveness of the Mgahinga and Bwindi Impenetrable Forest Conservation Trust Fund (MBIFCT) and dependent on the outcome either adopt it or find an alternative to address the needs of the Rwandan and DRC components. The idea is to increase the amount of the endowment accordingly, to such a level that it can buffer drops in income from tourism. MBIFCT was set up to finance the global biodiversity benefit as defined by the GEF. To the geographically extended Trust Fund could be added the hydrological component, mentioned above (I1.), which could generate

funding under the International Waters window of the GEF. An initial GEF grant can of course leverage other sources of funding.

5. The format of the fund could be that of the multi-donor trust fund as already proposed for the peat swamp forest projects in Indonesia and for the Amazon programme of the Dutch embassy in Colombia. To the endowment could be added a sinking fund component and a revolving fund component. The sinking component could f.e. finance a programme of training and capacity enhancement for the park management and for development of economic alternatives for the neighbouring communities. The revolving component could be used to give credits to starting businesses under f.e. the IGCP Enterprise Programme, to be paid back if the business is successful. The fund also could be the vehicle for the revenue sharing mechanism, as is being set up by the Rwanda's ORTPN to transfer a certain percentage of the income generated by the parks to the surrounding communities.

6. In order to maintain the Virunga Volcanoes park complex as a peace park and to provide sustainable livelihoods for the surrounding populations as a whole –especially in densely populated Rwanda – the highest priority has to be given to generate sources of income and employment outside the subsistence agriculture in which 90% of the population near the parks is working. If one would look at small to medium industries and to the ICT sector, energy (in the form of electricity) is an absolute requirement. Here there is a dilemma for a country like Rwanda, where water used for hydropower is diverted towards agriculture, thus increasing the need to use “dirty diesel” to produce electricity. This is exactly the opposite of what should be done to make the country earn income from producing carbon credits under the Clean Development Mechanism of the Kyoto Protocol. Building on existing (UNIDO/GEF) initiatives the Dutch development cooperation through its bilateral and multilateral channels should strongly support a Clean energy strategy for the countries sharing the Virunga Massive, including creating options for CDM projects. Reforestation to prevent erosion and sedimentation of water bodies suitable for hydropower could at the same time qualify for the CDM. The Dutch CDM office at the ministry of VROM should be consulted to see whether now or in the future the obligatory Dutch greenhouse gas emission reductions via the CDM could be realized f.e. through energy and/or forestry projects in Rwanda.

II. Establish relationships with international training institutes

1. During the visit to the Virunga-Bwindi region, Dr. Rose Mukankomeje, the Director General of the Rwanda Environment Management Authority (Pers. Comm, 18 July, 2005) stated that Rwanda needs assistance with improving their technical capacity and gave the example of lacking training in the execution of environmental impact assessments. It seems also that it is difficult for the region to obtain foreign consultants in technical fields because of the reputation the region has in terms of violence and instability ("Gaspard Ndagijimana, Personal Communication, 13 July, 2005,"). In addition, regarding 3b. from Table 4. above, a special role could be played by the methane gas from Lake Kivu, Rwanda. Considering the risks associated with exploiting this gas, a thorough EIA of any project to indeed exploit this gas has to be conducted.

There are many training institutes world wide focusing on different fields. In the Netherlands, for instance, the Dutch EIA Commission, which specializes in environmental impact assessments, can be very helpful to assist the Rwandan authorities in preparing the necessary EIA's. Contacts have already been established, after the visit of the IES team to Rwanda in July 2005, between the Rwanda Environmental Management Authority and the Dutch EIA Commission but would undoubtedly, need to be extended and strengthened.

Another example of training institutes is the International Institute for Geo-Information Science and Earth Observation (ITC) of the Netherlands which specializes in training and applying of GIS and RS to a number of fields. The ITC currently has an ongoing project with the National University of Rwanda in Butare to develop the university's capacity to train and carry out research in the field of Geographic Information Science (GIS) and Remote Sensing (RS) applied to rural sector transformation and poverty reduction. Such joint programs should be supported to help meet the technical needs in the region.

III. With funds obtained in a. and with assistance of remote sensing for monitoring

1. As a component of ensuring environmental security monitoring is essential. Both the monitoring of biophysical and man made aspects of the region as well as monitoring of the administration and effectiveness of projects is important. Regarding the former, we recommend the implementation of a permanent monitoring system aimed at detecting land use and land cover changes with systematic ground truthing by local authorities and counterparts such as IGCP should be set up. There should be periodic reporting of this monitoring, f.e. on the occasion and for the benefit of the quarterly tripartite meetings of the park authorities to discuss the joint management of the parks. Of course the results of the monitoring should also be made available to the governments and all other relevant decision-makers in order to allow them to take adequate action in time for environmental protection as well as maintaining the conditions necessary for the contracts to be formulated with donors. It is proposed that SarVision with its unique radar methodology and Synoptics because of its involvement in BEGo, take the lead in setting up this monitoring system from the remote sensing side.

2. A crucial part of monitoring is being able to compare new findings with the past or with other types of data, thus the use of geographical information system (GIS) technology is also essential. Other data types can include cadastral boundaries, land use zoning plans, and maps of land suitability assessment. Included in setting up the monitoring system which includes the remote sensing and GIS components there should be modules for training based upon a needs assessment, for the (local) authorities and counterparts. (Refer to II above.)

IV. Military assistance

1. Considering the fact that one of the major threats to the ecological integrity of the Virunga Massive still is the instability on the Congolese side, it is recommended – if this is not yet already arranged –to establish (informal) channels of communication with MONUC to prevent invasions of the parks or using them as shelter and to strengthen park protection if needed. (See recent recommendations by International Crisis Group to MONUC).

V. Continued cooperation among the three VCA countries

1. The key element of the management of the Virunga Massive as a peace park is formed by the quarterly meetings of the rangers and (park) authorities as facilitated by the IGCP. As is suggested at III.1. above, these tripartite consultations may benefit from updated monitoring reports. Also one may think of upgrading the Trilateral Memorandum of understanding between the three park authorities to a “Legal Framework for a Transboundary Area”, as is proposed in the report by IES Legal Advisor Serge Bronkhorst *The Virunga Volcanoes and the Bwindi Impenetrable National Park: Cooperation in the management of shared natural resources and the concept of Transboundary Protected Areas*”. This would imply a binding treaty between the three states. While this should be considered a desirable end goal to legally “cement” the necessary cooperation, the steps towards such an arrangement should be very carefully planned and built upon concrete progress of the on-going consultations between the three park authorities. By the end of the IES project, in October 2005, the IGCP reported that the three nations signed a Tripartite Declaration (14th October, 2005) that declares amongst other things to target *the establishment of a strategic transboundary collaborative management system that enables sustainable conservation of the Central Albertine Rift biodiversity for long-term socio-economic development*. A five year strategic plan is completed and a management plan for the Virunga-Bwindi region is underway ("Annette Lanjouw, Personal Communication, 20 October, 2005,").

VI. Funds from 1a. above & joint technical capacities.

1. A joint capacity is similar to 2. above except the local experts would be working alongside foreign experts of the same field to build infrastructure in rural areas. The benefits would be a transfer of modern expertise at the same time as infrastructure development.

7 Conclusion

The challenge now for these countries is to alleviate poverty; compliment traditional forms of livelihood with sustainable alternatives; raise park management to the next level by establishing transboundary collaboration at the higher levels of administration in the 3 countries; explore and develop clean and safe alternative sources of energy in addition to hydroelectricity; assist families with education for children; provide equal opportunities to all; install basic facilities in communities, for instance, access to water, sanitation, health care, schools and electricity. To accomplish all of the above there are a few areas more foundational where the international community can assist. These countries have signed and ratified all the major environmental related conventions; and, they have recognized the crucial role environmental conservation plays in the rest of the economy and the improvement of civil society. What the countries need first is that potential and current donors also recognize the importance of long term environmental conservation and start funding those needs.

There are organizations presently addressing many of the problems we have identified as priority. While there needs to be investigation on how much is planned and what is there already funds allocated for, it is clear that these priority problems need more attention or more long term support.

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9 Acronyms

BINP	Bwindi Impenetrable National Park
CARPE	Central African Regional Program for the Environment
CDM	Clean Development Mechanism
DFGFI	Dian Fossey Gorilla Fund International
DRC	Democratic Republic of Congo
EIA	Environmental Impact Assessment
FFI	Fauna and Flora International
GEF	Global Environment Facility
GIS	Geographical Information System/Science
GTZ	Gesellschaft für Technische Zusammenarbeit
ICCN	Institut Congolais pour la Conservation de la Nature
IES	Institute for Environmental Security
IGCP	International Gorilla Conservation Programme
ITC	International Institute for Geo-Information Science and Earth Observation
IUCN	The World Conservation Union
IZCN	Institut Zaïrois pour la Conservation de la Nature
MBIFCT	Mgahinga and Bwindi Impenetrable Forest Conservation Trust Fund
MGNP	Mgahinga Gorilla National Park
MINETO	Ministry of Environment and Tourism
MINITER	Ministry of Land, Reinstallation and Environment
MONUC	United Nations Mission in the Democratic Republic of Congo (Mission des Nations Unies en République Démocratique du Congo)
NGO	Non Governmental Organization
ORTPN	Office Rwandais du Tourisme et des Parcs Nationaux
OSCE	Organization for Security and Co-operation in Europe
ViNP	Virunga National Park
VNP	Volcanoes National Park
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organisation
UNHCR	United Nations High Commissioner for Refugees
UNICEF	United Nations Children's Fund
UNIDO	United Nations Industrial Development Organization
USAID	United States Agency for International Development
USDA	United States Department of Agriculture
UWA	Uganda Wildlife Authority
VCA	Virunga Conservation Area
VROM	Netherlands Ministry of Housing, Spatial Planning and the Environment (Ministerie van Volkshuisvesting, Ruimtelijke Ordening en Milieubeheer)
WCS	Wildlife Conservation Society
WFP	World Food Program (UN)
WWF	World Wide Fund for Nature (in the USA: World Wildlife Fund)

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IES EnviroSecurity Assessments

A major proportion of the world's ecosystems and the services they perform for society and nature is being degraded or used unsustainably. This process affects human wellbeing in several ways. The growing scarcity of natural resources creates a growing risk for human and political conflicts and hinders sustainable development and the poverty alleviation that depends on it. Situations involving resource abundance can also be related to serious environmental degradation, increased community health risks, crime and corruption, threats to human rights and violent conflicts – in short, to a decrease of security.

The overall objective of IES EnviroSecurity Assessments is to secure the natural resource livelihood basis on the local, regional and international level. IES pursues this objective along the following mutually related lines: (1) the conservation of ecosystems and their related services, (2) the implementation of the international legal order, (3) the provision of economic incentives for maintenance of ecosystem services, and (4) empowerment of relevant actors and dissemination of results.

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The **Institute for Environmental Security** (IES) is an international non-profit non-governmental organisation established in 2002 in The Hague, The Netherlands with liaison offices in Brussels and Washington, D.C.

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Our multidisciplinary work programme - **Horizon 21** - integrates the fields of science, diplomacy, law, finance and education and is designed to provide policy-makers with a methodology to tackle environmental security risks in time, in order to safeguard essential conditions for sustainable development.

Key objectives of the **Horizon 21** programme are:

- **Science:** Create enhanced decision tools for foreign policy makers, donors and their target groups on regional, national and local levels;
- **Diplomacy:** Promote effective linkages between environment, security and sustainable development policies.
- **Law & Governance:** Contribute to the development of a more effective system of international law and governance;
- **Finance:** Introduce new and innovative financial mechanisms for the maintenance of the globe's life supporting ecosystems; and
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