



Making space for birds: Sourcing solutions from the mountain gorilla conservation model in Rwanda

Marie Laure Rurangwa^{a,*}, Robert J. Whittaker^{a,b}

^a School of Geography and the Environment, University of Oxford, Oxford, OX1 3QY, UK

^b Center for Macroecology, Evolution and Climate, GLOBE Institute, University of Copenhagen, Copenhagen, Denmark

ARTICLE INFO

Keywords:

Avitourism
Bird conservation
Mountain gorilla
Multi-stakeholder partnership
Protected area
Rwanda
Systematic conservation planning

ABSTRACT

Rwanda being one of the most densely populated countries in Africa, a large proportion of its native vegetation has been converted into agriculture and settlements, leading to the extensive loss and degradation of natural habitats, with significance for birds as well as other taxa. Despite this, tangible success has been attained in the conservation of mountain gorillas thanks to the high priority afforded to this species and the vigorous protection of its habitats. This article reviews the current conservation approaches in Rwanda, and their effectiveness in addressing threats to the country's avifauna. Drawing lessons from the conservation of the mountain gorilla approach, and with reference to the principles of Systematic Conservation Planning, this paper argues that the creation of more reserves complementing existing protected areas, the development of bird-related tourism, and a multilevel collaboration of stakeholders at national and regional level, in which the public play a strong role, are crucial for the long-term conservation of birds. The aim of this analysis is both to provide policy options for Rwanda and to suggest an approach to conservation practice for wider application that is scalable and transferable within a developing country context.

1. Introduction

With roles ranging from food provisioning, pest and disease control, pollination, seed dispersal, top predators and environmental indicators, birds are vital to the functioning of ecosystems (Whelan, Şekercioğlu, & Wenny, 2015). In addition to that, birds have always fascinated and inspired all human cultures and reinforced their social cohesion as evidenced by songs, poems, riddles and customs of which they form the basis. Bird watching and photography enterprises have substantially contributed to economic growth, particularly in developed countries. For example, a private company, Birding Ecotours, organizes regular three-weeks photo and birding tours in 11 reserves of Kenya for a cost of US\$15,973 per person, including superior hotels where accessible (birdingecotours.com, accessed on 16/10/2019). Herget, Schamel, Scheder, and Job (2016) reported that crane migration viewing at Vorpommersche Boddenlandschaft National Park in Germany generated 4.4 Million Euros, and in the UK, an estimation of over £750 000 was retrieved from seabird tourism in 2009 (Royal Society for the Protection of Birds, 2010). In 2016, wildlife watching expenditures in the USA amounted to US\$ 75. 9 billion, and 88 % of participants (N = 43.8 million) were observing birds (U.S. Fish And Wildlife Service & U.S. Census Bureau, 2018). An earlier survey in 2011 (Carver, 2013)

had previously reported that US \$41 billion was spent on bird-related annual trips and equipment, and consequently, 666 000 jobs were generated across the USA.

Despite their crucial ecological and socio-economical contribution, a significant number of bird populations have been declining globally (Birdlife International, 2018). A net loss close to 3 billion North American birds since 1970 has been reported (Rosenberg et al., 2019) and one third of bird species require urgent conservation intervention (North American Bird Conservation Initiative, 2016). According to the Pan-European Common Bird Monitoring Scheme (2018), 57 % of European farm bird species populations registered population falls between 1980 and 2016. Africa's birds have not fared well. 10 % of the 2 355 bird species are considered globally threatened, largely due to habitat loss and degradation driven by agriculture and logging (Birdlife International, 2013). The situation is particularly severe for African vultures, whose populations have suffered declines of 80–97 %, largely due to the consumption of poisoned carcasses of large carnivores (Birdlife International, 2018).

In Rwanda, the clearance of the natural vegetation, which covered half of the country 50 years ago, has led to plummeting bird populations outside reserves and ten bird species extinctions (Vande Weghe, 2018; Vande Weghe & Vande Weghe, 2011). In contrast to the limited

* Corresponding author. Tel.: +44 7375200205.

E-mail addresses: rurangwaura8@gmail.com (M.L. Rurangwa), robert.whittaker@ouce.ox.ac.uk (R.J. Whittaker).

action towards the protection of birds, Rwanda has attained incredible success in the conservation of the mountain gorillas (*Gorilla beringei beringei*), which is the only great ape (excluding humans) that has been increasing in numbers in the last three decades (Gray et al., 2013; Greater Virunga Transboundary Collaboration, 2018). Consequently, the IUCN conservation status of this gorilla subspecies was recently downlisted (Hickey et al., 2018). Investing similar efforts in the preservation of birds guarantees a broad array of advantages, particularly fulfilling Rwanda's quest to expand and diversify its tourism industry, which is heavily reliant on gorilla trekking activities (Rwanda Development Board [RDB], 2018a).

Parallels between mountain gorillas and birds can be hard to draw since the former are genetically closer to humans, hence their loss strikes a chord, hastening support and fund mobilization. Secondly, the conservation plan and management of one species (*Gorilla beringei*), confined in two sites that are in close geographic proximity is relatively easy compared to the management of hundreds of species of birds with different behaviour and habitat affinities. Nonetheless, there are shared elements crucial to the conservation of the two groups that make sensible the transfer of insights from the mountain gorilla conservation approach to birds. These commonalities lie in the forms and magnitude of their threats, the high charisma that garners quick support from the lay public and scientists, and the potential economic returns when effectively managed. Added advantages of planning for birds as a whole taxon are their diverse functional traits, and ubiquitous dispersal patterns, which warrant wider conservation coverage of a diverse of species, ecosystems, and associated functions and services. This would be an important outcome, since focusing on mountain gorillas has not led to the cessation of threats to other animals within the same site, as shown by persisting antelope poaching incidences in Volcanoes NP (Sabuhoro, 2017).

The concept of prioritizing certain bird species, or the whole avian taxon as conservation surrogates has been extensively deliberated in the literature (Blair, 1999; Jones et al., 2016; Lambeck, 1997; Lindenmayer et al., 2002). Implementation on the ground of a global scheme was concretized in the late 1970s by BirdLife International's "Important Bird and Biodiversity Areas" (IBAs), which were identified based on the presence of species that are globally threatened, range or biome restricted, and congregatory (Fishpool & Evans, 2001). According to Birdlife International (2013) and Birdlife International (2018), the majority of IBAs across the world lack legal protection, and investment funds. The leading threat in Africa has been habitat loss and degradation due to expansive and intensive agriculture, and a surge in infrastructure projects, particularly in the transport, and energy sectors. Effective and wider conservation coverage of avian biodiversity may gain from learning from successful conservation models, and adopting working methods using holistic planning tools.

The paper proceeds with an overview of the Rwandan avifauna, and discusses how current conservation approaches entail loopholes in protecting birds and their habitats. Through the lens of systematic conservation planning, the paper demonstrates how practical lessons learnt from the conservation of the mountain gorilla can be adapted and scaled-up to alleviate threats to birds, and subsequently benefit other associated taxa.

2. Avian diversity

Although Rwanda (26 338 km²) has a small surface area, it is home to a large variety of vegetation types influenced largely by Eco-climatic zones comprising the Afro-alpine, humid, sub-humid and the sub-arid zones (Vande Weghe & Vande Weghe, 2011). The avifauna of some 703 species falls within the Afromontane, Guineo-Congolian, Lake Victoria, Zambesian, Soudan-Guinea savanna, Somali-Maasai, and Malagasy biogeographic regions (phytochoria), and 26 % are vagrants, intra-African and Palearctic migrants (Kanyamibwa, 2001; Vande Weghe, 2018; Vande Weghe & Vande Weghe, 2011). Although Rwanda has no

strictly endemic bird species, eight of the nine Lake Victoria endemics and near endemics are present, and the Afro-montane habitats harbour 26 of the 37 Albertine Rift endemics (Kanyamibwa, 2001; Vande Weghe & Vande Weghe, 2011). 46 % of 510 residents have adapted to the human-modified habitats, however, the persistence of the vast majority rests on continued conservation efforts (Vande Weghe, 2018).

3. Bird conservation challenges

3.1. Human population pressure

With a projected human population of 12 089 720 in 2018 and a density of 477 people per sq.km, Rwanda is the most densely populated country in mainland Africa (National Institute of Statistics of Rwanda [NISIR], 2018a). The Gross domestic product per capita has been increasing steadily from US\$700 in 2012 to US\$774 in 2017, however, 80 % of the population are subsistence farmers, mostly residing in rural areas (NISIR, 2018b). The burgeoning population over the last century exacerbated the quest for arable land and fuel woods, leading to massive degradation of all forests and wetlands outside reserves (Kanyamibwa, 2001; Masozera & Alavalapati, 2004; Weber, 1989). As a result, bird populations outside reserves have declined considerably, and five bird species without representation in National Parks are considered extirpated (Vande Weghe & Vande Weghe, 2011). Other environmental consequences have included increased flooding, landslides, soil erosion, river siltation, and poor agricultural production (Environmental Pulse Institute, 2015; Hategekimana & Twarabamenya, 2007).

3.2. Institutional reformation

As commonly practiced in Africa, pre-colonial conservation in Rwanda was firmly rooted in a body of beliefs, such as the totemic system that extended the perception of the self to animal and plant species (Bigirumwami, 1974; Diawuo & Issifu, 2017). Protected areas in Rwanda are largely a colonization legacy sustained predominantly by government institutions and international NGOs (Rutagarama & Martin, 2006). Established in 1973, the core conservation institution within Rwanda was the ORTPN (the Rwandan office of tourism and National Parks), which operated under the auspices of the Ministry of Agriculture. With an administrative and financial autonomy, the ORTPN had a final say in the allocation and use of tourism revenues, government subsidiaries, as well as bilateral and multilateral funding from international donors and organisations (Maekawa, Lanjouw, Rutagarama, & Sharp, 2013). The 1994 genocide against the Tutsi and the concurrent civil unrest hampered ORTPN management capacity, as it sustained loss of human life and infrastructure damage (Rutagarama & Martin, 2006). Further, ORTPN performance was affected by constant government restructuring. In late 1994, ORTPN was moved under the Ministry of Lands, Environment, Forestry, Water and Mines (MINITERE), and in 2011, it was transformed into a department of tourism and conservation of the Rwanda Development Board (RDB), a new institution that combined all major income-generating government agencies operating under the Ministry of Commerce.

Another key institution, The Rwanda Environment Management Authority (REMA), was established in 2005 under MINITERE (Presently known as the Ministry of Environment), and has become the central regulating body for environmental management, particularly with emphasis on the formulation and enacting of laws, policies and regulations pertinent to the environment (Republic of Rwanda [ROR], 2011). In 2012, the Environment and Climate Change fund (FONERWA) was established under the Ministry of Natural Resources (Presently known as the Ministry of Environment) to finance activities that protect the environment and that mitigate effects of climate change. In the same year and under the same Ministry, the Rwanda Natural Resources Authority (RNRA) was formed by merging the National Forest Authority with other Environmental entities, including the

Geology and Mines Authority. The RNRA had been pivotal to forest extension, in particular, the restoration of Gishwati forest. RNRA subsequently underwent further restructurings, culminating with it being split into three separate bodies (ROR, 2017).

Under the leadership of the above-mentioned institutions, important environmental legislation was passed, such as the Organic law on the Environment, the Biodiversity law, the Wetland law, the well-known 2008 law banning the use and manufacturing and importation of polythene bags, and the Forest policy, which won the 2011 UNEP future policy gold award for its contribution to forest cover increase despite a multitude of pressures (Ministry of Forestry and Mines, 2010; ROR, 2005, 2011; United Nations Department of Economic and Social Affairs, 2011). Rwanda has also ratified a number of international conventions relating to bird conservation, such as the Convention on Biological Diversity, the African Convention on the Conservation of Nature and Natural Resources, the Convention on Migratory Species, and the African-Eurasian Migratory Waterbird Agreement.

Despite the increasing numbers of institutions and items of legislation, very little attention has been paid directly to birds. Recent forest policy interventions have been dominated by the expansion of monoculture plantations of non-indigenous trees, especially eucalypts (Ministry of Forestry and Mines, 2010; Ndayambaje, Mugiraneza, & Mohren, 2014). Although such interventions respond to the cooking energy problem, they support significantly less biodiversity than native forests (Bizuru, Nshutiayesu, Nsabagasani, Tuyisingize, & Uwayezu, 2015; Vande Weghe & Vande Weghe, 2011). There is no distinct national legislation on the protection of birds, nor a leading organization or department solely in charge of bird conservation. Moreover, constant restructuring of core government institutions creates redundancy and exacerbates the problem. Consequently, the only bird populations that seem to be stable are those within protected areas, specifically National Parks, reflecting that the mandates of the institutions in charge – RDB and REMA are well stipulated in the law (Ministry of Trade and Industry, 2013; ROR, 2005). In other reserves and non-reserves, severe habitat degradation, roadkills, hunting largely for leisure, as well as indirect poisoning targeting large carnivores, have gone unpunished.

3.3. The protected area framework

Rwanda's contemporary biodiversity conservation strategy has principally centred on the protected area model. National Parks – the highest conservation status in Rwanda, cover 8.9 % of the land area (Fig. 1). The first National Park to be designated was Volcanoes National Park (Volcanoes NP). It was gazetted in 1925 to reinforce the protection of the mountain gorillas (*Gorilla beringei beringei*) (Weber & Vedder, 1983). In 1934, the eastern savannas of Akagera and Umutara were designated as a National Park, and reserved hunting area, respectively. In 2004, Nyungwe forest, the largest Afromontane rainforest in East Africa (Plumptre, Davenport et al., 2007; Plumptre, Kujirakwinja, Treves, Owiunji, & Rainer, 2007), and in 2015 the forest reserves of Gishwati and Mukura, were each upgraded to National Park status. In 2006, Rugezi marsh, a wetland located in the north of Rwanda was officially recognized as a wetland of international importance (Ramsar site) (Hategekimana & Twarabamenya, 2007).

One of the drawbacks of the protected area model is that it can indirectly confine the arena for conservation action within reserves, hence condemning outside landscapes to maximum exploitation, which eventually creates pockets of protected areas in extensive human-transformed habitats (Watson, Grantham, Wilson, & Possingham, 2011). The second and most fundamental problem of the protected area model is that the designation status, even when backed by laws, does not guarantee long term conservation, as it may be undermined by socio-political and economic changes (Watson, Dudley, Segan, & Hockings, 2014). Since gazettement, most of the Rwandan reserves have lost at least half of their size, principally due to clearing for farming and human settlements (Plumptre, Masozera, & Vedder, 2005; Vande

Weghe & Vande Weghe, 2011). The loss of habitat has been particularly severe for birds of prey, which often need large territories (Vande Weghe & Vande Weghe, 2011). On the other hand, tourism, particularly in National Parks has been increasing (Figs. 2 and 3).

4. The mountain gorilla conservation case

The endangered mountain gorilla (*Gorilla beringei beringei*) is a subspecies of the eastern gorilla endemic to the high elevation montane forests (2500–4507 m) of the Albertine rift region. One population of the mountain gorilla is found in the Virunga massif, a volcanic region encompassing the Volcanoes NP in Rwanda (160 km²), Parc National de Virunga (PNVI) in DRC (250 km²), and Mgahinga Gorilla National Park (MGNP) in Uganda (27 km²). The other population is found in Bwindi Impenetrable National Park (Bwindi INP) (321 km²) in Uganda, and the contiguous réserve naturelle de Sarambwe (RN Sarambwe).

4.1. Initiating the conservation of the mountain gorilla

Research on mountain gorillas was initiated in the 1960s by George Schaller (Schaller, 1963) and then reinforced by the well-known primatologist Dian Fossey, through her establishment of Karisoke Research Center (KRC) in 1967, after relocating from Congo due to political insecurities. KRC has been a hub of long-term research on mountain gorillas, documenting a broad range of aspects related to gorilla ranging patterns, demography, behaviour and ecology (Harcourt, 1986; Robbins, Sicotte, & Stewart, 2001). The data collected are shared with park managers and scientists and form the basis of improved conservation measures (Robbins et al., 2001).

Mountain gorillas were facing a myriad of threats. Among others are the degazetting of 55 % of their habitat in Rwanda for the European-funded Pyrethrum farming project in the 1960s, fatal accidents from antelope-targeted snares, infant captures for zoos and the pet trade, trophy hunting, and intense livestock grazing in the park in the 1970s (Harcourt & Fossey, 1981; Weber & Vedder, 1983). Consequently, the number of gorillas in the Virunga massif plummeted from 450 to 225 between the 1960s and the late 1970s (Harcourt & Fossey, 1981).

Initially, the conservation of the mountain gorillas was spearheaded by the ORTPN, and the Belgian government. KRC followed suit with active conservation, involving daily monitoring of gorillas and the removal of snares inside the park (Maekawa et al., 2013). The rise in the quest for gorilla trophies sparked the commencement of the Mountain Gorilla Project (MGP) in 1979. The MGP was a joint initiative of several leading international NGOs with the goals of instituting measures to curb poaching, developing a gorilla-based sustainable tourism, and raising public awareness (Vedder & Weber, 1990).

According to Harcourt (1986), the MGP's efforts lead to the prohibition of all cattle grazing in the forest in 1976, a threefold increase in the number of trained forest guards, and nationwide mass education on the conservation status, ecological role, and value of mountain gorillas, disseminated in the form of posters, seminars, broadcasting media and organised school and community visits to the park. Poaching levels declined significantly, the proportion of local farmers who wished to see the park converted declined from 50 % in 1980 to 18 % in 1984, and there was overall more support for gorilla conservation and prosecution of those who violated wildlife laws. A combination of strict law enforcement, and conservation education continues today, and has ensured increased public support and an almost total halt to habitat loss (Hickey et al., 2018; NISR, 2018a).

4.2. The setting up of a gorilla-based tourism

In 1978, Volcanoes NP had no proper tourism strategy and execution plan, and park costs exceeded tourism revenues, reflecting that generating profits was not perceived as a principal goal, but rather the maintenance of the park as a pristine area (Harcourt, 1986; Weber &

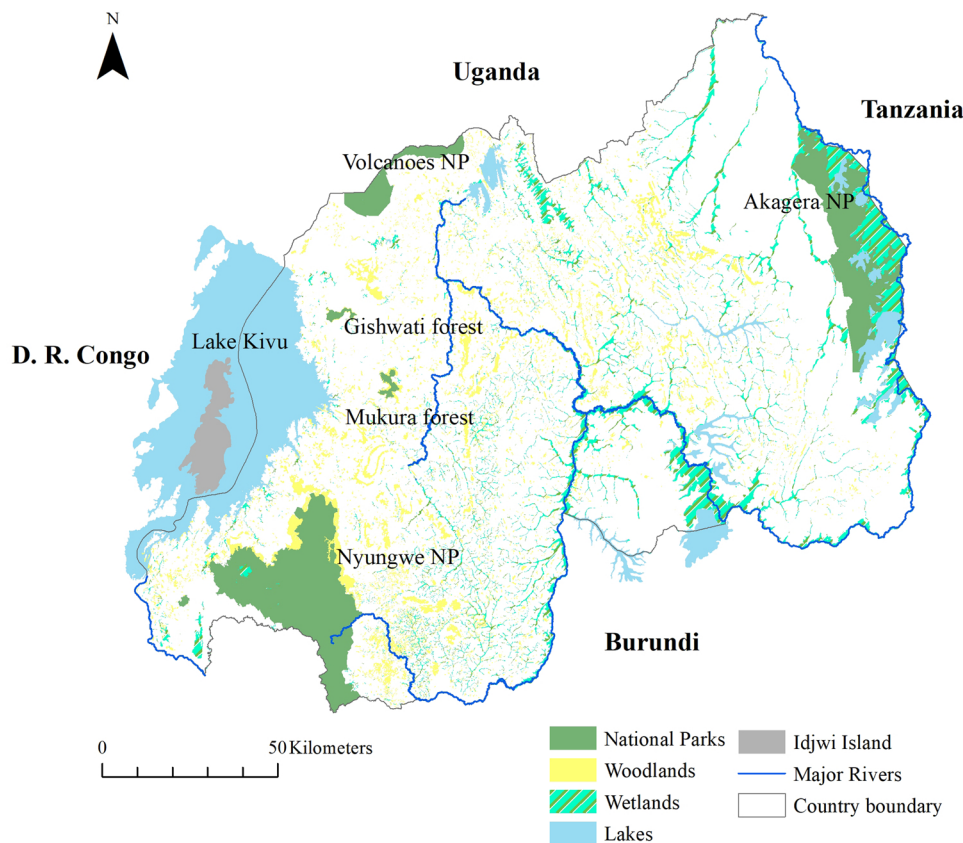


Fig. 1. Map of Rwanda, showing location of National Parks. Volcanoes NP (160 km²), and Nyungwe NP (1,010 km²) are contiguous to National Parks in neighbouring countries. The forests of Gishwati (15.7 km²) and Mukura (19.88 km²) are presently recognized as one protected landscape, the “Gishwati-Mukura National Park”. Akagera NP (1,084 km²) is a savanna ecosystem, whilst the rest are Afromontane forest ecosystems. All National Parks with the exception of Gishwati-Mukura NP are recognized as Important Bird and Biodiversity Areas by Birdlife international.

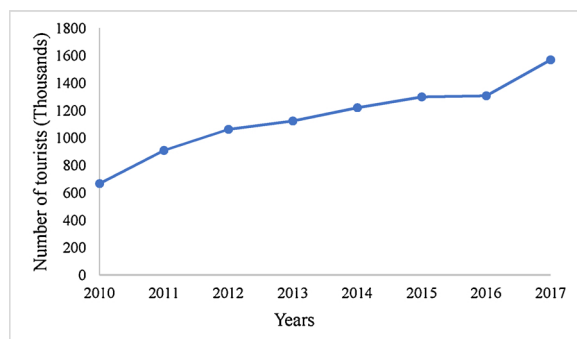


Fig. 2. The growth of tourist arrivals in Rwanda from 2010 to 2017. Retrieved from NISR (2018b) and RDB unpublished data. The numbers include foreign tourists visiting for a range of purposes including nature, culture and business.

Vedder, 2001). To bridge this gap the MGP implemented a tourism plan that entailed broader habituation of mountain gorillas, training guides, and installing appropriate tourist facilities and services (Maekawa et al., 2013; Vedder & Weber, 1990). As reported by Harcourt (1986), these efforts did not take long to yield results, for 5 790 people paid to visit Volcanoes NP in 1984 compared to 1 352 people in 1978, and the gorilla trekking fee rose from US\$5 to US\$45. The number of Rwandan tourists remained low, at 2.3 %, despite a lower trekking fee, equivalent to a 10th of the foreign tourist cost. The MGP phased out in 1991 and was succeeded by the International Gorilla Conservation Programme (IGCP), a coalition led by Fauna and Flora International (FFI), the World Wide Fund for Nature (WWF), and the African Wildlife Foundation (AWF), which pulled out of the coalition in 2015. In 2019, a new member, Conservation International joined.

Tourism management was then administered by the ORTPN, and the park financial resources continued to increase. A study by IGCP, conducted in 2001–2002, estimated regional gorilla-based tourism

revenues at US\$ 20.6 million per year, with 59 % retrieved at national and local level, and 41 % at international level (Hatfield, 2005). Maekawa et al. (2013) reported that in 2012 more than 180 people were employed in park operations, protection, research and tourism.

A revenue sharing scheme introduced in 2004 involved 5 % of annual tourism revenue being allocated to the livelihood improvement of adjacent communities (Mugabukomeye, 2007). The revenue sharing scheme disburses 40 % to community enterprises, such as: beekeeping modernization; cow and sheep rearing; agroforestry; seed production and storage; and rainwater harvest, whilst 60 % is re-injected in public infrastructure, including schools, health centres, water tanks, and road repairs (Mugabukomeye, 2007; Munanura, Backman, Hallo, & Powell, 2016; Nielsen & Spenceley, 2011). Since the inception of the tourism revenue-sharing scheme, funds disbursed to communities have been increasing substantially, for example investments in communities around VNP rose from US\$25,003 in 2005 to US\$235,171 in 2015 (Sabuhoro, Wright, Munanura, Nyakabwa, & Nibigira, 2017). More investments are expected with the recent increase of the revenue-sharing quota from 5 % to 10 %, which followed the adoption of the high-end tourism model exemplified by Kenya and Mauritius and which involved doubling of the price of trekking gorillas for the second time from US\$750 to US\$1500 in 2017 (RDB, 2018a).

The bulk of national tourism revenues is contributed by Volcanoes NP, and the trekking of mountain gorillas remains the preferred tourist activity (Fig. 3). Tourist earnings in Volcanoes NP rose from US\$ 430 542 in 1995 to US\$ 17.1 million in 2017 (RDB, 2018a; Sabuhoro et al., 2017). Tourism has presented a public-private platform for the local community and the private sectors to fully engage with the mountain gorilla conservation cause. In June 2019, SafariBookings.com, an online marketplace for African safaris registered more than 1 165 national and international tour operators offering Volcanoes NP as a destination. In addition, public-private enterprises such as the Sabyinyo Silverback community lodge — a joint venture between local community, the government of Rwanda and a private company — are emerging and

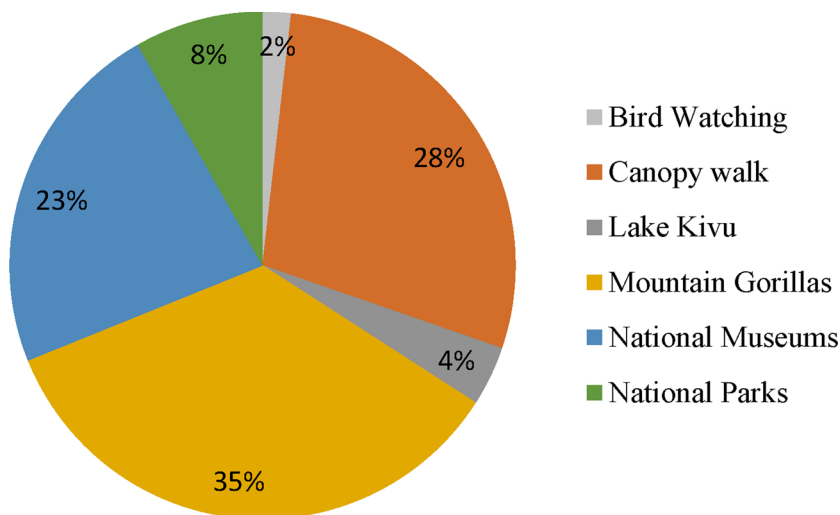


Fig. 3. Preferred tourist attractions in Rwanda (N = 8088) according to the online poll by the Rwanda development Board-Tourism and Conservation department (RDB, 2018b). Although, there is overlap among the assessed attractions, bird watching per se stands out as the least preferred activity, while visiting Mountain gorillas ranks first. The Canopy walkway is a 90 m long bridge in the canopy of Nyungwe NP hanging at an elevation of 60 m. Lake Kivu is the largest lake in Rwanda, with the most diverse tourist facilities.

contributing considerably to the economic security of employees and their dependents (Nielsen & Spenceley, 2011; Rutagarama & Martin, 2006; Sabuhoro, 2017).

Tourism in Volcanoes NP has generally improved the quality of life of adjacent communities. The construction of schools, health centres, and water tanks around the park have considerably shortened travel distances used when seeking these amenities, thus saving time and resources (Ekise, Nahayo, Habumugisha, & Mbabazi, 2013). A report by Black (2015) investigating the amelioration of community livelihood linked to the operation of the Sabyinyo Silverback community lodge, found that 16 out of 19 staff interviewed were satisfied by their job, and 14 affirmed that the lodge provided space for personal growth and empowerment. Sabuhoro (2017) noted similar positive perceptions on the socio-economic improvement of participants in tourism community enterprises around volcanoes NP, such as the Iby'Iwacu Cultural Village, formed in 2006 by the government of Rwanda, conservation partners, and a private tour operator to engage ex-poachers in culture-based tourism activities.

4.3. Transboundary collaboration

Since the initiation of the MGP to the present, the collaboration of Rwandan and international organizations to save mountain gorillas has been conducted in a manner that minimizes redundancy and promotes effective use of the available resources (Harcourt, 1986; Plumptre, Davenport et al., 2007; Plumptre, Kujirakwinja et al., 2007). The fact that mountain gorillas are not confined within the boundaries of Rwanda, made it imperative to garner cooperation of the whole Virunga massif authorities. The scale-up process to DRC and Uganda has been largely facilitated by the IGCP, the successor to the MGP. Transboundary collaboration started in the 1990s with the development of a communication system for regular information exchange and capacity building for park managers and field staff, as well as joint execution of standardized ranger-based monitoring, gorilla census, and law enforcement (Lanjouw et al., 2001; Plumptre, Davenport et al., 2007; Plumptre, Kujirakwinja et al., 2007).

Collaboration was later cemented by formal agreements between the three countries including: a 2001 declaration of park authorities endorsing the formation of a trans-frontier park between the Virunga massif and Bwindi INP; a 2004 Memorandum of Understanding between Protected Areas Authorities aiming at stepping up collaboration from park level to institutional level, expanding the geographical scope of this collaboration from the Virunga Massif, habitat of the Mountain gorilla, to the larger area currently known as the Greater Virunga Landscape encompassing eight parks; and a 2005 tripartite agreement between the ministries of the environment in the three countries,

formalizing the collaborative conservation and management of the transboundary landscape. Another memorandum of understanding was signed by the three countries in 2006, agreeing on a 50 % sharing of tourist trekking fees generated from a gorilla family that crossed the border.

Also in 2006, the Ten-year Transboundary Strategic Plan for the Central Albertine Rift was adopted, expanding the scope of cooperation from mountain gorilla conservation and tourism to eight key areas entitled: “enabling environment, landscape management, effective management capacity, collaboration, law enforcement, education and awareness, economic development, and financial sustainability” (Transboundary Core Secretariat, 2006). The expansion of the mandate necessitated a multi-level governing structure composed of representatives from the three countries who would ensure that activities of regional interest take precedence over national ones, and experts in the group are given a platform to share their insights (Refisch & Jensen, 2016). The core body was the Greater Virunga Transboundary Collaboration, a secretariat constituted in 2008, and formalized in a 2015 treaty to oversee and coordinate transboundary activities across the Greater Virunga landscape.

Remarkably, regional conservation collaboration was maintained during extreme insecurity and when the three countries were at political odds (Lanjouw et al., 2001; Maekawa et al., 2013). This helped considerably in curbing transfrontier threats ranging from trade in infant gorilla, ivory, illicit timber production, fire control, and an influx of 750 000 Rwandan refugees who resided at the boundary of Southern PNVi in 1994–1996 following the Rwandan civil war and genocide (Maekawa et al., 2013; Nielsen & Spenceley, 2011; Plumptre, Davenport et al., 2007; Plumptre, Kujirakwinja et al., 2007). From 2007 to 2009, a North-Kivu rebel group CNDP (Congrès National pour la Défense du Peuple), took control of the Mikeno sector, a part of the PNVi used by mountain gorillas. Although CNDP restricted access to ICCN, the Congolese wildlife conservation authority (Institut Congolais pour la Conservation de la Nature) and cross-border joint patrols were discontinued, rangers were allowed to pursue gorilla monitoring and anti-poaching patrols, and alternative arrangements were made for each park to be patrolled by its rangers, and bordering areas to be covered concurrently (Refisch & Jensen, 2016). Three years later, M23 – a rebel group composed of former members of CNDP who had been integrated in the Congolese army, resumed fighting and occupied a large portion of the mountain gorilla home range in PNVi. M23 allowed ICCN to conduct gorilla monitoring activities, attesting to the trust afforded to conservation partners, and the latter's flexible communicative tactics, even with parties having unparallel mandates and goals (Milburn, 2016; Refisch & Jensen, 2016).

The concerted collaborative actions, along with quick veterinary

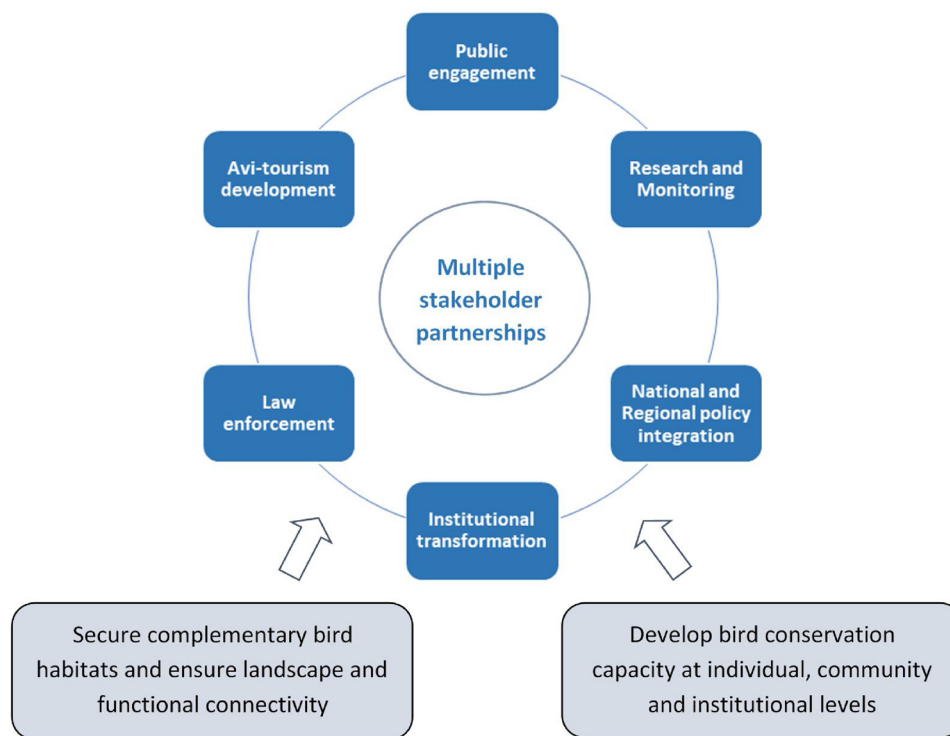


Fig. 4. Framework for bird conservation that promotes partnerships between communities, governments, NGOs and the private sector in order to advance bird conservation, research and tourism. The stages of the framework are non-sequential and may happen concurrently. The legal protection of suitable bird landscapes, and the commitment of pro-conservation individuals and organisations are central to the effectiveness of the partnerships.

intervention, and community involvement in development and conservation activities, such as the building of a stone buffer wall in exchange of payments, have facilitated the increase of the Virunga massif gorilla population from 380 individuals to 480 between 2003 and 2010, representing a 26.3 % population increase and a 3.7 % annual growth (Gray et al., 2013). The 2015–2016 census revealed a further increase from 480 to 604 (Greater Virunga Transboundary Collaboration, 2018). Adding the 459 individuals (minimum count) recorded in Bwindi INP and RN Sarambwe (Hickey et al., 2019), the total number of mountain gorillas is currently estimated at 1063 individuals. The increase in number and the mechanisms in place to curb major threats, recently prompted the downlisting of the conservation status of the mountain gorilla from critically endangered to endangered (Hickey et al., 2018).

Conservation measures taken to conserve the mountain gorillas in Rwanda are not entirely context-dependent, but at least in part may be transferable to other places and species. They have been emulated in the conservation of the most threatened ape in Africa, the Cross River gorilla (*Gorilla gorilla diehli*) (except for tourism development), and efforts have come to fruition as evidenced by the creation of new protected areas that harbour gorilla populations, increased research, regular patrols which include joint patrols between Cameroonian-Nigerian rangers, involvement of the community as stewards of gorillas, a decrease in gorilla hunting, and the generation of alternative sources of livelihoods (Dunn et al., 2014; Wildlife Conservation Society, 2019).

5. Adapting the mountain gorilla conservation approaches to avian conservation

Effective conservation of any landscape or species necessitates conservation planning that goes beyond a prioritization framework and an associated execution plan (Jones et al., 2016; McIntosh, Pressey, Lloyd, Smith, & Grenyer, 2017). Systematic conservation planning methods aim to achieve this through a broad spectrum of quantitatively measured principles spanning representativeness, persistence, efficiency, flexibility, and accountability (Kukkala & Moilanen, 2013; Margules & Pressey, 2000; Margules & Sarkar, 2007). Grounded in these principles, key lessons learnt from the conservation of the

mountain gorilla can be tailored to respond to the plight of birds and opportunities for their conservation in Rwanda (Fig. 4).

5.1. Enhancing avian research and monitoring

Although birds represent a globally well-studied taxon, for Rwanda relatively little is known beyond species prevalence. Regular surveys are mainly restricted within reserves, and the data are not readily accessible. With limited resources, research is often relegated to the lower end of priorities. However, such a sacrifice may prove counter-productive in the long-term. As noted in the case of the mountain gorilla, close monitoring and long-term research were crucial in devising appropriate interventions (Robbins et al., 2001). Further, research findings aid in the identification of priority sites, species or surrogates, and offer a baseline for measuring conservation impact, hence facilitating evaluations and accountability processes (McIntosh et al., 2017).

As often reported in avian conservation programs across the world, citizen science presents an ideal way to avert the cost of conducting research, and to keep engaged both enthusiastic birders and the general public, whilst building ecological knowledge. Platforms such as ebird¹, inaturalist², and xeno-canto³ facilitate the ease of collecting and sharing avian data in a cost-effective manner. Institutions such as the University of Rwanda center of excellence in Biodiversity and natural resource management, and the IPRC-Kitabi (formerly, Kitabi College of Conservation and Environmental Management) are well positioned to capitalize on citizen science tools to help build capacities of conservation practitioners and academics in Rwanda.

5.2. Protecting complementary bird habitats

In the face of increasing bird habitat transformation linked to anthropogenic pressures, it is imperative to confer and uphold legal status

¹ <https://ebird.org/home>.

² <https://www.inaturalist.org/>.

³ <https://www.xeno-canto.org/>.

and protection of key bird habitats, particularly non-reserves as they still harbour a diversity of birds. Key habitats without a comprehensive protection status include: Akanyaru and Nyabarongo wetlands, which have been classified as IBAs (Kanyamibwa, 2001); lakes and associated wetlands in the Bugesera region; and remnants of afromontane forests such as Busaga, and gallery forests including Mashoza Parike and Ibanda Makera. In addition to natural habitats, human-modified landscapes in urban or agricultural landscapes can still be inhabited by a high number of bird species. Gatesire, Nsabimana, Nyiramana, Seburanga, and Mirville (2014) applied the point count sampling method to assess the bird species diversity in the city of Musanze, which is located 15 km away from Volcanoes NP and comprises built-up environments as well as agricultural and forested areas. In comparisons with checklists for Buhanga eco-park and Volcanoes NP, they found that the city had a higher bird diversity than Buhanga eco-park, and the same number as Volcanoes NP. Endemic birds were largely confined within the two protected areas, whereas migrating birds were mostly restricted within the city.

Selecting which sites to conserve is not a trivial decision, and ought to be guided by the principle of “representativeness”, whereby the conservation areas encompass samples of all or most biodiversity of a given area (Margules & Pressey, 2000). In the case of the mountain gorilla, this was achieved by gazettement as protected areas their habitats spread across the DRC, Rwanda and Uganda. However, given the high number of bird species, their broad distribution patterns, and constrained conservation resources, optimizing the number of birds conserved within Rwanda would therefore require the protection of complementary areas. “Complementarity” in this sense, would be achieved if a habitat added some desirable avian diversity features unrepresented by other selected habitats (Margules & Pressey, 2000). Existing compilations of important habitats which still harbour a wide range of birds (Bizuru et al., 2015; Kanyamibwa, 2001; Vande Weghe, 2018; Vande Weghe & Vande Weghe, 2011) can serve as baselines for the site prioritization stage, and involvement of a range of stakeholders can be facilitated to minimize conflicts of interest.

As discussed above, the prominent form of protected areas in Rwanda is the “National Park”, however, all important habitats need not acquire this status to be assigned rigorous biodiversity monitoring and management plans. Some habitats, particularly those in human-modified landscapes will require alternative conservation arrangements, for instance, extending protection to single plants and trees, and setting up a minimum size and form of green space. The idea of expanding important biodiversity habitats, as envisaged for Volcanoes NP, is attractive, however, its feasibility and support by communities may prove challenging due to the high population pressure, and lack of alternative “free” sites to establish expropriated homes and enterprises. It is thus crucial to secure protection of existing bird habitats, and to ensure that they are not mere paper parks, but recognised in development masterplans.

5.3. National and transboundary institutional collaboration

Given past downsizing of protected areas, the current degradation of natural landscapes outside reserves, uncertainties of climate change (Musana & Mutuyeyezu, 2011), and varying species trait-based adaptations, proper conservation planning should take into account biological and physical processes, as well as the dynamism of threats (Botts et al., 2019; Pressey, Cabeza, Watts, Cowling, & Wilson, 2007). The question of persistence of bird populations, relating to how long conservation sites remain in good state and continue to contain viable populations (Kukkala & Moilanen, 2013; Margules & Sarkar, 2007), can only be thoroughly addressed with strong and stable institutions, clear laws and management plans, and cross-sectoral dialogues to prevent and mitigate conflicting policy agendas.

Within Rwanda, important bird habitats are almost always surrounded by a matrix of agricultural lands and settlements. Of great

concern is the “Crop Intensification Program”, a national policy initiated in 2008 with the aims to increase agricultural productivity of six economically valued crops: maize, wheat, rice, Irish potatoes, beans and cassava. The policy has centred on the consolidation of adjacent farmlands for the growth of one crop designated per region, and the use of improved seeds, and inorganic fertilizers, which are often subsidized by the government (Kathiresan, 2011). High national adoption of this policy will inevitably lead to the collapse of farmland bird populations due to the considerable reduction of crop diversity and the increased application of agrochemicals.

Landscape connectivity, and matrix permeability could be achieved with increasing indigenous tree cover on farms and homes, adopting widescale eco-friendly farming practices such as controlled use of harmful agro-chemicals and creating corridors between smaller and larger habitat fragments (Şekercioğlu et al., 2019). Restoration of sites and species populations offers an effective way to ensure long-term persistence of bird populations. Re-introduction of species has been done in Akagera NP, with the reintroduction of lions, and rhinoceroses from South Africa, and the rehabilitation of Grey-crowned cranes previously held in captivity in Rwandan homes (Nsengimana, Becker, Ruhagazi, & Niyomwungeri, 2019; Sun, Bariyanga, & Wronski, 2018).

Within the leadership of the Ministry of the Environment, and the Bonn challenge commitment, a global initiative launched in 2011 to restore 150 million and 350 million ha of degraded and deforested lands by 2020 and 2030, respectively, Rwanda made a bold pledge to restore 2 million ha of degraded forests and lands under the so-called “Border to border” restoration program, representing the highest bid globally in proportion to the country’s size (2.6 million ha) (Bonn Challenge, 2011; Environmental Pulse Institute, 2015). Nonetheless, the discrepancies in the perceptions of forest restoration, and divergent policy agendas in the agriculture and forestry sectors pose hindrances to the implementation of policies of forest restoration designed to optimise biodiversity and ecosystem functions (Chazdon et al., 2016; Van Oosten, Uzamukunda, & Runhaar, 2018).

Aligning conflicting policies and agreements should also extend beyond national borders. As discussed above, a key aspect in the conservation of mountain gorilla is collaboration across borders. Three out of the four Rwandan National Parks and most of the major rivers and lakes are part of transboundary landscapes. Any efforts put in place by Rwanda, if not supported by neighbouring countries, will be in vain. Formal institutions like the East African community provide ideal platforms for exchanging good Environmental practices. The transboundary collaboration in the Virunga landscape offers a model that can be adapted to maximise protection to the avian biodiversity even during episodes of political turmoil, such as many African states have experienced.

5.4. Avitourism for efficient conservation

Another theoretical strong point of systematic conservation planning is the efficiency in the management of conservation resources for the maintenance of biodiversity and functional ecosystem services (Margules & Pressey, 2000; McIntosh et al., 2017). It has been argued that the cost of conservation, particularly in Africa, is not very high when accounting for both ecological and economic returns, such as water filtering, and ecotourism revenues (Naidoo & Adamowicz, 2005). Harcourt (1986) reported that in the 1980s the cost of mountain gorilla conservation in Rwanda was US\$ 150 000 per year. Each gorilla was costing US\$1250 per year, which was US\$250 less than the cost of keeping them in zoos at that time, without accounting for the biodiversity and ecosystem services they were performing in their natural habitats. At present, the high gorilla-based tourism revenues not only contribute significantly to their conservation, but are also used to fund other national priorities (Nielsen & Spenceley, 2011; RDB, 2018a).

The tourism sector is generally growing in Rwanda, and has overtaken coffee and tea exports as the leading foreign exchange earner.

Tourism revenues are predominantly retrieved from National Parks, especially Volcanoes NP, which contributed more than 90 % of the US \$18.7 million generated from all National Parks visits in 2017 (RDB, 2018a). The number of tourists has doubled in the last 7 years (Fig. 2). The highest number of tourist visits is usually registered by Akagera NP, and more revenues are envisaged with the reintroduction of lions and rhinos in 2015 and 2017, respectively (NISR, 2018b; Sun et al., 2018). Avitourism on the other hand is still in its infancy (Fig. 3), although there is growing willingness on behalf of the government, as demonstrated by regular participation in international tourism exhibitions, such as the British Birdfair.

Naidoo and Adamowicz (2005) concluded that the reason why the costs of avian biodiversity conservation tend to outweigh their benefits in many places in Africa hinges on the undervaluation of tourism revenues. By modelling the costs associated with conserving the forest in comparison to other spatial land-uses, and surveying the actual prices tourists were willing to pay to watch birds in Mabira forest, Uganda, they estimated that up to 90 % of all bird species in the forest would be protected if tourist entrance fees were optimized from the US\$5 charged to the US \$47 tourists were willing to pay. In Nyungwe NP, birding packages are still few and undervalued compared to the range of birds and habitats found there (Banerjee et al., 2018; Lal et al., 2017). Improving eco-tourist facilities near these habitats, coupled with acute marketing strategies of Rwandan birds, would, we believe, guarantee substantial revenues, some of which could then be reinvested in the conservation of birds and their habitats. A few companies are already capitalizing on a high-end avitourism in Africa, including itineraries in Rwanda. Birding Africa, a South-African company offers a six-day guided tour in Rwanda for a group of six that costs US\$ 3590 and typically covers Nyabarongo wetlands, Nyungwe NP and Akagera NP (birdingafrica.com, accessed on 09/10/2019). Birdwatchers are ideal tourists since they usually have a high education and income, are willing to spend more while pursuing their passion, and they are also supportive of conservation-related causes (Biggs, Turpie, Fabricius, & Spenceley, 2011; Steven, Morrison, & Castley, 2016).

A heightened tourism sector can underpin national economic growth, however, a diligent approach is needed, as tourism itself is known to add further stress to fragile ecosystems and can alienate local communities, undermining their sense of belonging and responsibility towards nature (Rutagarama & Martin, 2006; Sabuhoro et al., 2017).

5.5. Increasing public awareness and engagement

It would be unusual to find a Rwandan who had never heard of a mountain gorilla, where it lives and its contribution to the country's development. This awareness can be attributed to mass education programs transmitted through formal and informal channels, as well as assisting communities to visit gorillas, and to engage in direct conservation activities (Vedder & Weber, 1990). Extending this to birds would be possible, through incorporating bird conservation information into the national curriculum, particularly at primary and secondary levels, and organizing community visits to nearest bird watching hot-spots. Recurring public events such as *Umuganda*⁴ could be used to sensitize the public, and also promote the planting of cultural significant indigenous trees such as fig trees, which are known to support high bird diversity (Kissling, Rahbek, & Böhning-Gaese, 2007), instead of the most often planted non-native tree species. The promotion of indigenous trees would also be a way for Rwandans to reaffirm their cultural heritage. Cultural beliefs and practices have anchored the preservation of many sacred sites and species across the world

⁴ Umuganda —coming together, is a mandatory community service day that takes place on the last Saturday of every month all over the country. All residents gather for communal services ranging from building and repairing public infrastructures to planting trees.

(Bhagwat, Nogué, & Willis, 2014). Their annihilation may also have adverse effects as proven by the endangered status of the Grey-crowned crane (*Balearica regulorum*), which was once an emblematic totem of the Rwandan pre-colonial ruling monarch.

Although the loss of some traditions may not be reversed, there is always room to reinvent and adapt them to the present context. RDB has extended to mountain gorillas a traditional ceremony of naming a newborn baby, known as “kwita izina”. During the event all infant gorillas born in the last 12 months are given names. The gorilla naming ceremony has become an annual conservation celebration event that gathers a multitude of people from environmentalists to Hollywood movie stars. Similar adaptation to birds would certainly be positive. For instance, a citizen science style program to document and disseminate Kinyarwanda bird names and associated cultural stories would safeguard the language, and equally enable the passing on of traditional ornithological knowledge and reverence to the young generation.

5.6. Multi-stakeholder partnerships as the way forward

For any conservation plan to bear fruit, it should be flexible enough to garner maximum support from a range of stakeholders (Kukkala & Moilanen, 2013; Margules & Sarkar, 2007). The flexibility can be achieved by, for instance, prioritizing areas with high “irreplaceability” in terms of species and functional diversity, and devising alternative plans (Watson et al., 2014). For example, Nyabarongo wetland in Rwanda, has been designated as an Important Biodiversity and Bird area (Kanyamibwa, 2001), yet, its banks are extensively cultivated with sugarcane. Its long-term management will necessitate a transparent process engaging all major stakeholders (Fig. 4). A sensible trade-off would take into consideration economic returns, sugar-related health problems, flooding events, biodiversity support and ecosystem services. A hybrid arrangement could also be made to ensure an eco-friendly sugar cane production. Some cases would demand prudent dialogues. For instance, bushes and uncultivated wetlands are perceived as breeding sites for malaria-transmitting mosquitoes. Malaria being the leading cause of morbidity and mortality in Rwanda, the Ministry of health has launched campaigns of clearing or spraying bushes and wetlands with insecticides (The New Times, 2018). It is of utmost urgency that different parties engage in conversations before embarking on solutions that could have cascading effects on the environment.

6. Conclusion

The mountain gorilla is the only great ape that has been increasing in numbers owing to a high public awareness, cooperation between local and international stakeholders, a coordination of long-term research and monitoring of their status, and the development of a tourism that contributes substantially to national income. In contrast, the only relatively stable avian populations in Rwanda are currently restricted within four National Parks. Past experiences have shown that the protection status of an area does not always buffer against detrimental changes. Emulating strategies that have successfully contributed to the wide support for the mountain gorilla conservation cause carry great potential in securing the protection of birds and associated ecosystem services, especially if conducted through a cooperative and transparent process, as provided by Systematic Conservation Planning tools.

Conservation is often a continuous process. The fate of mountain gorilla remains conservation-dependent, and the threats to birds may seem insurmountable. However, there are rays of hope in human ingenuity, national and global willingness to restore degraded ecosystems, and gains from responsible nature-based enterprises.

Funding

MLR is supported by a PhD scholarship from the Commonwealth Scholarship Commission in the UK (CSC).

Declaration of Competing Interest

We have no competing interest to declare.

Acknowledgements

We are very grateful to F. Ruzigandekwe and two anonymous reviewers for their valuable comments on earlier drafts of the manuscript, P. Akayezu for assisting with producing the study map, I. Kambogo, T. Ngoga and J. Rudasingwa for kindly providing access to tourism statistical data, and the Rwandan Bird Club for lively discussions on High-end bird tourism in Africa.

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