Regional golden monkey (*Cercopithecus mitis kandti*) conservation action plan 2023–2028

Deogratias Tuyisingize, Chloé Cipolletta, Winnie Eckardt, Damien Caillaud, Abel Musana, Richard Muvunyi, Moses Turinawe, Richard Muhabwe, Samuel Amanya, Innocent Mburanumwe, Jacques Katutu, Chantal Shalukoma, Felix Ndagijimana, Tara S. Stoinski, and Beth A. Kaplin

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TABLE OF CONTENTS

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FOREWORD

The golden monkey, *Cercopithecus mitis kandti*, is a subspecies of blue monkey restricted to the Virunga massif that covers parts of Rwanda, Uganda, and the Democratic Republic of the Congo (DRC), and the Gishwati-Mukura National Park in Rwanda. It is listed as endangered on the IUCN Red List (Butynski & de Jong, 2020). The origin of this golden monkey action plan goes back to 2006, when a study in the Mgahinga Gorilla National Park (MGNP), on the Ugandan side of the Virunga massif, suggested a 41% decline in the golden monkey subpopulation there between 1998 and 2003, from 2438 ± 1463 SD to 989 ± 521.5 SD individuals (Twinomugisha & Chapman, 2006). Habitat loss and degradation, mainly through bamboo harvesting, were thought to be the main causes of the subpopulation's decline. In late 2003, the Uganda Wildlife Authority (UWA) together with researchers began a golden monkey habituation project for research and eco-tourism in MGNP, which was reinforced in 2009 (Horton, 2018; Sandra Gray, pers. comm.).

Meanwhile, in 2003, both the Rwanda Development Board (former Rwandan Office of Tourism and National Parks) and Dian Fossey Gorilla Fund (DFGF) reported that the golden monkey is the only primate species other than the mountain gorilla *(Gorilla beringei beringei)* living in the Volcanoes National Park (VNP), part of the Virunga massif in Rwanda. Based on this information, these two organisations initiated a golden monkey habituation project for research and tourism in VNP. In 2007, DFGF conducted the first golden monkey survey in VNP to provide baseline information for golden monkey population trends in this part of the Virunga massif. It was supported by Conservation International, the Cleveland Metroparks Zoo, and DFGF.

The regular park patrols and results from surveys across the entire Virunga massif have highlighted the considerable presence of illegal human activities in the Parc National des Virunga (PNVi) (Hickey et al., 2019; Robbins et al., 2011), part of the Virunga massif in DRC. Furthermore, there are several anecdotal reports of golden monkeys being sold and consumed for bushmeat in the PNVi. The PNVi golden monkey subpopulation might, therefore, be facing higher levels of threats and decline than their counterparts in VNP and MGNP, which have low levels of illegal human activities (Hickey et al., 2019).

Although previous IUCN Red List assessments have indicated that the Nyungwe National Park (NNP) in Rwanda was habitat for golden monkeys (Butynski & de Jong, 2020), surveys in NNP have not recorded them (Plumptre et al., 2002, 2007; Easton et al., 2011; Gross-Camp & Kaplin, 2011). It is probable that the closely related blue monkey *Cercopithecus mitis doggetti*, which does occur in NNP, was misidentified as the golden monkey.

In 2008, anecdotal reports by DFGF interns and staff suggested the presence of the golden monkey in the Gishwati forest, Rwanda, a tropical montane forest fragment 26 km southwest of VNP, separated by a human-dominated landscape. The presence of golden monkeys in the Gishwati forest was confirmed in 2010 by the Forest of Hope Association (http://www.fharwanda.org/) and by scientists working there (Chancellor et al., 2012). Given that the Gishwati forest lost more than 98% of its original forest cover between the 1980s and 1990s (Nyandwi & Mukashema, 2011), the golden monkey population of Gishwati forest is now thought to be at high risk of extirpation. The government of Rwanda gazetted the remnant Gishwati forest and the nearby (16 km apart) Mukura forest fragment together as a national park in 2016, now called the Gishwati-Mukura National Park (GMNP).

Previous studies have shown that golden monkeys prefer bamboo and fruiting trees as key food species and key habitat (Twinomugisha et al., 2007; Tuyisingize, 2016; Tuyisingize et al., 2022), although there is a small population, detected in 2018, living in a plantation of exotic pines in the Gishwati-Mukura landscape, where they eat mostly pine cones and fruit (Ngabikwiye et al., 2019). There are many reports of illegal human activities in the Gishwati-Mukura landscape. They include bamboo cutting and fuelwood collection, grazing, presence of feral

dogs, and uncontrolled collection of water in the golden monkey habitats, which may lead to opportunistic snaring as well as disease transmission. In addition, recent findings suggest a decline in the regeneration of bamboo and a shift in golden monkey habitats, which are likely related to decreased rainfall and herbivory in the region (Ayebare et al., 2018; van der Hoek et al., 2019).

The preliminary findings of golden monkey studies in the Virunga massif (VNP and MGNP) were disseminated at the 22nd Congress of the International Primatological Society (IPS) held at Entebbe, Uganda, in 2006. Further findings were disseminated through presentations at the society's subsequent congresses in Edinburgh, UK (2008), Cancún, Mexico (2012), Hanoi, Vietnam (2014), Chicago, USA (2016), and Nairobi, Kenya (2018). Discussions at these meetings stressed the urgent need for a golden monkey conservation action plan. In preparation for the golden monkey conservation action plan, DFGF and a then graduate student, Deogratias Tuyisingize at the University of Rwanda conducted a comprehensive survey in VNP and the Gishwati forest to update the status of golden monkeys in Rwanda and to provide a baseline for evaluating future conservation initiatives.

At the Nairobi IPS Congress, we discussed our findings from the most recent surveys (2017–2018) at a meeting with Russell Mittermeier, Tara Stoinski, Beth Kaplin, Chloe Cipolletta, Winnie Eckardt, and Madelene Nyiratuza. This led to the initiative to convene workshops with stakeholders to develop a golden monkey conservation action plan. Conservationists, park authorities, researchers, and local community members were invited to contribute to the action plan. The first workshop was held in Musanze, Rwanda, on 5 October 2018. Participants shared and reviewed existing information on the status of golden monkeys—published articles, submitted reports, and data on their distribution, ecology, population size, conflicts with local communities, illegal human activities, as well as conservation opportunities in their respective habitats, including VNP, MGNP, PNVi and GMNP. The second workshop was held in Musanze, Rwanda, on 18 February 2019. Participants representing each of the parks where the golden monkeys are found shared their knowledge about the threats and discussed measures to reduce, stop or mitigate them.

Given the threats to the golden monkey populations, we hope that this document will help in raising funds for the conservation of this species across its range, besides orienting research projects. Key targets in the plan include activities that support community engagement and development, the development of golden monkey tourism, and the strengthening of protective measures and law enforcement. The plan also calls for more research to support conservation efforts. Success of this action plan is dependent upon the cooperation of all stakeholders, from government, local authorities, and conservation organisations to the private sector and local communities.

Deogratias Tuyisingize,
Dian Fossey Gorilla Fund

EXECUTIVE SUMMARY

The golden monkey, *Cercopithecus mitis kandti*, an Endangered subspecies of blue monkey, is found in only two small populations in the central part of the Albertine Rift region in Central/East Africa. Since the 1950s, the habitat of golden monkeys has been lost or degraded in the Virunga massif (Democratic Republic of the Congo, Rwanda, Uganda), including a reduction of approximately 50% in the Volcanoes National Park (VNP), the Rwandan part of the Virunga massif, and by a staggering 98% in the Gishwati forest located in Rwanda. Surveys of golden monkeys in Mgahinga Gorilla National Park, Uganda suggest that the population is also in decline in Uganda. These surveys and daily ranger-based monitoring also show continuing threats to both populations across their range. As human disturbance continues within the golden monkey habitat, pressure on the remaining small and fragmented populations may result in the extinction of this subspecies. Consequently, a regional Conservation Action Plan (CAP) was developed in collaboration with conservationists, park managers, researchers, and local communities from the three countries where golden monkeys occur to address threats to the species.

Stakeholders were identified and brought together in two separate workshops held in Rwanda. Existing data and gaps in knowledge about distribution, ecology, population size, interactions with local communities, illegal human activities, as well as conservation opportunities, were discussed and used to create a joint vision with an associated set of concrete actions. The vision, agreed upon by all stakeholders, is to have "viable golden monkey populations thrive across their range by 2028". The goals of this five-year action plan (2023–2028) include the stabilisation of golden monkey populations through cessation of the loss and degradation of their habitat, restoration of the degraded habitats, interventions to reduce crop-foraging conflicts, and the development of sustainable golden monkey-centred tourism to reduce pressure on existing groups, while increasing the contribution of golden monkey tourism in revenue sharing. A threat analysis was performed to rank and connect the drivers of the threats to the survival of the golden monkeys in each of the protected areas where they range. Stakeholders set expected outcomes, actions, and timelines, to create a five-year plan to address the most severe threats to golden monkeys.

Key proposed measures include community engagement that involves the development of diversified, multiple, small-scale income-generating projects, the expansion of off-farm income generating activities, the development of strategies to reduce crop foraging, and the establishment of alternative, sustainable, and accessible fuelwood resources and weaving materials to reduce pressure on the forests. Furthermore, to support conservation efforts, the plan calls for the initiation of conservation education where it does not exist and the strengthening of existing conservation education efforts in communities and surrounding schools to support conservation efforts. Revenue sharing needs to be enhanced and improved through the promotion of tourism based on golden monkey trekking, which will require an increase in the number of groups habituated. Research is needed to improve our knowledge of golden monkey ecology and behaviour. Finally, protection in collaboration with local communities, and the reinforcement of laws protecting forests and wildlife while ensuring that the benefits of conservation accrue to those living near the parks, are important for the success of the conservation plan.

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We are most grateful to the conservation organisations and local communities that are operating in and around the golden monkeys' habitats, and we acknowledge the important role these communities play in the design and implementation of this golden monkey conservation action plan.

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ACRONYMS

CoEB: Centre of Excellence in Biodiversity and National Resource Management

DFGF: Dian Fossey Gorilla Fund

FHA: Forest of Hope Association

GMNP: Gishwati-Mukura National Park

ICCN: Institut Congolais Pour la Conservation de la Nature

IGCP: International Gorilla Conservation Programme

IUCN: International Union for Conservation of Nature

MGNP: Mgahinga Gorilla National Park

MGVP: Mountain Gorillas Veterinary Project

NGS: National Geographic Society

PNVi: Parc National de Virunga

RDB: Rwanda Development Board

UR: University of Rwanda

UWA: Uganda Wildlife Authority

VNP: Volcanoes National Park

WCS: Wildlife Conservation Society

1. INTRODUCTION

1.1 Taxonomy

The golden monkey or golden guenon is currently recognized as a subspecies *Cercopithecus mitis kandti by* the International Union for Conservation of Nature (IUCN) (Butynski & de Jong, 2020). This classification is used in this action plan, although some authors consider it a separate species, *Cercopithecus kandti* Matschie, 1905 (Taxonomic Serial No: 944227), a classification also adopted by Groves (2006), Myers et al. (2019), and the Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES), taxon identification number 9726.

1.2 Distribution and ecology

Today, the golden monkey is restricted to just two small populations in the central part of the Albertine Rift (Aveling, 1984; Butynski & de Jong, 2020; Groves, 2006; Myers et al., 2019). These remnant populations are largely restricted to two forest fragments of different habitat types, the Virunga massif and the Gishwati forest (Figure 1).

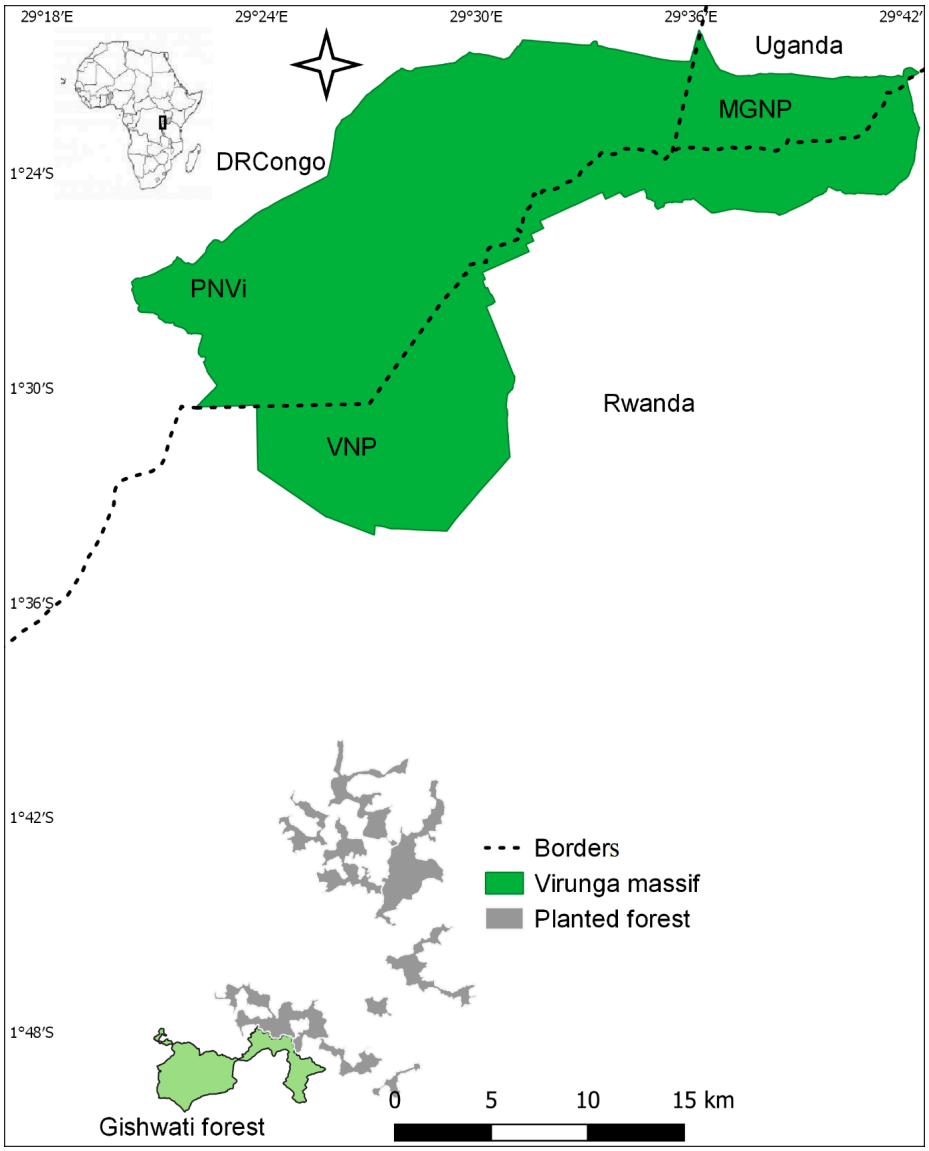

Figure 1. Golden monkey habitats as of 2018: Virunga massif (VNP, MGNP, PNVi), Gishwati forest part of Gishwati-Mukura National Park, and pine plantations (Source: Dian Fossey Gorilla Fund).

The Virunga massif spans three countries and has three protected areas: the Volcanoes National Park (VNP) in Rwanda; the Mgahinga Gorilla National Park (MGNP) in Uganda, and the Park National des Virunga (PNVi) in the Democratic Republic of the Congo (DRC), mostly in the bamboo zone. Another population of golden monkeys is found in the Gishwati forest portion of the Gishwati-Mukura National Park (GMNP), Rwanda, which is tropical montane forest dominated by fruit-producing trees and is located approximately 26 km from the southernmost border of the VNP (Butynski & de Jong, 2020). Golden monkeys were thought to be present in Nyungwe forest, but there have been no confirmed golden monkey sightings there over the last 25 years of systematic surveys by the Wildlife Conservation Society (WCS) teams and other general biodiversity surveys (Plumptre et al., 2002; B. A. Kaplin, pers. obs.)

Today, the golden monkey is restricted to a narrow elevational distribution from 2100 m to 3550 m, mostly within the bamboo (*Oldeania alpina*) zone in the Virunga massif and the Afromontane forest in Gishwati (Aveling, 1984; Twinomugisha et al., 2003; Groves, 2006; Tuyisingize, 2016). There is also a small population living in patches of the otherwise cleared forest that was replaced by a pine plantation in Gishwati in the 1980s (Tuyisingize *et al.*, 2022).

Golden monkeys are mostly arboreal and have a high degree of dietary flexibility reflecting adaptations to different habitat types and food availability in the respective locations (Twinomugisha et al., 2007; Tuyisingize et al., 2022). This is typical in the genus *Cercopithecus* (Butynski, 1990; Kaplin et al., 1998; Takahashi et al., 2019). More than 100 different food plant species have been recorded in their diet across habitats (Twinomugisha et al., 2007; Tuyisingize et al., 2022). Bamboo forest is their main habitat and bamboo the principal food source for the population in the Virunga massif, while the Gishwati population relies on fruit, leaves and insects (Tuyisingize et al., 2022).

1.3 Population trends

The golden monkey population declined by approximately 41% in MGNP (Uganda) between 1998 and 2003, leaving the subpopulation with less than 1,000 individuals (Twinomugisha & Chapman, 2006). This decline is attributed largely to degradation from intensive bamboo harvesting and the outright clearcutting of its forests (Twinomugisha & Chapman, 2006).

In VNP (Rwanda), however, surveys conducted in 2007, 2011 and between 2017 and 2018 suggest that the golden monkey subpopulation is stable, with about 4,626 (range: 4,165 to 5,088) individuals estimated in the most recent survey (Tuyisingize et al., 2022) (Table 1). This stability might be linked to the park's long-term protected status (since 1925) and the protection measures that have intensified since the 1980s. However, golden monkeys seem to avoid areas with illegal activities (Tuyisingize et al., 2022).

No golden monkey survey data are available for the Parc National des Virunga (PNVi) in DRC. Given that many illegal human activities are still observed in the PNVi (Hickey et al., 2019), and that golden monkeys are hunted

Table 1. Golden monkey population estimates in the Virunga massif (VNP, Rwanda and MGNP, Uganda) and the Gishwati-Mukura National Park (GMNP), Rwanda.

Sites	Population estimates	Year	References
VNP	4,331 (2,723–5,938)	2007	Tuyisingize *et al*. (2022)
VNP	4,487 (2,903–6,071)	2011	Tuyisingize *et al*. (2022)
VNP	4,626 (4,165–5,088)	2017–2018	Tuyisingize *et al*. (2022)
GMNP	172 (154–190)	2017–2018	Tuyisingize *et al*. (2022)
MGNP	2438 (975–3,901)	1998	Twinomugisha *et al*. (2006)
MGNP	989 (467–1511)	2003	Twinomugisha *et al*. (2006)

Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019.

for bushmeat, we can expect that this golden monkey subpopulation is declining. Regular surveys in the PNVi are, therefore a critical step to improve conservation and management. Previous field studies pointed out possible habitat overlap between Stuhlmann's blue monkey, *Cercopithecus mitis stuhlmanni*, near the corridor connecting Mikeno and Nyamuragira sectors of the PNVi in Uganda (Hickey et al., 2019), and future research would be helpful to determine if hybridization occurs there.

The most recent golden monkey survey in the Gishwati forest (2018) estimated a total of 172 individuals (range 154–190) (Tuyisingize et al., 2022). The numbers of golden monkeys in Gishwati certainly declined from 1995 to 2000 because of deforestation that left only 2% of the Gishwati forest remaining (Plumptre et al., 2001; Nyandwi & Mukashema, 2011). The size of the population living in the planted forests is likely small, and their conservation prospects are of concern given they have limited formal protection.

1.4 Threats

Although today the golden monkey populations are found mostly in protected areas, they are still facing a number of human-related threats and challenges (Ayebare et al., 2018; Ndayishimiye, 2018; Hickey et al., 2019) (Table 2). The main illegal activities that threaten the golden monkeys across their habitats include bamboo and tree cutting, feral dogs, stoning and chasing by humans following the monkeys' crop foraging in cultivated fields (Figure 2), forest fires, snares, and forage for livestock in the parks (McGuinness & Taylor, 2014; Ndayishimiye, 2018). In the Virunga massif, most of the illegal activities are in zones dominated by bamboo (Hickey et al., 2019), the main habitat for golden monkeys (Twinomugisha & Chapman, 2006; Tuyisingize, 2016). There is also poaching with potential disease transmission in each of the national parks (Butynski & de Jong, 2020).

In the PNVi (DRC), there are records of golden monkeys being hunted for bushmeat (PNVi staff, pers. comm.), which are supported by the presence of hunting found there during the 2015–2016 gorilla survey in the Virunga massif (Table 2). In Uganda, local communities around MGNP have been observed to harvest bamboo shoots in the park for food (Twinomugisha & Chapman, 2006). This practice is thought to have been imported from communities around Mt. Elgon, where bamboo shoots are commonly eaten by local people (Karanja, 2017).

Ndayishimiye (2018) surveyed farmers affected by golden monkey crop foraging, and recorded observations by Gorilla Doctors staff of golden monkey deaths by stoning following instances of crop foraging around VNP (also see Table 2). Further threats include disease transmission between golden monkeys and human communities as well as between golden monkeys and livestock surrounding VNP (Muhayimana, 2018). In addition, VNP is

Table 2: Summary of common threats to golden monkeys in the Virunga massif and Gishwati-Mukura National Park, Rwanda. X = present; NR = not recorded.

Threats per site	MGNP	VNP	PNVi	GMNO
Bamboo cutting	X	X	X	X
Forest fire	X	X	X	X
Snaring	X	X	X	X
Wood collection	X	X	X	X
Feral dogs	X	X	X	X
Disease	X	X	X	X
Stoning and chasing	X	X	X	X
Grazing	X	X	X	X
Grass cutting	X	X	X	X
Hunting	NR	NR	X	NR
Water collection	NR	X	NR	NR

Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019.

Figure 2: Golden monkey eating a potato © DFGF.

Figure 3: Water collection in the Virunga massif © DFGF.

surrounded by villages with little access to water, and local communities tend to fetch water from the forest, especially during the dry season (Figure 3). This illegal use of the park may elevate the risk of zoonotic disease transmission. Gastrointestinal parasites have already been detected in *Cercopithecus* monkeys, including blue monkeys (Munene et al., 1998; Chapman et al., 2005; Kouassi et al., 2015), and transmission may occur when people fetch water from the forest. The Gishwati forest part of GMNP and the plantations in this landscape are surrounded by mining concessions and illegal mining, which directly affect the golden monkey's habitat. Illegal grazing, wood collection, and the collection of livestock forage were mainly recorded in the forest of the GMNP and may also be a risk of zoonotic disease transmission and habitat degradation and loss.

1.5 Conservation status

Since the 1950s, the habitat of the golden monkey has been dramatically reduced and degraded throughout its historical range as a result of intensive human activities (Spinage, 1972; Plumptre et al., 2001; Twinomugisha et al., 2003; Nyandwi & Mukashema, 2011). The two golden monkey populations were once connected but were separated by road construction between the two largest towns (Musanze and Rubavu) in the north-west of Rwanda and agriculture-related activities in the surrounding landscape, which removed forest connectivity (Spinage, 1972). VNP was reduced by 50% from 328 km^2 to 160 km^2 between 1958 and 1973 (Spinage,1972; Plumptre et al., 2001), and the area surrounding VNP is one of the most densely populated areas in Africa with up to 1,000 people/km^2 (NISR, 2012). Such forest clearance and land use change has resulted in the loss of most of the lower elevation forests such as the Afromontane mixed forest zone (similar forest type to the Gishwati forest) (Figure 4), which was the only vegetation zone containing fruit-producing trees in VNP (Spinage, 1972).

The Ugandan side of the Virunga massif was gazetted in 1930 as the Mgahinga Forest Reserve with 33.7 km^2 (https://ugandawildlife.org/national-parks/mgahinga-gorilla-national-park). Since then, it has experienced several bouts of habitat loss and degradation, including human settlements that removed 10.4 km^2 of the forest, which was regained in 1993 when the forest was declared a national park (Twinomugisha et al., 2003). Similarly, for DRC, the PNVi-Mikeno sector (240 km^2) experienced habitat loss and degradation although its size remained the same. It was first invaded by cattle herders in the late 1950s (Dart, 1960), and then degraded by forest clearing (about 16 km^2) by refugees between 1994 and 1996 (Plumptre et al., 2001).

The Gishwati forest has suffered particularly significant habitat loss due to a World Bank project that clear-cut forest for cattle pasture and pine plantations in the 1980s, and further due to habitat degradation and loss for human settlements after 1995 (Plumptre et al., 2001; Nyandwi & Mukashema, 2011). These activities reduced the Gishwati forest cover from 280 km^2 in the 1980s to less than 10 km^2 in the 2000s (Nyandwi & Mukashema, 2011). A part of Gishwati (5.6 km^2) was restored in 2015 through efforts from the Government of Rwanda and conservation partners. Approximately 15 km^2 was restored, which prompted the gazettement of the Gishwati forest together with another isolated forest patch, the Mukura forest, to form the Gishwati-Mukura National Park (34 km^2) in the same period (Table 3).

Further imminent threats to the habitat of the golden monkey across its range include the potential effects of climate change on the bamboo habitat (van der Hoek et al., 2019). A decline in bamboo regeneration has already been observed in VNP and MGNP (Sheil et al., 2012; van der Hoek et al., 2019), with an anticipated impact on golden monkey food availability and distribution (Ayebare et al., 2018).

1.6 Current management strategies

The conservation of golden monkeys benefits greatly from conservation efforts in their habitats, which are mainly in national parks. The presence of charismatic and endangered species such as mountain gorillas and eastern chimpanzees (*Pan troglodytes schweinfurthii*) within their range has also led to increased conservation funding from donor support and tourism revenues.

Table 3. Summary of conservation status of the golden monkey habitats. NS: Not surveyed

Conservation status of golden monkey habitat	VNP Rwanda	MGNP Uganda	PNVi DRC	GMNP Rwanda
Size of the park (km^2)	160	33.7	240	34
Establishment year	1925	1993	1925	2016
Management	RDB	UWA	ICCN	RDB
Human density (# people/ km^2) around the park	Up to 1,000	Up to 500	Up to 110	Up to 300
Golden monkey population size (recent)	4,626 (4,165–5,088) in 2018	989 (467–1,511) in 2003	NS	172 (154–190) in 2018
Main crops grown around park boundary	Potatoes	Potatoes and maize	Potatoes and maize	Potatoes and maize
Type of buffer zone	None	None	None	*Alnus* sp.
Width of the buffer zone	None	None	None	10–20m

Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019.

However, during the last 20 years golden monkey trekking has increasingly contributed to tourism-revenue generation in the VNP and MGNP, making golden monkeys second in income generation after mountain gorilla tourism in these parks. Existing tourism development plans recommend golden monkey tourism habituation for both research and tourism in Rwanda and Uganda. Today, golden monkey tourism, research and health monitoring are conducted in Rwanda and Uganda, but not in DRC. Tourism activities are contributing to economic development and job creation in Rwanda and Uganda. Golden monkeys must, therefore, also be recognized for their contribution to tourism-revenue generation (e.g. in the VNP and MGNP) and the potential to generate tourism revenue in Gishwati and the PNVi in the future (Mehta & Katee, 2005).

We believe that economic potential can change people's attitudes towards a species and thus may also mitigate human-wildlife conflict between local people and golden monkeys (Sabuhoro et al., 2017). Specific and targeted management strategies, especially concerning wood collection and the use of bamboo in these areas, are needed to reduce the serious threats to the golden monkey's habitats.

Figure 4. Park border in the Virunga massif © DFGF.

2. GOLDEN MONKEY CONSERVATION ACTION PLAN

2.1 Preparation and process

2.1.1 Threats analysis

Two workshops were convened, in 2018 and 2019, which brought together 20 and 23 participants, respectively, with 26 unique participants, including conservation biologists, conservation practitioners, park authorities, researchers, and local community members (representatives of cooperatives of ex-illegal park users, and leaders of community conservation groups), from Uganda, Rwanda, and DRC (Annex 1). The first workshop focused on developing the plan's vision and goals, and the development of a problem tree that helps to find solutions to the causes and effects of threats (problems) around the golden monkeys and their habitat. The second workshop focused on the design of possible interventions (actions) needed to minimize threats to golden monkeys and their habitat. *Guidelines for Species Conservation Planning* (IUCN SSC SCPSC, 2017) and the *Conservation Action Planning Handbook* (The Nature Conservancy, 2007) were the main references used to guide participants through the process.

The first workshop with 20 participants was held in Musanze, Rwanda, on 5 October 2018. Participants shared and reviewed information on the status of golden monkeys, such as published articles, reports, and data on distribution, ecology, population size, conflicts with local communities, and illegal human activities, as well as conservation opportunities in their respective habitats in VNP, MGNP, PNVi and GMNP. After reviewing the available information, the participants jointly identified known and perceived threats to the golden monkeys to be used for threat analyses at each site.

During the first workshop, participants were given guidance on how to conduct a threat analysis to be used in building a problem tree indicating the main threat that was identified as the "small, fragmented and declining golden monkey populations". The threat analysis allowed participants to identify direct threats (any factors that are detrimental to population abundance), drivers of threats (the root causes of a direct threat), and constraints (major factors that impact a population) to the golden monkeys and their habitats (IUCN SSC SCPSC, 2017).

The second workshop, attended by 23 people, was also held in Musanze, Rwanda, on 18 February 2019,. Participants shared results from the threat-listing for each site to guide the identification of measures to reverse the threats. Based on the action plan's vision, the participants were grouped by golden monkey habitat (one of the four national parks) and asked to create a table showing budgets for proposed key activities to be implemented during a five-year plan.

2.1.2 Problem tree

To gather more specific and detailed information on the most important threats (to be later prioritized for the conservation action plan), park staff and researchers with the most on-the-ground experience ranked each threat by considering the degree to which they affect golden monkeys on a Likert scale from one to four (1 = low; 2 = medium; 3 = high; 4 = very high). The guidelines used for this exercise were those of The Nature Conservancy (2007) and the World Wide Fund for Nature (WWF, 2007). All information on the identified threats—including drivers and constraints—were used to build a problem tree (a visualization technique which links threats with their drivers and constraints to addressing the threats) (Figure 5).

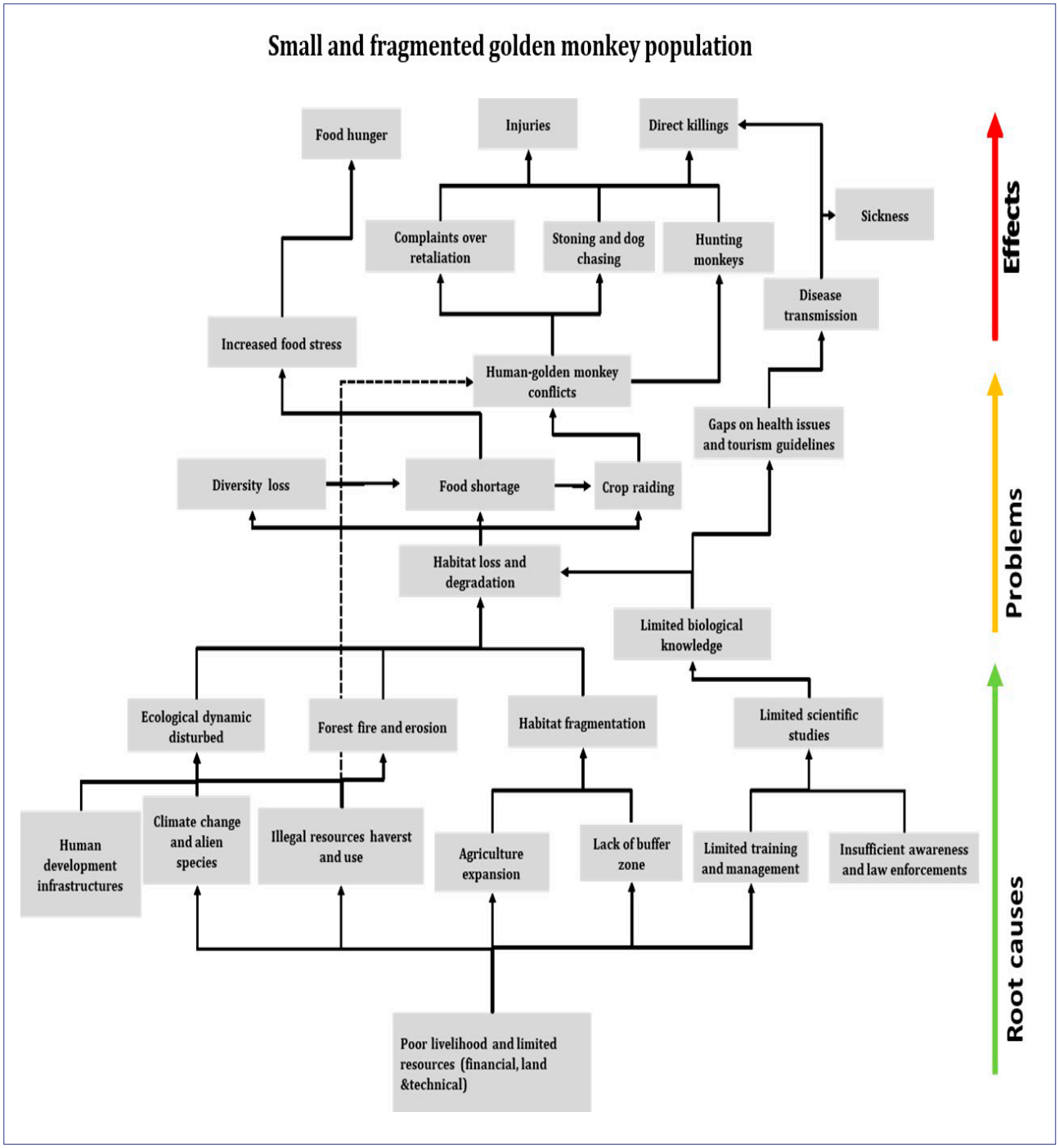

Figure 5. Problem tree depicting the analysis of threats to the golden monkey, their drivers, and constraints (Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019).

2.2 Vision and goals

The following vision was articulated during the first workshop: "To secure thriving, viable golden monkey populations across their range by 2028". A set of shared goals for all the habitats (VNP, MGNP, PNVi and GMNP) were identified, based on the agreed vision:

1. To stabilize the golden monkey population, including building resilience in local communities.
2. To halt the loss and degradation of the habitats and restore those previously degraded.

Table 4: The site-specific objectives for golden monkey conservation.

Sites	Specific objectives
VNP, Rwanda	Document rates and impact of golden monkey crop-foraging and retaliation incidences and reinforce measures to mitigate the conflict between local people and crop-foraging golden monkeys.
MGNP, Uganda	Remove invasive and alien species from the park and establish fire prevention measures.
PNVi, DRC	Initiate golden monkey tourism opportunities, initiate research on the ecology, population dynamics, and population trends of golden monkeys and their habitats.
GMNP, Rwanda	Assist in rehabilitating the degraded areas; initiate tourism experiences focused on golden monkeys.

Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019.

Table 5: Summary of budget of recommended activities needed in Volcanoes National Park (VNP), Rwanda.

Recommended actions	Potential partners	Time frame	Estimated funding needed US$
Improve golden monkey protection	RDB, conservation partners, local communities	5 years	70,000
Improve knowledge on golden monkey disease	RDB, conservation partners, local communities	5 years	20,000
Golden monkey population survey	RDB, conservation partners, local communities	5 years	15,000
Reduce habitat degradation	RDB, conservation partners, local communities	5 years	85,000
Improve sustainable golden monkey ecotourism	RDB, conservation partners, local communities	5 years	20,000
Increase local community awareness and support of golden monkey tourism	RDB, conservation partners, local government	5 years	30,000

Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019.

Table 6: Summary of budget of recommended activities needed in Mgahinga Gorilla National Park (MGNP), Uganda.

Recommended actions	Potential partners	Time frame	Estimated funding needed US$
Reduce illegal bamboo harvesting	UWA, conservation partners, local communities	5 years	22,000
Establish a sustainable bamboo harvesting programme outside the park benefitting local communities	UWA, conservation partners, local communities	5 years	65,000
Improve knowledge of golden monkey ecology, behaviour and population dynamics and trends	UWA, conservation partners, local communities	5 years	50,000
Preserve golden monkey habitat from habitat loss and invasive species	UWA, conservation partners, local communities	5 years	24,000
Reduce the impact of fire on MGNP	UWA, conservation partners, local communities	5 years	20,000
Improve sustainable golden monkey ecotourism	UWA, conservation partners, local communities	5 years	8,000
Increase local community awareness and support of golden monkey tourism	UWA, conservation partners, local communities	5 years	12,000

Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019.

2.3 Site-specific objectives and actions to achieve each of objectives

During the second workshop, participants identified and recommended measures to be implemented to achieve goals for each of the protected areas with golden monkey populations (Table 4). A total of US$ 1,047,000 (one million and forty-seven thousand dollars) was estimated as the amount needed to carry out the activities recommended in VNP (Table 5), in MGNP (Table 6), in PNVi (Table 7), and in GMNP (Table 8).

Table 7: Summary of budget of recommended activities needed in Parc National des Virunga (PNVi), DRC.

Recommended actions	Potential partners	Time frame	Estimated funding needed US$
Improve protection of the golden monkey population	ICCN, conservation partners, local community	5 years	33,000
Improve knowledge of the conservation ecology of the golden monkeys, and possible disease transmission	ICCN, conservation partners, local community	5 years	58,000
Preserve golden monkey from habitat loss	ICCN, conservation partners, local community	5 years	115,000
Establish and initiate golden monkey tourism and tourism regulation see (see section 3.3)	ICCN, conservation partners, local community	5 years	33,000
Initiate local community awareness and sensitization	ICCN, conservation partners, local community	5 years	75,000

Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019.

Table 8: Summary of budget of recommended activities needed in Gishwati-Mukura National Park (GMNP), Rwanda.

Recommended actions	Potential partners	Time frame	Estimated funding needed US$
Improve knowledge of golden monkey ecology, behaviour, population dynamics and trends	RDB, conservation partners, local communities	5 years	35,000
Improve knowledge of golden monkey disease	RDB, conservation partners, local communities	5 years	20,000
Assist in restoration of degraded habitat	RDB, conservation partners, local communities	5 years	49,000
Reduce threats leading to habitat degradation	RDB, conservation partners, local communities	5 years	108,000
Develop and implement the programme of ecotourism based on golden monkeys (see section 3.3)	RDB, conservation partners, local communities	5 years	40,000
Reinforce programmes that address alternative local people's livelihoods around GMNP	RDB, conservation partners, local communities	5 years	70,000

Source: Compiled by the report authors, based on workshop discussions in 2018 and 2019.

3. IMPLEMENTATION OF THE ACTION PLAN

Four protected areas cover most of the range of the golden monkey. Each has been subject to different phases of habitat loss and land use change and policies, but the participants with expertise from each protected area were able to identify common objectives for the conservation of this species:

1. Reinforce the protection and monitoring of the golden monkey population and its habitats.
2. Carry out more research on the ecology, population dynamics, and population trends of the golden monkeys and their habitats.
3. Reinforce existing and planned golden monkey tourism opportunities and visitor guidelines.
4. Initiate and reinforce programmes that create alternative livelihood opportunities (e.g., bamboo harvesting opportunities outside protected areas), which reduce pressure on the golden monkey habitat.

To coordinate the conservation measures identified, we grouped them into five categories:

1. Community engagement and development
2. Community sensitization
3. Tourism
4. Research
5. Protection and law enforcement

3.1 Community engagement and development

Most illegal human activities around the Virunga massif are induced by poverty (Sabuhoro et al., 2017; Munanura et al., 2018), and the proposed measures for the conservation of the golden monkey must, therefore, take into consideration poverty alleviation in the communities surrounding the golden monkey habitats. They include building on existing governmental and conservation partner initiatives, as well as developing support for community-based conservation. In the DRC, this would involve improving security and access to electricity, and in Uganda and Rwanda providing support for public infrastructure (e.g., health clinics, clean water) and sustainable livelihoods, housing, and capacity building and for the communities themselves with regard to their housing and livelihoods (livestock), and capacity building for off-farm income-generating activities, such as mushroom farming and wool production, and in training cooperatives to cultivate bamboo for handicrafts charcoal production outside the parks (see below).

Governments have put in place tourism revenue-sharing mechanisms to benefit communities adjacent to national parks. Current tourism revenue-sharing strategies seem to be complex and need restructuring to satisfy stakeholders while ensuring conservation goals. Current tourism revenue sharing is criticized for not reaching its potential conservation impacts (Munanura et al., 2016; Tolbert et al., 2019). The existing revenue-sharing programmes could evaluate whether needs of individual households rather than those of the larger community, should be targeted for more effective golden monkey conservation outcomes (Cook & Berrenberg, 1981; Sabuhoro et al., 2017).

In the Virunga massif, local communities harvest bamboo heavily as a source of fuelwood (Figure 6), weaving material, and poles for beans, while the bamboo is also the key food species and key habitat for Virunga golden monkeys (Twinomugisha & Chapman, 2006; Sheil et al., 2012; Tuyisingize, 2016; Tuyisingize et al., 2022). Alternative, sustainable, and accessible sources of poles, weaving materials, and fuelwood sourced from outside golden monkey habitats need to be identified and established to solve this issue. For example, the Rwanda

Figure 6: Bamboo collection in the Virunga massif © DFGF.

Development Board and the Uganda Wildlife Authority and their conservation partners have started planting small indigenous bamboo woodlots along water catchments for stream stabilization in riparian zones and to provide alternative bamboo resources, as it is one of the fastest growing plants and adaptable to any type of soil in the tropical region (Buckingham et al., 2014).

Poor people living around the golden monkey habitats usually use the traditional cooking system on three stones, which wastes much of the energy that would be used for cooking (Manibog, 1984). Providing improved, more energy-efficient cooking stoves to local communities would help to mitigate this conservation issue. It is important to work with communities in the selection of energy-efficient cooking stoves in order to ensure adoption.

3.2 Community sensitization

Education programmes are needed to build and improve the relationship between local communities and conservation. During the last two decades, the park authorities, together with conservation partners, have been providing conservation education programmes to local communities regarding the importance of the parks. Illegal human activities persist, however, even though the majority of people report that they benefit from living near parks in the Virunga massif (Tolbert et al., 2019).

There are limited educational opportunities for many communities living near the four protected areas, which are home to golden monkeys, and a lack of off-farm employment opportunities. Education programmes for school children and community training around the VNP, MGNP, and GMNP are limited to just a few schools and villages (https://www.mcdou.org/ceep-project, https://gorillafund.org/, http://www.fharwanda.org/). Conservation education efforts in communities and schools need to be reinforced and initiated where lacking to ensure long-lasting conservation success of the proposed action plan. Park authorities, conservation partners with special skills in conservation education, and conservation donors should be encouraged to organize awareness-raising and funding to support local conservation education. School material, such as educational children's books on golden monkeys and their habitats, should be developed and provided to schools, especially in the Mgahinga Gorilla National Park (Horton, 2018).

Given that some local communities still rely on the forest (Munanura et al., 2018), future conservation education training involving students and local community members should focus on building knowledge about and skills for the identification of alternative fuelwood sources (e.g., tree and bamboo planting outside the parks), and on establishing alternative income sources, such as beehive cooperatives. Park authorities and conservation partners have been using environmental and nature clubs, conservation debates, and conservation courses, and citizen science programmes to deliver conservation messages, which, however, reach a limited number of trainees. These education programmes and the teaching content and calendars should be revised and diversified to reach both the students and their parents. These programmes should also acknowledge and integrate traditional knowledge as a source of information that can inform conservation efforts.

Existing community sensitization programmes currently use conservation movies (shown in the evenings) and community cooperatives (https://gorillafund.org/). Although these initiatives reach a large number of people—20,000 a year through movies delivered around VNP (https://gorillafund.org/), for example—the number could be increased, and conservation messages could be disseminated throughout the day, and focus on a diversity of species, including golden monkeys. Conservation messages could be communicated during public community works (using radio drama, local journals in local languages, and in local churches). The importance of golden monkey conservation and the conservation of biodiversity in general should also be integrated into the national curriculum to ensure that students and teachers around the parks and the wider region are knowledgeable of this unique primate, its conservation status, and its contribution to revenue sharing, besides the overall importance of biodiversity. Action-based education programmes are powerful tools in conservation and can promote and facilitate park visits by local students and communities (Jacobson, 2010). Furthermore, building upon the success of the gorilla naming ceremony in Rwanda (https://www.rdb.rw/kwitizina/, 2019), park authorities and conservation partners could strengthen existing community sensitization by creating a golden monkey naming ceremony to raise conservation awareness and funding, and to promote positive attitudes.

While education must play a crucial role, it is important to combine educational activities with tangible, direct household benefits. The conservation education programmes need to support the development of projects that generate revenues for local communities. Participating in golden monkey conservation-centred activities and encouraging local communities to be more active in protecting the golden monkey are critical steps for conservation. These activities should ensure the benefits of living near the parks, such as promoting agricultural practices that are conservation friendly, such as mushroom farming, that provide food-rich protein that can substitute bushmeat and mitigating crop-foraging incidences by golden monkeys by cultivating crops that do not attract them and other wildlife. Such projects, if developed in a participatory manner with the target communities, can demonstrate the value of conservation in more tangible ways, by improving household revenues, improving nutrition, assuring food security, and providing alternatives to natural resource access outside the parks.

3.3 Tourism

As of 2019, two groups of golden monkeys in the VNP and one group in the MGNP are habituated and being visited by tourists. As of 2021, up to 16 tourists visit a golden monkey group per day in the VNP (Abel Musana, unpubl. data). The governments share the tourism revenues with the local communities—10% of revenue in Rwanda, and 5% in Uganda and DRC (Adams & Infield, 1999; Munanura et al., 2016; Sabuhoro et al., 2017). This revenue goes directly to public infrastructure (e.g., schools, clinics, and roads), the maintenance of stone walls and trenches at park boundaries to limit wildlife from exiting the parks, and cooperatives around the park, which then channel the support to households and to support activities that help reduce illegal human activities in the above-mentioned national parks (Adams & Infield, 1999; Munanura et al., 2016; Sabuhoro et al., 2017).

The current tourism revenue sharing strategy needs to be revised to ensure more funds are made available to address urgent community needs. For example, marketing of golden monkey tourism should be intensified, and the number of habituated golden monkey groups should be increased in the VNP and MGNP. The latter would

reduce the number of tourists per group visit in the parks and at the same time increase the number of golden monkey tourists resulting in an increased revenue to be shared with local communities. Golden monkey tourism activities should be initiated in the GMNP and PNVi, along with the design and implementation of a revenue sharing policy for local development around these golden monkey habitats. Feasibility studies should investigate the maximum number of groups to be habituated as well as the associated risks.

There is also no comprehensive study at present on the number of tourists and distances between golden monkeys and visitors that ensure sustainable tourism practices where golden monkey tourism operates. Current regulations need to be revised and harmonized (such as number of tourists per group). A study is needed to provide information to develop guidelines for golden monkey tracking that ensures the sustainability of golden monkey tourism and guarantees conservation benefits for the species. Such guidelines should include instructions that help tourist guides to navigate through golden monkey groups (e.g., splitting tourists into smaller visitor groups while being with the monkeys as opposed to keeping all tourists together in one visitor group during a visit), and rules to be respected while visiting the golden monkey (e.g., minimum allowable distance to the golden monkeys, avoidance of noise, keeping the forest clean, and establishing precautionary measures against disease transmission). Improved conservation measures and regular monitoring have the potential to lead to population growth in habituated primates as has been the case for the mountain gorillas (Granjon et al., 2020; Robbins et al., 2011).

3.4 Research

Despite their endangered status, little research has been conducted and published on golden monkeys. Studies to resolve taxonomic uncertainties in this species are of interest, and regular surveying is essential to monitor and document golden monkey population trends—the changes in their distribution and abundance, and the effects of illegal activities on golden monkey survival. Vital will be an understanding of whether the isolated forest patches are population sinks (Dias, 1996). In addition to surveys, there is a need for long-term ecological research to investigate, for example, the impact of climate change. Disease transmission is a critical threat to the golden monkey population, and studies are needed to greatly improve our understanding of disease threats and their transmission pathways. Such long-term golden monkey research and monitoring projects can offer local employment and capacity building for students.

3.5 Protection and law enforcement

Good relationships between park management personnel and the local communities around them is key for protection and management of biodiversity (Wilkie et al., 2006; Oldekop et al., 2016). Although all golden monkey habitats are regularly patrolled and protected in collaboration with communities (in VNP and MGNP), golden monkeys still face many threats (bamboo cutting, wood collection, and grazing, amongst others) related to their habitats and conflicts with local communities. Strengthening the enforcement of the existing protection and laws governing the integrity and management of the existing national parks is, therefore, essential. This can be achieved by reinforcing existing collaboration with local communities, while improving local people's livelihoods and integrating local people in the daily protection of the park. The anti-poaching units should be improved by providing more rangers, while increasing the number of community conservation groups (*animateur de conservation*). This can be supplemented by a campaign of education about, and law enforcement against, illegal activities that aligns with the above section on community sensitization.

Despite some success in arresting poachers and other people that illegally use the park's resources, those arrested are often released without prosecution due to a lack of evidence or weak environmental laws. To ensure effectiveness of the laws, park authorities should continue working with conservation organisations to influence public institutions (e.g., National Police, the Ministry of Justice, local leaders) in charge of law enforcement.

Ensuring the benefits of living near the parks through reducing human-wildlife conflicts is one of the ways to engender positive attitudes toward conservation (Oldekop et al., 2016). A comprehensive assessment of existing measures and their effectiveness is needed, and alternative measures to enforce existing measures should be investigated.

4. CONCLUSIONS

Habitat loss and degradation, human-wildlife conflict, and gaps in biological knowledge are major threats to the golden monkeys. This five-year (2023–2028) action plan aims to ensure sustained golden monkey populations and to improve income generation independent of forest resources for local communities that live near golden monkey habitat to reduce threats to the species. The success of this action plan will depend on community engagement and development, community sensitization, tourism, and research, as well as improving protection and law enforcement.

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ANNEX: PARTICIPANTS AT THE GOLDEN MONKEY CONSERVATION ACTION PLAN WORKSHOPS OF 5 OCTOBER 2018 AND 18 FEBRUARY 2019.

#	Names	5th Oct 2018	18th Feb 2019	Institutions
1	Altor Musema	x	x	International Gorilla Conservation Project – Democratic Republic of the Congo
2	Jacques Katutu		x	Institut Congolais pour la Conservation de la Nature /Parc National de Virunga
3	Samuel Amanya		x	Uganda Wildlife Authority / Mgahinga Gorilla National Park
4	Janvier Kwizera	x	x	Rwanda Development Board / Volcanoes National Park
5	Oreste Ndayisaba		x	Rwanda Development Board / Volcanoes National Park
6	Moses Turinawe		x	Uganda Wildlife Authority / Mgahinga Gorilla National Park
7	Edison Kabenga	x	x	Community member / Gishwati Mukura National Park
8	Thierry Inzirayineza	x	x	Forest of Hope, Rwanda
9	Methode Majyambere	x	x	University of Rwanda / Biology Department
10	Yntze van der Hoek		x	Dian Fossey Gorilla Fund / Karisoke Research Center
11	Jean Bosco Noheri	x	x	Mountain Gorilla Veterinary Project – Gorilla doctors
12	Eric Ndayishimiye	x	x	Dian Fossey Gorilla Fund / Karisoke Research Center
13	Abel Musana	x	x	Rwanda Development Board / Volcanoes National Park
14	Eddy Kambale Syaluha	x	x	Mountain Gorilla Veterinary Project – Gorilla doctors
15	Jean Damascene Hakizimana	x	x	Rwanda Development Board / Volcanoes National Park
16	Winnie Eckardt	x	x	Dian Fossey Gorilla Fund / Karisoke Research Center
17	Eric Nsengiyumva	x	x	Community member / Volcanoes National Park
18	Beth A. Kaplin	x	x	Center of Excellence in Biodiversity & Natural Resource Management, University of Rwanda
19	Alain Ndoli		x	The International Union for Conservation of Nature, Rwanda
20	Protais Niyigaba	x	x	Wildlife Conservation Society, Rwanda
21	Chloė Cipolletta	x	x	National Geographic Society, East Africa
22	Deogratias Tuyisingize	x	x	Dian Fossey Gorilla Fund / Karisoke Research Center
23	Elisabeth Nyirakaragire	x	x	Rwanda Development Board / Volcanoes National Park
24	Dennis Twinomugisha	x		Makerere University, Uganda
25	Julius Nziza	x		Mountain Gorilla Veterinary Project – Gorilla doctors
26	Innocent Mburanumwe	x		Institut Congolais pour la Conservation de la Nature /Parc National de Virunga

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