

Strengthening Conservation of Owl- Faced Monkeys (*Cercopithecus Hamlyni*) in the Albertine Rift Region (ARR)

Wycliffe Tumwesigye^{1, *}, Louis Rugerinyange², Claude Hakizimana³, Doreen Atwongyeire¹, Goretty Nagawa¹, Daniel Ndizihiwe⁴

¹Department of Economics and Environmental Management, Bishop Stuart University, Mbarara, Uganda

²Nyungwe National Park, Rwanda Development Board, Kigali, Rwanda

³Kibira National Park, National Institute for Conservation of Nature and Environment, Bujumbura, Burundi

⁴Department of Agriculture and Agribusiness, Bishop Stuart University, Mbarara, Uganda

Email address:

wtum2012@gmail.com (W. Tumwesigye)

*Corresponding author

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Abstract: The owl-faced monkeys (*Cercopithecus hamlyni*) are endemic to the Albertine Rift Region (ARR). They live in and feed on bamboo plantations as their primary habitat. Illegal bamboo harvesting threaten the owl-faced monkeys and associated biodiversity across the Nyungwe-Kibira trans-boundary ecosystem in the ARR. Spatial distribution of bamboo plantations, mechanisms for propagation and management in Rwanda and Burundi are poorly documented. The study aimed at mapping potential *Cercopithecus hamlyni* habitats, establishment of threats facing bamboo plantations, and training local communities in bamboo propagation and management techniques. The study used GIS data from IUCN red list and diva-gis websites, 300 household interviews and focus group discussions of key informants from Rwanda and Burundi. GIS 10, SPSS version 18 and Microsoft Excel were used for data analysis. Results indicate that potential habitats for *C. hamlyni* include: Western DR Congo, South Eastern Rwanda and North Western Burundi. Results show that 67% of the households harvest bamboo trees for handcrafts and construction while 50% harvest bamboo trees for sale due to high poverty levels in their households. The study concluded that collaborative trans-boundary management of protected areas, capacity building for local communities, formation of cooperatives and enacting appropriate laws promotes biodiversity conservation in the region. Strengthening law enforcement and propagation of bamboo plantations on marginal land were recommended.

Keywords: Bamboo Habitat, *Cercopithecus Hamlyni*, Biodiversity, Conservation, Trans-Boundary Ecosystem

1. Introduction

The Owl-faced monkey (*Cercopithecus hamlyni*) is a classified and vulnerable species by International Union for Conservation of Nature and Natural Resources (IUCN) red list of 2015 [1] and is endemic to the Abertine Rift Region [2]. The primates are and not properly habituated so they do not interact freely with humans (Figure 1) hence making it

difficult to conduct research on their behavior. Habituation program for *hamlyni* was started by Wildlife Conservation Society (WCS), Rwanda and Burundi in the early 20th Century but this did not continue for long due to limited financial resources.



Figure 1. (a) Female *C. hamlyni* (Source: WCS, 2010) Figure 1. (b) Male *C. hamlyni* (Source: WCS, 2010).

Bamboo plantations provide shelter, food and protection for the *Cercopithecus hamlyni* hence an important habitat to these primates (Figure 1). Female primates (Figure 1a) can be distinguished from males (Figure 1 b) by possession of a pair of testis. Bamboo plantations are essential for climate regulation [3], soil protection [4], construction and hand craft making [5]. Illegal and unsustainable bamboo harvesting does not only affect the environment but also poses a great threat to the *C.hamlyni* primates, *Apalis argentea*, *Phodilus prigoginei* and other diverse species from both protected and un protected areas that benefit from bamboo plantations. The vice affects the soil, water, air, the tourism sector and research in the region. Increased house household poverty

levels and lack of awareness have increased illegal bamboo harvesting [6] both in and outside protected area in the ARR. Bamboo harvesting is one of the major threats to biodiversity in Nyaruguru district and Kabarore commune across Kibira-Nyugwe landscape. Bamboo trees are used for construction and meat roasting, among other activities (Figure 2). Community based initiatives, alternative income sources and awareness creation among communities have potential for enhancing conservation of *C.hamlyni* in the ARR [7, 8]. High population density of communities adjacent to the protected areas [9], most of which depend on agriculture, threaten biodiversity conservation in the region [10].



Figure 2. Bamboo harvesting from Nyungwe NP: Source Nyungwe NP RBM Report, 2010.

Bamboo plantations are harvested from in and outside protected areas for different purposes. The poles from bamboo are used for construction and as sticks for meat roasting (Figure 2). Bamboo plantation contribute to improved household income [11], building residences, construction of fences, making handcrafts, medicine, making bicycles and young shoots are used as foodstuffs [5, 12, 13]. The many uses derived from bamboo plantations, have

enhanced their unsustainable harvesting in most developing countries including Rwanda and Burundi. What drives illegal harvesting of bamboo plantation and measures for their sustainable management are not properly document. The study aimed at mapping potential *C.hamlyni* habitats, establishment of threats facing bamboo plantations, and training local communities in bamboo propagation and management.

2. Study Area

Map showing study sectors in Rwanda and Burundi.

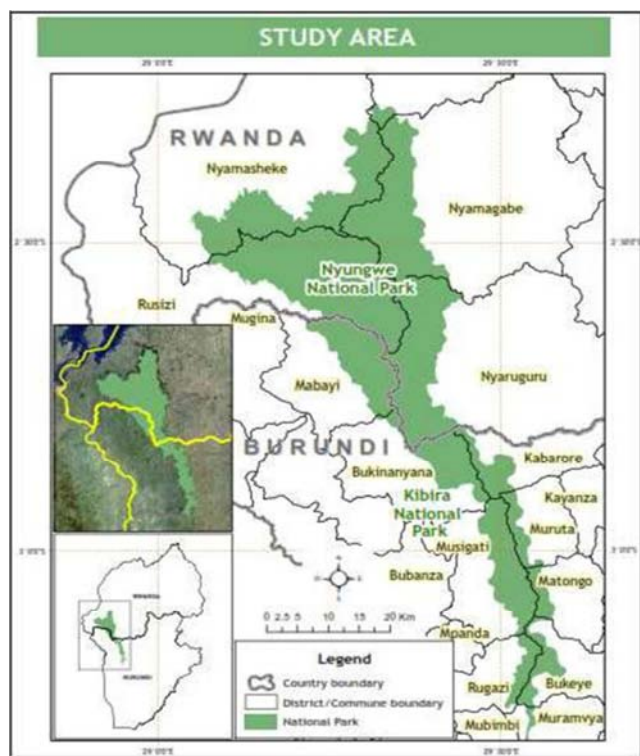


Figure 3. Target sectors include: Ruheru, Nyabimata & Busanze (Rwanda); Bukinanyana & Kabarore (Burundi).

The research was conducted in two countries of Rwanda and Burundi, covering the Nyungwe Kibira ecosystem. Two sub counties were selected from Rwanda and two from Burundi (Figure 3). The area is a hotspot for bamboo and *hamlyni* primates.

2.1. Methodology

One hundred and fifty households were randomly selected from Ruheru, Nyabimata and Busanze sectors (Rwanda) and 150 households from Kabarore and Bukinanyana communes (Burundi) for interviews (Figure 2). The selected households are adjacent to the Nyungwe-Kibira trans-boundary landscape. The local communities in this area have been extensively involved in illegal activities including poaching and harvesting of bamboo trees from the two parks [8, 14]. Both open-ended and closed ended questionnaires were used during household interviews [15]. Additionally, focus group discussion were conducted with park employees, and community leaders working in the region [16]. Focus group discussions involved local leaders, government representatives, private sector, Wildlife Conservation Society (WCS) staff, rangers, park administrators and NGO representatives from the two countries to generate more data [16, 17, 18]. Furthermore, the 10 year Nyungwe National Park management plan (2012-2021) was consulted for identification of illegal activities including bamboo harvesting.

2.2. Data Analysis

Data was analyzed using SPSS version 18,[19], ArcGIS 10.4 and Microsoft Excel 10. The applications were robust and relevant to the study objectives.

3. Results

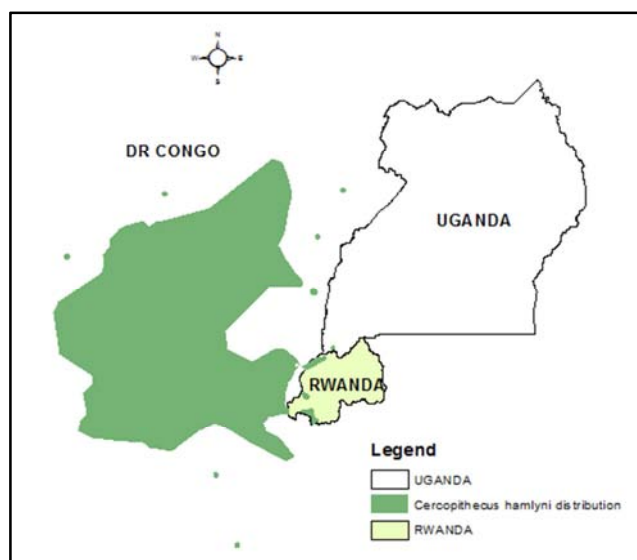


Figure 4. Potential habitat for *C.hamlyni* in ARR.

Figure 4 shows potential bamboo habitat for *C.hamlyni* in the ARR. The primates are endemic to the region and live in bamboo plantations from which they obtain food and shelter. Unfortunately, bamboo plantations are threatened by illegal harvesters and other activities by communities from the region.

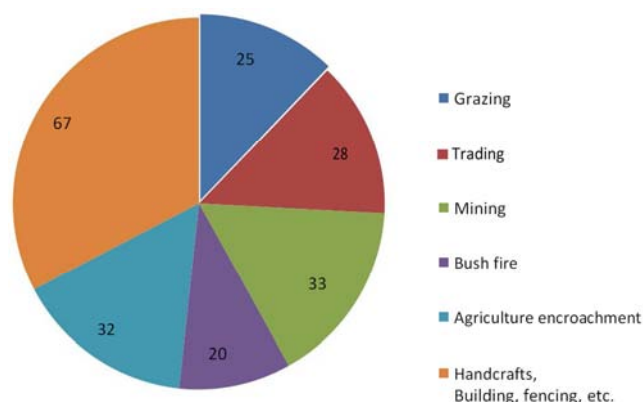


Figure 5. Bamboo threats in Rwanda –Burundi ecosystem.

Figure 5 shows that the largest amount of bamboo plantations (67%) are harvested for handcrafts and construction materials while the smallest amount (20%) is destroyed by bush fires in the region.

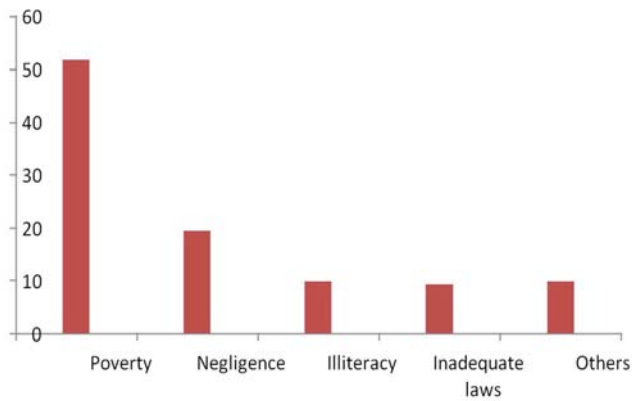


Figure 6. Causes of bamboo harvesting in Nyungwe-Kibira ecosystem.

Figure 6 shows that 50% of bamboo plantations are harvested because of poverty and the smallest percentage due to other reasons.

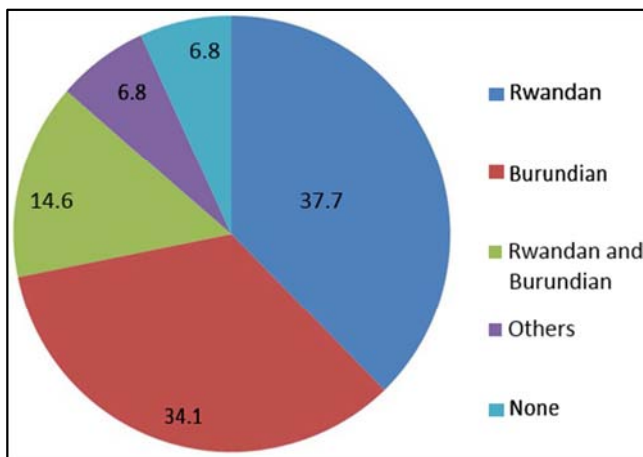


Figure 7. Participants in illegal bamboo harvesting across Nyungwe-Kibira ecosystem.

Figure 7 shows the origin of illegal bamboo harvesters across the Nyungwe-Kibira ecosystem. Majority of bamboo illegal loggers (37.7%) were from Rwanda followed by those from Burundi (34.1%) and the least number (6.8%) are not know by the adjacent communities where they come from.

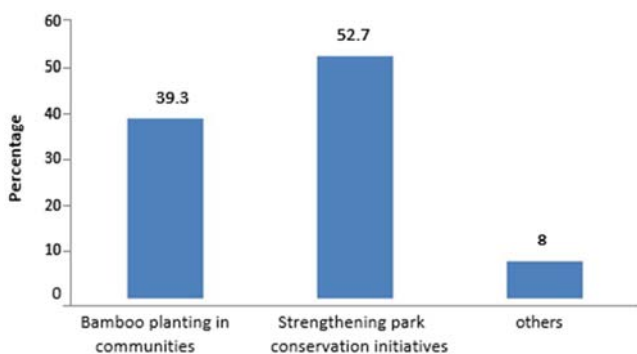


Figure 8. Strategies for increasing bamboo plantations.

Figure 8 shows strengthening National Park conservation initiatives (52.7%) and planting bamboo plantations in

community land (39.3%) are the strategies that with potential to increase bamboo plantations in the region.



Figure 9. Bamboo seedbed demonstration: Left- seedbed establishment; Right- seedlings ready for transplantation.

Proper bamboo propagation and management requires skills and competences to become successful. The trees need great care from seedbed to maturity (Figure 9). This brings great reward at the end of the struggle.



Figure 10. Training workshop for bamboo propagation.

Figure 10 shows the training workshop on proper bamboo propagation and management, beginning from seedbed establishment to maturity.



Figure 11. Demonstration farm for bamboo plantation in Rwanda.

Figure 11 shows successful bamboo propagation and management. Capacity building for community members was done by COJEPENYA cooperative, anon-governmental organization and resulted into effective propagation and management of bamboo plantations in Rwanda.

Figure 12 shows unsuccessful bamboo propagation and seedbed management in Rwanda.

Limited amount of water supply results into drying and death of seedlings in the seedbed.



Figure 12. Lack of proper skills leads to death of bamboo seedlings, Nyaruguru district, Rwanda.



Figure 13. Environmental Education workshop at KCEM, Rwanda, identifying measures to conserve *C.hamlyni* and bamboo habitat.

Figure 13 shows and Environmental Education workshop at Butare, Rwanda. Participants came from Rwanda and Burundi and included local leaders, WCS and park

management staff. Measures of expansion of bamboo plantations on marginal land, buffer zones, along the river banks, school compounds and road reserves were discussed as strategic bamboo planting outside protected areas.



Figure 14. Conservation of *C.hamlyni* workshop participants, KCEM, Rwanda.

Figure 14 shows the participants that attended a workshop for designing strategies for conservation of *C.hamlyni* and its habitat. The Environmental education workshop was conducted to identify key areas regarding the environment in Rwanda and Burundi and to forge the way forward in protection of *hamlyni* and bamboo habitat.

3.1. Regional Cooperation and Bamboo Cooperatives for Reducing Bamboo Illegal Harvesting

In Burundi a cooperative called COPROBAH was formed to engineer environmental conservation and protection of *C.hamlyni*. This cooperative was made up of 5 environmental associations: AGDB/BURUNDI, DUKORERHAMWE, TWIYUNGUNYANE, ANPC BURUNDI-E and TURWANYE INZARA.



Figure 15. Profile for COPROBAH Cooperative.

The year 2014, the 22nd day of August, the representatives of the above associations decided to work in synergy and

thereby, create a cooperative for the Promotion of bamboo propagation and protection of *Cercopithecus hamlyni* (COPROBAH). As unity is strength, the primary purpose was to promote bamboo propagation on marginal land and protection of the rare primates called *hamlyni* that live in bamboo and eat bamboo trees in the area of the Kibira NP and its surroundings. The major cooperative objectives include:

- (1) Restore ecological *hamlyni* habitat by planting bamboo in the degraded spaces of the Kibira National Park and its surroundings.
- (2) To promote bamboo propagation and management on marginal land and buffer zone of the park to reduce the movement of illegal bamboo users.
- (3) Protect waterways taking source in Kibira to restore their good fuel flow to the lake Rwegura

COPROBAH planned activities included:

- i. environmental sustainability
- ii. protection of ecosystem on Lake Rwegura
- iii. contribution to the protection of the Kibira and its biodiversity
- iv. reduction of poverty using diversified bamboo products
- v. reduce the effects of greenhouse gases and promoting carbon sequestration
- vi. promotion of joint trans-boundary management of massive Nyungwe-Kibira ecosystem and biodiversity and
- vii. improvement of tourism attractions in Nyungwe-Kibira landscape.

3.2. Discussion

C.hamlyni bamboo habitat was found in DR Congo, Rwanda and Burundi. The findings agree with IUCN 2015 red list that they are endemic to the Albertine Rift Region [1]. The bamboo plantations provide shelter and food to the primates hence essential for their survival [20]. Conservation of *C.hamlyni* and their bamboo habitat should be a concern for all stakeholders due to low existing numbers [21] and low rate of multiplication, one offspring in two years. Bamboo plantations are beneficial to biodiversity, humans and provide diversified ecosystem services [5, 22, 23, 24]. This has resulted into severe harvesting and unsustainable use of bamboo plantations in the region. In Nyungwe-Kibira ecosystem, Illegal bamboo harvesters come from Rwanda and Burundi and they use it to make sticks for roasting meat, building construction, medicine, fencing and handcrafts, mats, chairs [5, 11, 12, 25] and sale to obtain income. Such great demand poses a threat to bamboo plantations in the region.

Sustainability of bamboo plantations need well designed strategies in the region. These include training for local communities, environmental education and regional cooperation and collaboration. The local communities require effective training in bamboo propagation and management lest they fail to benefit from bamboo plantations and keep poor. Planting bamboo using mature bamboo trees cannot be

successful if they are not well uprooted. The bamboo trees will dry from the garden where they are planted (Figure. 12) and this also reduces the bamboo trees in the parent land. Seedlings requires constant and sufficient water supply for proper growth. If this requirement is not met, all seedlings in the seedbed dry up and die (Figure 12) causing a great loss to both the government and cooperative members. This was the case with MBEREHEZA cooperative in Nyaruguru district, Rwanda (Figure 12) that got money from Rwanda Development Board (RDB) and a piece of land from the government but could not achieve the intended outcome.

Capacity building for the farmers through training and workshops (Figure 9, 10, 11, 13 & 14) is essential for effective bamboo propagation and management. Government official, private sector representatives, community leaders, head teachers of adjacent schools, NGO representatives, park employees, trans-boundary secretariat representatives from both Burundi and Rwanda were involved in the training to conserve *C.hamlyni* and their habitats in the region. The regional stakeholder discussed and agreed on designing an environmental education strategy to enhance bamboo plantation and biodiversity conservation across the two countries. This was written based on household interviews conducted in both Burundian and Rwandan districts adjacent to the protected areas. Some activities highlighted in the strategy include: sensitization of local communities using drama competitions, identification of suitable bamboo species that can grow in the region, establishment of bamboo seedlings, giving incentives to best bamboo growers; and trans-boundary workshops, community meetings, eco clubs in schools and the media. The activities were intended to contribute to behavior and attitude change for the local people and students in the focus area regarding conservation of *C.hamlyni* and their bamboo habitat.

Strengthening trans-boundary cooperation would reduce illegal bamboo harvesting in Nyungwe-Kibira ecosystem. This would include environmental education, ecotourism, increased law enforcement, joint patrols among others. This study is in agreement with previous studies which explained that international cooperation enhances forest management [26]. Involvement of community members local leaders and all stakeholders at all levels across both countries can reduce illegal bamboo harvesting, enhance propagation and management of plantations, and reduce poverty in the region [27]. Trans boundary and collaborative management has proved effective strategies in enhancement of biodiversity conservation [28, 29]. Biodiversity conservation across the Nyungwe-Kibira ecosystem focuses on bamboo plantations as a critical habitat for *Cercopithecus hamlyni*, *Apalis argentea* and *Phodilus prigoginei* species that use bamboo plantations as their major habitat. Creating awareness among local communities to respond to the conservation challenges of habitat loss and habitat fragmentation is paramount to conservation of *C.hamlyni*. All the stakeholders revealed that trans-boundary ecosystem management and community education are the possible mitigation measures to reduce pressure on the critical (bamboo) habitat in the area. Due to

limited land possessed by the local community members, the local people plant the bamboo trees along the buffer zones and river banks. This reduces pressure on bamboo trees in Kibira and Nyungwe National parks that would threaten biodiversity in the region. This study identified Trans-boundary ecosystem management involving the staff of Kitabi College of Conservation and Environmental management (KCCEM), Nyungwe NP and Kibira NP, Rwanda Development Board (RDB) and the National Institute for Conservation of Nature and Environment (INECN) of Burundi Nyungwe-Kibira management secretariat would effectively enhance biodiversity management in protected areas.

3.3. Conclusions

C.hamlyni and their bamboo habitat are threatened in the ARR. This affects the environment, humans and the associated biodiversity. Measures to mitigate this challenge need be put in place across the region to sustainably management bamboo habitat and *C.hamlyni* primates, endemic to the ARR. Collaborative and trans-boundary management involving all stakeholders at all levels have great potential to enhance biodiversity conservation in the region. Enacting and strengthening law enforcement provides better primate conservation in the region.

3.4. Recommendations

KCCEM should mobilize more funds from both national and international donors so that they provide scholarships to trainees from Burundi, DR Congo and Rwanda, the critical habitat for *C.hamlyni*. These graduates should be equipped with better skills for biodiversity conservation in the region and strengthen conservation activities after returning back to their home countries.

Capacity building for all stakeholders at local, national and regional levels is still needed to enable all stakeholders understand better *C.hamlyni* and the need to properly propagate and manage their bamboo habitat in the region.

The regional governments should provide more funds and marginal land to the local communities to expand bamboo plantations on the marginal land and reduce pressure on the bamboo plantations in protected areas. More bamboo growing cooperatives should be formed and be trained in sustainable bamboo plantation management.

Trans-boundary research, environmental education in schools, collaboration, cooperation, law enforcement and projects implementation need to be strengthened for effective biodiversity conservation and management.

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