RWENZORI MOUNTAINS NATIONAL PARK, UGANDA (N684)

STATE OF CONSERVATION REPORT

SUBMITTED BY

UGANDA WILDLIFE AUTHORITY:

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EXECUTIVE SUMMARY

The Rwenzori Mountains National Park (RMNP) World Heritage site (WHS), number 684, is a natural property located in Uganda, East Africa. The site was inscribed as a World Heritage Site in 1994.

Following the Extended Session of the 44th World Heritage Committee (WHC) held at Fuzhou, China in 2021 (virtual meeting), a number of resolutions were reached and documented under DECISION 44 COM 7B.85 particularly focusing on issues which were raised by the IUCN/ UNESCO reactive mission of 2019. The mission report therefore formed the basis for the decision made at the Fuzhou meeting in China. To be very specific, the following issues were highlighted under Decision 44 COM 7B.85 for attention by the State Party of Uganda:

i. The need for the State Party to abandon pursuance of the development of the Cable Car in RMNP for its purported impacts on the maintenance of Outstanding Universal Values (OUVs) of Rwenzori Mountains National Park (RMNP).
ii. The need for an action plan for monitoring the elephant population in the property with a view of creating a migratory corridor between RMNP and the other national parks in Uganda.
iii. Noted the development of small-scale hydropower (HEP) projects outside RMNP and requested the State Party to conduct a Strategic Environmental Assessment (SEA) for the Rwenzori water catchment, including RMNP, to assess the indirect and cumulative impacts on the OUVs arising from the existing and planned small-scale run-of-river HEP infrastructures and to ensure that Environmental Impact Assessments (EIA) for any future small scale hydropower development proposed in the catchment of the property, fully assess the potential impacts in relation to the OUV in line with the IUCN World Heritage Advice Note on Environmental Assessment
iv. Notify the World Heritage Centre (WHC) of Uganda's plans to reopen Kilembe Mines and that a detailed EIA be conducted and submitted to the WHC before any irreversible decisions are made.
v. The need for a wildlife monitoring plan to ensure that the Key wildlife species are regularly monitored.
vi. Revise the Tourism Strategy to focus on low impact tourism activities
vii. Continued monitoring of climate change impacts on the OUVs of the property and submit a Disaster Risk Management and Climate Change adaptation plan

and have it submitted to the WHC once it is available.

viii. Revise the General Management Plan to fully address the OUV of the property, and ensure coordination with other strategies and studies

The state of Uganda noted that some of the issues were captured out of context and would wish to correct the impression that a wildlife corridor can be created between RMNP and other parks in Uganda. The action would result into animosity of communities towards the property and destroy UNESCO image worldwide. It is also important to note that there is already connectivity between RMNP and Virunga National Park (VNP) of the Democratic Republic of Congo (DRC). The WHC needs to take note that this part of the decision was made without adequate analysis of issues by the reactive monitoring mission and is therefore misplaced. The WHC is advised to abandon this clause as it is not practical and can never be implemented. The good and perpetual existence of RMNP and its biodiversity therein will depend on the support it will receive from the neighboring community. If the community realizes that the decisions of the WHC are detrimental to their welfare, the WHS will be negated and biodiversity will be exposed to more threats.

The construction of hydropower projects in the vicinity of RMNP was done after subjecting them to EIA. These projects are located outside the park and have negligible impact on the property's OUVs because of their sizes that do not attract many people in the vicinity of the park. Implementation of mitigation measures is being undertaken with substantial support being realized from the projects that are contributing positively towards the protection of the OUVs of RMNP. For example, Ndugutu/ Sindila Hydropower project constructed a ranger outpost to support surveillance and patrol efforts in their area. The same project supported boundary marking in the part where their operations are being implemented. The Kyondo ranger outpost was also constructed by the Kyarumba hydropower project. Another outpost is being planned in Bwesumbu Subcounty in Kasese District. These are positive contributions with no negative impacts.

Meanwhile, the Cable car project that is purported to have adverse impacts on the OUVs of RMNP has never been started and no credible recommendation to the commencement of this project is documented. The recommendation to abandon the project was documented in error as the project or its plans are not in place yet. The WHC will be consulted if any project of that magnitude has to be implemented. In this regard, the State of Uganda appreciates the idea of revising the Tourism Strategy to cater for the low tourism impact activities and infrastructure. This recommendation is already catered for in the strategy and can only be revised when the contents to the effect are changed. However, it should be noted that the site requires a substantial

resources to protect the park and its biodiversity. Its therefore not feasible that the site can only depend on low tourism activities to generate the required resources.

Regarding the issue of the review of the General Management Plan (GMP) of the site, it's important to note that the GMP runs up to 2026 when it will be expiring and a new plan will be put in place. It is also important to note that the capture of Kilembe Mines under the decision was done in error as the Kilembe Mines activities are derelict and in case of any resumption, the mines will be subjected to EIA with the involvement of all stakeholder in the decision-making process.

Since 2019, the State of Uganda has put to action and implemented a number of recommendations and continue to follow up on decision 44 COM 7B.85. The Disaster Risk Management and Climate Change Adaption Plan was submitted to the World Heritage Centre (WHCe), coordinated patrols between Uganda and the Democratic Republic of Uganda are ongoing, monitoring of climate change impacts and biodiversity surveys are being implemented, enhancement of community livelihood is also being done, and monitoring of impacts as proposed in the EIAs of the HEP projects is being undertaken. Monitoring activities have also indicated that there are no impacts so far created by the establishment of the small-scale HEP stations that are located outside the park. Whereas no SEA has been done yet for the HEP small-scale projects outside the property, positive impacts have been noted from their establishment through support to anti-poaching, employment of local communities to reduce pressure on the property, support to boundary maintenance and replanting, support to anti-poaching activities and supply of clean water to the community as part of the benefits of these projects. As for the reopening of Kilembe Mines, no plans yet of the sort and any discussions to the effect will be communicated to the WHCe at the earliest stage to enhance coordination between the Uganda and the Centre. Uganda would also wish to confirm that the cable car project has never been commenced.
Uganda, with support from WWF, carried out staff capacity building in SMART and use of drone as well as renewal of expired resource use MoUs. The outbreak of COVID-19 affected the implementation of the SEA for the HEP projects, formulation of the wildlife monitoring plan, and review of the tourism strategy. Site management also enhanced the resource offtake monitoring mechanisms through signing of memoranda of understanding with the community. The Memoranda compel community members to abide by the provisions of their commitments. A number of interventions have been implemented to fight human-wildlife conflicts and reduce the incidents of fire within the site.
Other conservation issues that have a likelihood of affecting the Outstanding Universal values of the property have been highlighted as poaching, illegal resource harvest, human wildlife conflicts, climate change, fires, financial unsustainability, and

increasing human population. A number of mitigation measures that are being implemented on-site to control the impacts of these issues have been highlighted herein including community livelihood improvement, Forest Land Restoration and buffer zone management, river bank protection, elevation of infrastructure to deter them from destruction by flooding, continued monitoring of HEP, climate change monitoring and intensified patrols against the human-induced threats. The management authorities will also enhance the marketing of the site, and come up with other revenue streams like payment for ecosystem services.

In respect to conformity with Paragraph 172 of the operational Guidelines to the UNESCO Convention, Uganda has no intentions to either change the boundaries of the property or develop major infrastructure related to site management that may negatively impact the property's Outstanding Universal Values, its authenticity and integrity.

Uganda has therefore done everything possible to maintain and protect the Outstanding Universal Values of the property. The water catchment values and integrity of the site are being adequately protected despite the effects of global warming that cannot be fully addressed locally at site level, and the 2020 outbreak of COVID-19 pandemic that negatively affected many programs especially tourism and community conservation activities. Mitigation of a number of activities that have a likelihood of impacting the site have already been outlined. The community relations are good and management issues are being adequately handled. In general terms, the site values, integrity and site protection are all being addressed.

STATE OF CONSERVATION REPORT FOR RWENZORI MOUNATINS NATIONAL PARK (WHS)
December 1, 2022

1. INTRODUCTION

Rwenzori Mountains National Park (RMNP) World Heritage Property (number 684) is located in Uganda along the international border between Uganda and the Democratic Republic of Congo (DRC) in Africa. It was inscribed on the World Heritage list in 1994 as a natural property.

This report covers a period of two years up to November 2022 and gives an account of the key conservation issues (state of conservation) in and around the RMNP since the last report of 2020.

2. ISSUES OF CONCERN AT THE WHC MEETING HELD AT FUZHOU, CHINA IN 2021

Following the Extended Session of the 44th World Heritage Committee (WHC) held at Fuzhou, China in 2021 (virtual meeting), a number of decisions were generated with Decision 44 COM 7B.85 particularly focusing on issues which were documented by the IUCN/ UNESCO reactive mission that formed the basis for the decision of the WHC. The following issues were highlighted under Decision 44 COM 7B.85 for attention by the State Party of Uganda:

i. The need for the State Party to abandon pursuance of the development of the Cable Car in RMNP for its purported impacts on the maintenance of Outstanding Universal Values (OUVs) of Rwenzori Mountains National Park (RMNP).
ii. The need for an action plan for monitoring the elephant population in the property with a view of creating a migratory corridor between RMNP and the other national parks in Uganda.
iii. Noted the development of small-scale hydropower (HEP) projects outside RMNP and requested the State Party to conduct a Strategic Environmental Assessment (SEA) for the Rwenzori water catchment, including RMNP, to assess the indirect and cumulative impacts on the OUVs arising from the existing and planned small-scale run-off-river HEP infrastructures and to ensure that Environmental Impact Assessments (EIA) for any future small scale hydropower development proposed in the catchment of the property, fully assess the potential impacts in relation to the OUV in line with the IUCN World Heritage Advice Note on Environmental Assessment
iv. Notify the World Heritage Centre (WHC) of Uganda's plans to reopen Kilembe Mines and that a detailed EIA be conducted and submitted to the WHC before any irreversible decisions are made.
v. The need for a wildlife monitoring plan to ensure that the Key wildlife species are regularly monitored.
vi. Revise the Tourism Strategy to focus on low impact tourism activities

vii. Continued monitoring of climate change impacts on the OUVs of the property and submit a Disaster Risk Management and Climate Change adaptation plan and have it submitted to the WHC once it is available.

viii. Revise the General Management Plan to fully address the OUV of the property, and ensure coordination with other strategies and studies.

3. RESPONSES TO DECISION 44COM 7B.85 OF THE WH COMMITTEE

Following the visit of the IUCN/WHC reactive mission to RMNP, and recalling DECISION 44COM 7B.85 of the Extended Session of the WHC held at Fuzhou (China), Uganda noted that the reactive mission did not fully understand the landscape around RMNP in respect to community settlements next to the WH property, the location and magnitude/ sizes of the HEP projects in respect to the impacts they may cause to the property and the water catchment values of the Park, the operations and reopening of Kilembe mines, the cable car project idea, revision of the GMP and the conduction of coordinated patrols between RMNP site management and Virunga National Park staff. The Mission had limited time on site and didn't witness some of the issues documented in their report. The following subsections therefore provide feedback and give an account of the situation as is on ground at the property. The subsections have an update on actions which have been undertaken in respect to those that can be implemented and have explainations why some of the provisions of DECISION 44 COM 7B.85 are based on unverified information that is inadequately researched to form basis for a scientific decision of the WH Committee.

3.1. Clarification of issues

a) Conduction of Coordinated patrols with Virunga National Park Staff

The trans-boundary initiatives, mainly coordinated by the Greater Virunga Transboundary Collaboration Secretariat (GVTCS) are still ongoing focusing on field meetings and coordinated patrols. Six (6) coordinated boundary patrols were conducted along the common boundary between RMNP and DRC's Virunga National Park (VNP). Most areas of the Protected Area (PA) along the international border with DRC were patrolled. The patrols covered areas of Mihunga, Langoma, Bukurungu, Kinyamiyeye, Lamia Congo border, Kakubunguka, Mukasimon, Malindi to Kakuka and the north-western spar of the Park. However, insecurity caused by insurgents in the DRC has been a limiting factor on the extent of patrol coverage by the DRC Rangers. The general patrol coverage is demonstrated later on the map under section 3(c) on the implementation of the General Management Plan (GMP). The outbreak of Corona Virus (Covid-19) in 2020 affected some operations both in DRC and Uganda. For example, the quarterly meetings between Uganda and DRC to plan operations and discuss conservation issues at the common border had been suspended and resumed at the beginning of 2022.

b) Establishment of a wildlife migratory corridor between RMNP and other Ugandan National Parks

RMNP in Uganda is contiguous (along its entire Western boundary) with Virunga National Park (VNP) in DRC which allows transboundary movement of wild animals, ensuring the free flow of genes between the two national parks. With this connection between two world heritage sites, the need for establishing migratory corridors is addressed. The establishment of a wildlife migratory corridor within Uganda connecting RMNP to other Protected Areas (PAs) like Queen Elizabeth National Park (QENP), Kibale National Park (KNP) and/or Semuliki National Park (SNP) is not tenable. The land between RMNP and other PAs is heavily settled by communities who have lived in the areas for more than 100 years. Therefore, the resettlement of such communities out of their ancestral land which they have owned and occupied before RMNP was created as a forest reserve/national park and later inscribed a World Heritage Site (WHS) is counterproductive to conservation of the site as it will create animosity between the local community and the property. The local community, mainly the Bakonjo people, who live on the slopes of the Ruwenzori Mountains are mountain people; resettling them away from their ancestral land (around RMNP) will not only affect their social life but also their livelihood, culture and lifespan. it will damage UNESCO's image internationally and will generate a lot of negative publicity for UNESCO. To create, for example, a 10km x 10km will not be enough land to connect the two parks except for the narrowest park which is an entire Municipality. This will have heavy compensatory costs beyond the annual budget of Uganda. A suitable corridor between Queen Elizabeth National Park (QENP) and RMNP will require Uganda to spend its entire 20-year budget on this exercise without spending in other areas of the economy. The State of Uganda, therefore, suggests that this issue be dropped and put to rest and should never be discussed at any forum of the WHC. If information on creation of a corridor between QENP and RMNP through people's land gets to ears of the community, the WHC will have created a problem that may never be solved to mitigate the impact of a such decision on biodiversity.

c) Hydro power (HEP) issues

The small-scale HEP projects are not located within RMNP. There is no interface or common border between the projects and the property. The projects only tap water flowing out of RMNP after its exit and not within the WHS. Before they were established, each of the HEP projects was subjected to a detailed EIA based on which mitigation measures were formulated and are being implemented. Each of the small-scale HEP projects has two (2) or three (3) local people at the dam to manage the infrastructure to ensure that the system is not silted. Their

powerhouses are located between 5 – 10km away from the boundary of the park. The HEP projects are not connected, don't use the same water systems and their impacts on the park are not yet seen. Regarding their impact on the water catchment functioning, the HEP projects use part of the river flow with larger amounts of water left to flow naturally. Moreover, all the water that is channeled through the HEP turbines is rechanneled back in the respective river valleys after about 3 - 5km from the powerhouses. Moreover, almost 95% of the valleys on the Rwenzori mountains have natural running water streams that the community has access to for domestic use. The IUCN/UNESCO monitoring mission didn't review the EIAs of these projects and the mission personnel therefore had limited knowledge because of the limited time they spent on ground. It would therefore be of great value if the WHC also looks at the contribution of these projects to the protection of RMNP. For example, the monitoring activity reports have not reported any detrimental activities but positive impacts have been noted since their establishment through support to construction of anti-poaching infrastructure, employment of local communities to reduce pressure on the park, support to boundary maintenance and replanting of boundary markers and restoration of the mountain slopes, financial support to anti-poaching activities and supply of clean water to the community. Section 5.5.6 below and Annex 1 contain information related to tests conducted to measure the possible of impacts of the HEP projects on the catchment function of the rivers along which the projects are located. The results indicate that the water flowing out of the turbines still have same quality like that flowing immediately out of the park. Therefore, flagging out the HEP mini projects without scientific evidence of significant impacts on the OUV is unscientific and therefore misleading. This condition needs to be dropped.

d) Development of the Disaster Risk Management and Climate Change Adaptation Plan and reconstruction of damaged infrastructure

Following the conclusion of the Extended 44th session of the WH Committee and its attendant decisions, a number of activities have been done to maintain the OUVs of the site. In 2021, Site management was supported by the WHCe with USD. 75,000 for reconstruction of some of the infrastructure which had been destroyed by floods that carried away a number of bridges like Kurt Schaeffer, Mahoma, Kyoho, Buraro and Bujuku. The destruction of the infrastructure triggered the urgent designing of the Disaster Risk Management and Climate Change Adaptation Plan.

Uganda Wildlife Authority (UWA) – Site Management Authority – secured funding to develop a combined Disaster Risk Management and Climate Change Adaptation Plan (DRIMAC). The main objective of DRIMAC is to provide guidance on Climate change and disaster risk management and to provide a framework for stakeholders'

involvement and participation in disaster risk management in the Rwenzori Landscape. Before completion, the draft was shared with IUCN and the WHCe for input. The plan was later finalized and submitted to the WHCe. The DRIMAC was a result of an interactive process that involved various stakeholders. The planning team was composed of representatives from UWA, District Local Government, Non-governmental Organizations (NGO's) operating around RMNP and some community representatives around RMNP. Apart from using interdisciplinary processes, a wide range of consultations were carried out to seek views of various stakeholders as part of the planning process.

Before the DRIMAC was developed, the WHCe supported the site management with USD. 75,000 as contribution towards reconstruction of bridges, trails and ladders that had been damaged by floods. The State of Uganda also earmarked USD. 93,000 as counterpart funding and five (5) bridges – Kurt Shiefer, Buraro, Kyoho, Mahoma and Bujuku were repaired and replaced. The hiking trails with their attendant ladders and walk boards were also repaired/ constructed to protect the most sensitive fragile ecosystems in the mountains.

However, it should be noted that the Action Plan for monitoring key wildlife species and the review of the Tourism Strategy were not done because of the outbreak of COVID-19 which has to date left negative impacts on the revenue stream of the Site Management Authority. A second funding of USD. 30,000 has been approved by the WHCe for the census of chimpanzees and other mammal species within the RMNP World Heritage Site. A funding agreement has now been made and will be signed soon ahead of the disbursement of the money and the census is expected to commence at the beginning of February 2023. The GMP review is awaiting the expiry of the running one before it is renewed and reformulated.

e) The reopening of Kilembe Mines and assessment of impacts of Kilembe Copper Mines and the HEP projects on water quality

The derelict Kilembe Mines are located about 10km away from the boundary of RMNP downstream. Currently, there are no mining activities recorded inside the Park. Kilembe mines closed its operations in the 1970s and since then no mining activities have been operational. During the times when the mines were still active, mining was being done underground and not on the surface and hence had no impact on the then Forest Reserve ecosystem before the Park was gazetted and inscribed on the World Heritage List. We believe that UNESCO wouldn't have inscribed it on the World Heritage list if this threat was there then. To confirm or rule out the fears of the advisory bodies and hence the WHC on the impact of the old mines to the environment, and the impacts of the HEP small-scale projects on

the water quality, water samples were collected recently (December 2021) with a view of assessing the possibility of presence of contaminants, if any, being discharged into the environment and determining the water quality generally. The assessment was done jointly between the HEP project managements, UWA and the Ministry of Water and Environment (MWE) of Uganda on Rivers Nyamwamba, Sindila and Ndugutu **(Annex I).** Whereas R. Nyamwamba (which flows through the old copper mines) was expected to be directly affected by the old mines was considered to be polluted, samples from other rivers remained the control for purposes of comparison of the three water sources. The parameters investigated included conductivity, water velocity, Water temperature, mineral and salt composition and amount of dissolved oxygen in the water. Annex I shows water certificates for rivers Nyamwamba, Sindila and Ndugutu.

The results clearly indicated that there are no significant differences in the parameters of the three major rivers flowing out of RMNP. All the rivers have a low mineral content, implying that there is no mineral contamination for the sites located inside and outside the Property. It is also clear that the water from the old mine tunnels at Kilembe does not impact the mineral composition of water within River Nyamwamba. This, therefore, confirms the fact that the old Kilembe Mines and the newly established HEP projects have no impacts on the catchment functionality of the Rwenzoris. However, the turbidity of water at the Park was low as opposed to outside the park. This implies that the water in Rivers Nyamwamba, Sindila and Ndugutu has fewer particles before it flows out of the park into community areas where it is affected by agricultural activities. This impact is not related to the HEP stations but an effect of community agricultural activities. This is already being addressed through river banks restoration (section 5.4) and UWA will continue work with other agencies and conservation partners to implement the restoration of river banks management to enhance water quality. The fear for pollution of the water bodies of Lake George and Edward that are associated with Virunga National Park as flagged out under DECISION 42 COM 7B.95 has now been confirmed to be unfounded following the tests made in 2019-2020 and 2021. The previous State of Conservation and this report contain two consecutive tests to the effect.

f) Cable car project

One other issue that was documented out of speculation without scientific evidence is that of the cable car. Whereas the State of Uganda only did a prefeasibility study, and has not even commenced a feasibility study over the matter of the cable car, and whereas the state of Uganda has not even identified funds to commence the feasibility study, and whereas there is no data based on

which the WHC made the decision, flagging off this matter as an issue was premature and the decision of the WHC was based on hearsay and should be dropped. The IUCN/WHC mission visited a serene RMNP forest. This matter is fit to be dropped too.

g) Review of the RMNP's Tourism Strategy

The mention of the review of the RMNP's Tourism Strategy to focus on the low impact tourism activities is a good idea that can be taken as advice for future developments but should never be taken as an issue before any development is put in place. Currently the Tourism Strategy provides for the construction of trails, tourism huts made of temporary structures, plus wooded and hanging foot bridges. These structures have a low tourism impact on the site and recommended review seems to be misguided and should be dropped. The protected area authorities will continue to plan and put in place infrastructure of very low to minimal impact. The Site needs substantial funds to save the biodiversity and the proposed low tourism impact infrastructure will be out focus.

h) Other implemented activities include monitoring of climate change impacts, biodiversity surveys, and continued assessment of the impacts of HEP projects. Other strategies have been incorporated into the main body of preceding sections.

i) Lastly but not the least, the GMP for the site is based on a ten-year period and its renewal will only be handled after expiry of such a period. In this case, the RMNP GMP runs up to 2026. The review and renewal will therefore be done at that time. This needs to be noted.

4. OTHER CONSERVATION ISSUES

4.1 The General Management Plan (GMP)

In order to conserve the site's Outstanding Universal values (OUVs), the site management authorities formulated a general management plan (GMP) in 2016 that runs until 2026. The Plan is duly approved by the UWA's Board of Trustees for implementation. The plan was generated through a participatory process that involved all key stakeholders from the Local Community representatives, Local Governments, NGOs, Central Government Agencies, UWA staff and Urban Authorities. Likewise, its implementation is being done jointly by the stakeholders through a number of programmes on which updates are outlined below.

4.2 Resources access for neighboring communities

Rwenzori mountains National park World Heritage Site, is an important source of

resources for communities; especially the "Bakonzo" people who live on the slopes of the mountain. The park authorities have been allowing regulated access to resources to support communilty welfare. Allowable non-timber resources include firewood **(Plate 1)**, smilax, dry bamboo stems, medicinal plant parts, mushrooms, water, honey, fibre and bamboo sheath. During the reporting period, 14 resource access Memoranda of Understanding (MoUs) were renewed and signed to enhance sustainable resource access by the local communities along the Park's front line Parishes **(Table 1)** of Kithobira, Bughalitsa, Bukara, Butyoka, Nsura, Mitandi, Kamabale, Kibwa, Musandama, Nyakatoke, Kakuka, Masule, Mabere and Bumathe. These resources are quantified and valued economically in monitory terms **(Table 2)** using market prices. Therefore, empowering local communities to manage and access selected park resources has stimulated a sense of responsibility, thereby not only boosting their image and status but also improving the relations between the community and the park management. The formation of specific resource user groups has increased the interaction among the resource use group members and helped to appropriately manage group dynamics.

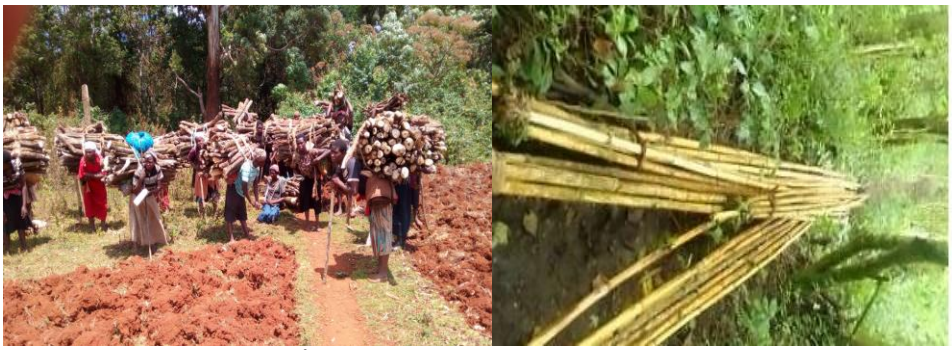


Plate 1: Photos of firewood and bamboo collected from the park

Table 1: resource use MoUs reviewed and signed				
	Parish	**Details**	**Subcounty**	**District**
1	Bumathe	Collaborative Resource Use	Harugale	Bundibugyo
2	Mabere	Collaborative Resource Use And Boundary Mgt	Harugale	Bundibugyo
3	Kakuka	Collaborative Resource Use And Boundary Mgt/ TFP	Sindila	Bundibugyo
4	Masule/Kanyangoma	Collaborative Resource Use And Boundary Mgt	Ngite	Bundibugyo
5	Nyakatoke	Collaborative Resource Use And Boundary Mgt	Nombe	Ntoroko
6	Musandama	Collaborative On Re-Forestry, Ant	Nombe	Ntoroko

		poaching And Coffee Farming		
7	Kibwa	Resource Use And Boundary Management	Karangura	Kabarole
8	Kamabale	Resource Use/Boundary Management	Karangura	Kabarole
9	Mitandi Ward	Resource/Boundary Management	Kyamukube Town Council	Bunyangabu
10	Nsura	Resource Use/Boundary Management	Kyamukube town council	Bunyangabu
11	Butyoka	Resource Use And Boundary Management	Katebwa	Bunyangabu
12	Bukara	Resource use and boundary management	Bukara	bunyangabu
13	Kithobira	Resource use and boundary management	Kitholhu	Kasese
14	Bughalitsa	Resource use and boundary management	Rukooki	Kasese

Table 2: Resource use from RMNP as an equal opportunity for economic gain by the community

Resource Use Harvest					
Years	**Firewood (bundles)**	**Bamboo (bundles)**	**Mushrooms (baskets)**	**Medicinal plants (baskets)**	**Smilax (bundles)**
2019/2020	3724	2407	74	118	301
2020/2021	2446	1760	55	270	438
2021/2022	2046	1015	50	135	150
2022/2023	541	132	25	15	25
Total	**8757**	**5314**	**204**	**538**	**914**
Monitory Value (UGX)	**43,785,000**	**26,570,000**	**2,040,000**	**5,380,000**	**4,570,000**
Monitory Value (USD.)	**11,833.8**	**7,181**	**551**	**1,454**	**1,235**

4.3 Cultural values

Since time immemorial the local community have regarded the Rwenzoris as a repository of many blessings to their socio-economic well-being. As such, the mountains constituted a form of reserve even before the colonial period (Yeoman et al., 1990). The cultural significance of the mountains is demonstrated by traditional rituals performed within

RMNP, including the construction of hunters" shrines for animal sacrifices, ceremonies involving the exorcism of evil spirits, and human burials. There is a belief that if a person dies in the mountains his body is not to be brought home but must be buried where he died. These sites are known by the cultural leaders who have since worked with the park management and other partners to map them out as a basis for their conservation and continued use.

4.4 Collaboration with stakeholders in Park management

In its conservation initiatives, the State party engages local communities and other stakeholders in the conservation of the property. RMNP continues to collaborate with different stakeholders to implement the GMP within the framework of UWA's policy on partnership and mission. Apart from community groups, other key stakeholders include the district local government, Water Management department, cultural institutions, local tourism institutions and other departments of Government

4.5 Community participation in park programmes

The park promotes community participation in management interventions and benefit sharing schemes. These include increased involvement and participation of communities in General management planning and other plans, fire management, boundary management, collaborative sustainable use for Non Timber Forest Products, resource use monitoring.

4.6 Support of community livelihood

The park supports community livelihood through provision of benefits that accrue from conservation such as park resources, sharing 20% of gate entry revenues, ecotourism ventures, training and support of income generating activities initiated by communities. The park has continuously involved local communities in the conservation and tourism activities (*Rwenzori mountaineering services (RMS), Kisamba eco-tourism community group, Ruboni community, Bunyangabu Community Tourism, Rwenzori Action for Tourism Services (RWATS), Katebwa Community Chimpanzee Habituation Association, Kyondo community Tourism, Mt. Gessi eco-tourism group, Nyamughasani Community Tourism Association, Rwenzori Guides and Escorting Association and Turaco Tourism Community Group*) around the site from which they generate revenue.

Four reformed poacher groups comprising of 175 members were supported with 400 (Kenya Top Bar (KTB) hives and trained in bee keeping techniques and apiary management in order to supplement their livelihood. These groups have supported the management of the site to sensitize the communities against illegal resource access, poaching, as well as implementing livelihood projects in the five Districts of Kasese, Bunyangabu, Kabarole, Ntoroko and Bundibugyo. With support from WWF-Uganda Country

Office, 4 reformed poacher groups and 04 youth groups were also supported with livelihood projects to a tune of UGX 61,140,000 (USD 16,524).

Local kitchen	Community participation	Improved energy saving stove under construction
		
Commuity consultation meetings for reviewing resource use MoU and signing		
		

Plate 2: Community training in construction of energy-saving stoves

WWF handover hives	Apiary management	Benefits of resource access
		
		

Plate 3: Community livelihood projects

A total of 05 Collaborative Resource management groups in five districts adjacent to the PA were trained and equipped with knowledge and skills in energy-saving stove technology, efficient sustainable rain water harvesting techniques and woodlot establishment and management. The adoption of construction of fixed energy-saving stoves technology is projected to help resource users to sustainably manage their own resources without exploiting them and reduce pressure exerted on the site for fire wood and ultimately enhancing the conservation of the park. A total number of 50 fixed energy savings stoves were constructed by collaborative resource use groups of **Kibiriri Bee keeping association** in Ndugutu Sub County, Bundibugyo District; **Kisamba Resource use /Boundary management group** in Kasese District; **Kisebere Sibahikwa Boundary/reformed poacher group** in Bunyangabu District; **Mt. Eden Ecotourism group** in Kabarole District and **Nyamugasani Community Conservation and Mountaineering Services group** in Kasese District. With support from the World Bank under the "Investing in Forests and Protected Areas for Climate-mart Development" (IFPA-CD) project, funds totaling to UGX. 72,000,000 (USD 19,459) was received towards training the groups in the aforementioned areas.

4.7 Revenue sharing projects

The revenue sharing guidelines were reviewed in 2022 and approved by the Board of Trustees of UWA to enhance equitable benefit for the communities in the front-line parishes who bare the highest of conservation costs. In the reviewed guidelines, the distribution of funds is dependent on the area population and length of the park boundary with a particular community or area. The guidelines provide for sharing of 20% of park entry fees to the local community through their respective local governments to implement a number of development/livelihood projects. During the last financial year that ended on 30th June 2022, the site management disbursed UGX. 385,780,869 (USD. 104,265) to parishes neighboring the Park for the period July 2019 – June 2021. The funds were released to respective district local governments as shown in table 2 below. A disbursement ceremony was arranged in Kasese Municipality where Uganda's Minister for Tourism, Wildlife and Antiquities was the Chief Guest to issue out the cheques to the various community representatives. The funds have already been remitted to the beneficiary groups through the lower local governments for implementation of the planned and approved projects.

4.8 Human Wildlife Conflicts

In a bid to enhance conservation of the primates (chimps, baboons and monkeys), the community around the property was sensitized about animal behavior and their conservation value. Community members were also mobilized to identify hot-spot areas of incidences of crop-raiding which were mapped and planting of Mauritius Thorn (MT) is being done to mitigate and minimize crop damage by wild animals. However, the Local

Table 3: Revenue Sharing Funds Accumulated: July 2019 To June 2021 Disbursed				DLGs receiving RS cheques
No.	**District**	**Total Amount Per District (Shs)**	**Total In Usd.**	
1.	Kasese	231,865,787	64,407	
2.	Bundibugyo	86,210,534	23,947	
3.	Bunyangabo	39,879,904	11,078	
4.	Kabarore	19,253,818	5,348	
5.	Ntoroko	8,570,826	2,381	
	Total	**385,780,869**	**107,161**	

Government mandated to control vermin does not have capacity to do so. Therefore, Rwenzori Mountains National Park responds to incidences of crop raids by vermin where possible. There is need for the adjacent districts to establish vermin control units, train and deploy staff to respond to such incidences with support from UWA. A pilot program for promoting alternative economic high-value buffer crops such as garlic growing in the frontline parishes was initiated within Katebwa-Kinyampanika parishes in Bunyangabu District **(Plate 4)**. Due to its success, the programme is being extended to Kyambogho, Bunyandiku, Kisamba, Nyakaka and Muhambo parishes (in Kasese District) which are prone to Human-wildlife conflicts. The crop is non-palatable to many primate species and is highly valued for human medicinal properties and as a revenue making stream for the community. Figure 3 below is a pictorial depiction of a garlic crop (left and the Mauritius thorn (right) as interventions against problem animals and vermin.

Plate 4: Problem animal interventions: growing garlic & Mauritius thorn respectively

4.9 Patrols

During the reporting period, routine patrols were done. 242 patrols **(Figure 1)** were conducted in the Financial Year 2021/2022 and an additional 63 conducted in the period of July-September 2022. These resulted in the arrest of 105 suspects involved in illegal activities in and around the park

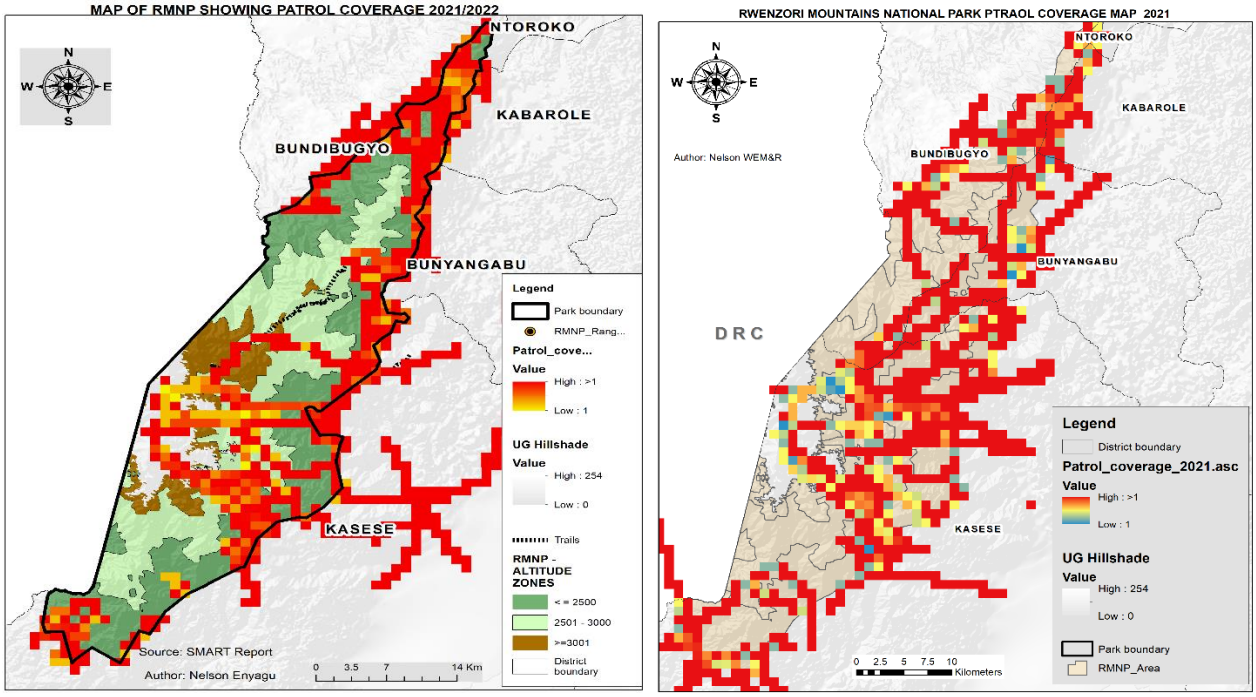


Fig 1: Maps showing patrol coverage

During the period under review, illegal activities were recorded during the patrols and these activities present various threats to the wild animal populations. These illegal activities were mainly encroachment (few incidents of small areas at the park edge), poaching, logging and non-timber forest product collection (honey, firewood, bamboo and charcoal burning). The majority of the incidences of human activity encountered were poaching (90%) using wire snares. The patrol teams also observed 9 incidents of poaching using metal traps which were meant for large animals like the Rwenzori duiker. Poaching signs were observed throughout the park, but were concentrated mainly in the forest area below 3000m.a.s.l which is near the park boundary and thus could easily be accessed by the poachers.

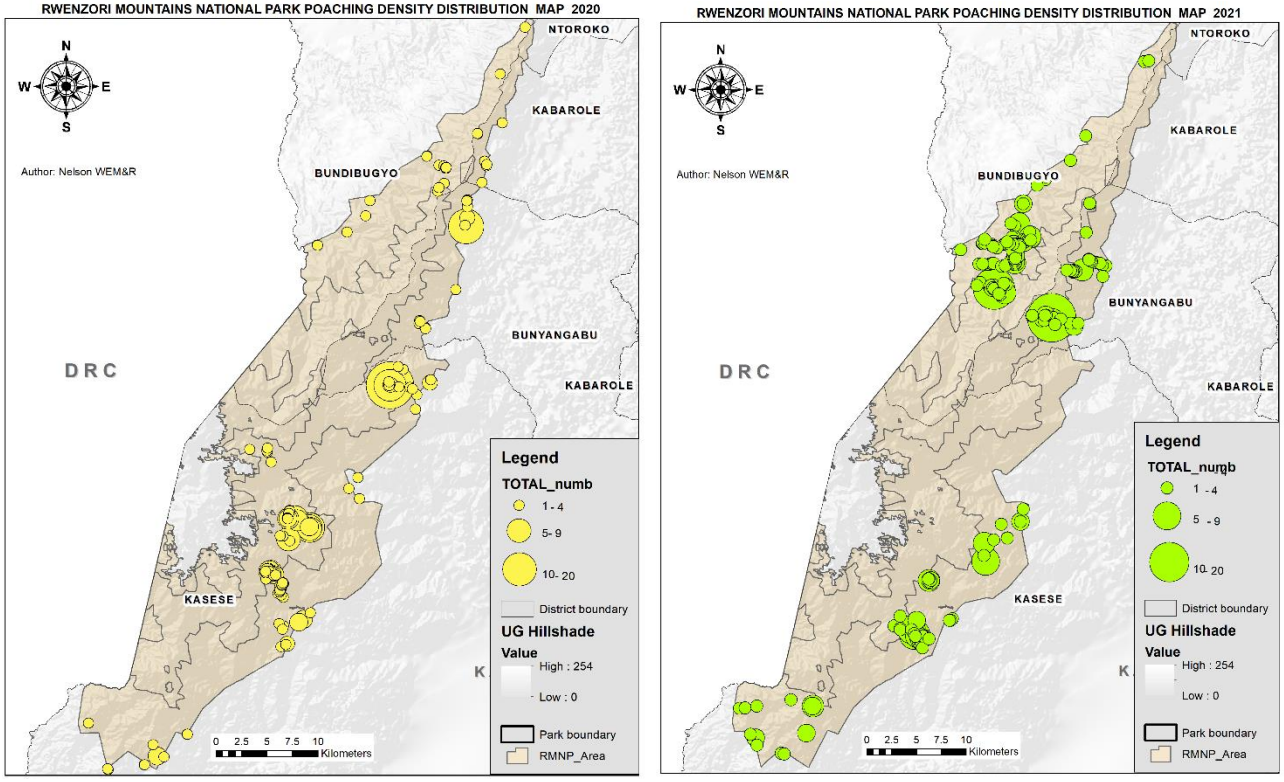


Figure 2: Poaching intensity in 2020 and 2021

4.10 Transboundary collaboration between DRC and Uganda

The trans-boundary initiatives are still on especially field meetings and coordinated patrols. Quarterly meetings are being held between Uganda and DRC to plan operations. The insecurity across in DRC is a limiting factor to the coverage of extended patrols by the DRC Rangers. 2 coordinated boundary patrols were done along the DRCs Virunga National Park. Most areas of the PA along the porous border with DRC were patrolled. The patrols covered areas of Langoma, Bukurungu, Kinyamiyeye, Lamia Congo boader, Kalindera, Kakubunguka, Mukasimon, Malindi to Kakuka the north western spar of the Park.

5. MONITORING ACTIVITIES

5.1 Climate Change and Disasters:

The state, like other countries, is experiencing an increase in the frequency and severity of disasters. The potential losses due to disasters is set to increase as the impact of climate change continues to unfold. Most common hazards with potential for disasters in RMNP are floods, landslides, droughts and wild fires. These have had adverse effects on the communities, the economy, infrastructure and the environment, as well as the

development priorities of the state. During the year 2020, Rwenzori Mountains experienced devastating floods that destroyed most of the tourism infrastructure such as bridges, ladders, boardwalks and tourism trails in the mountain. The state lost very important bridges like Kurt Shefer, Mubuku, Zurangi, Mahoma and the central circuit trail due to floods and landslides. The floods also led to water shortage, loss of lives, property and displacement of communities from their homes. These floods occurred at all the rivers that originated from Rwenzori Mountains such as Lhubiriha, Nyamughasani, Nyamwamba, Mubuku, Rwimi and Lamia.

5.2 Weather monitoring (*Data collection) on weather parameters is continuing*

Weather data is continuously collected on quarterly basis from Automatic weather stations installed at different altitudes to monitor impacts of climate change in the park. The stations provide information on different parameters like temperature, relative humidity, rainfall **(Figure 3)** and wind speed.

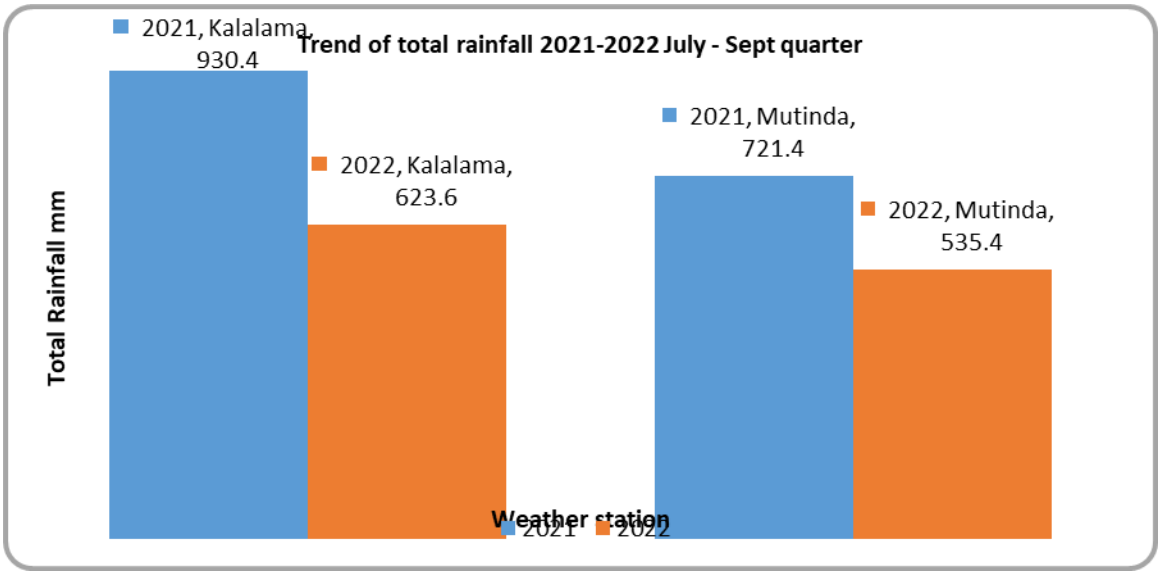


Figure 3: Rainfall patterns for RMNP in 2021 and 2022

5.3 Glacier monitoring

The glaciers are the Rwenzoris most popular tourism attraction and their loss could greatly negatively impact tourism and tourism revenue. The glacier area has reduced significantly **(Table 4)** from 7.5km^2 (1906) to less than 1km^2 (2003). Snow Recession monitoring continued from the three permanent sample plots established on Mt. Stanley, Mt. Speke and Margarita peak. The findings indicate an annual reduction of **2 acres** of glacier with a loss of volume of about **0.6m^3** during the reporting period. RMNP also adopted the use of drone technology in monitoring the glacier as a new technology. An area of 2.8Acres of glacier was mapped in Mt Stanley with a cumulative volume of

33,789.8m^3 measured as baseline information for continuous monitoring of impact of climate change to glaciers on Mt Rwenzori. The melting of glaciers has also resulted into crevasses which are a threat to tourism and infrastructure. Mitigation of climate change continues through tree planting outside the property, construction of elevated infrastructure to ensure that they are not swept away by floods. Site management will be glad learning from other sites on how this challenge (climate change mitigation) is being handled.

Table 4: RMNP glacier recession trends

Years	Available Glacier (Acres)	Reduction (Acres)
2010	304.7	304.7
2018	226.7	78
2019	211.6	15.1
2020	198.5	13.1
2021	183.7	14.8
2022	180.6	2.3

5.4 Climate change mitigation and soil conservation interventions

In recognition of the potential for both small and largescale disasters, Uganda Wildlife Authority, with support from UNESCO developed a Climate Change, Disaster Risk Management Plan for Rwenzori Mountains National Park to ensure that appropriate actions are taken prior, in the event of and after the occurrence of disasters. The plan provides site managers with a set of disaster prevention priorities, guidelines for disaster preparedness, responses, recovery and emergency procedure guidelines. The plan also provides a framework for disaster risk management planning for various sectors as well as for the region, local authorities at local levels. A holistic approach to disaster risk management is now being promoted; aiming to reduce the impacts of and increasing resilience to natural hazards. In addition, with financial support from UNESCO, UWA re-constructed Kurt shiefer Bridge and redesigned the central circuit trail which was destroyed by floods.

Site management, in collaboration with WWF-Uganda Country Office, implemented “A sustainable future for Uganda’s unique World Heritage Project” with financial support from HEMPEL Foundation. The main aim of the project was to build a desired situation where the management of the Rwenzori Mountains National Park is able to protect the

park against climate change and human induced activities like encroachment and poaching. The project focused on sustaining biodiversity, maintaining connectivity between habitats and the functioning of ecosystems in the Greater Virunga Landscape for the benefit of biodiversity and surrounding communities.

The project strengthened RMNP management capacity to restoring critical buffer zones, establishing new Payment for Ecosystem Service (PES) schemes through engaging the private sector in a Payment for Water Services (PWS) and engaging the stake holders and local communities in conservation activities.

The project was implemented in partnership with the National Environment Management Authority (NEMA), Local Government (LG) authorities from all the 5 neighboring Districts and the communities adjacent to the PA. Following this initiative, activities aiming at mitigating the impact of climate change in Rwenzori were initiated. The programme brought on board all water users to support conservation of the water catchment areas through a participatory inclusive community actions and implement catchment –based and community driven activities aimed at improving soil and water conservation in hot spot areas, riverbank restoration **(Plate 5)**, community tree growing on individual farmers' land plots and community livelihood.

Plate 5: River banks protection intervention along Nyamwamba River

A total of 2086 households with 1441 males and 609 females, as well as 36 institutions were mobilised and recruited from 20 villages in Midstream Nyamwamba River valley through awareness-raising meetings and informed-consent process. These individual households and groups of farmers committed a total land of approximately 1600 hectares to undertake catchment management measures in order to mitigate flooding along the river course.

To support communities to implement soil and water conservation measures (Task 1) on priority hotspots in the sub catchment the following milestones were achieved

- Raised awareness of 1420 of the targeted 1000 community members on the advantages of controlling soil erosion/floods through implementation soil and water conservation interventions
- Trained 750 out of the targeted 350 community members in implementation soil and water conservation interventions
- Provided 200 Hoes incl. handles, 200 Spades, 200 Pangas 200 Pick axes 200 Gum boots procured and distributed to farmers youths and women to support establishment of soil and water conservation structures
- 16 ha out of targeted 10 were established to serve as demonstration centres, Green planting of hedge rows and grass strips was also completed to stabilize the strictures last season to complete all the 16 ha of demonstration. However, the planting was followed a severe drought period from June-August that resulted in the drying of the planted hedge rows and grass strips and these deaths are being replaced with the coming of the current September rains
- Establishment of 211 ha out of the targeted 150 ha of soil and water conservation structures were also completed with creation of grey SWC structures and are currently being finalized with green infrastructure by desilting the structures and carrying more planting of hedge rows and grass strips on the bands.

The project also supported communities to restore deforested and degraded communal and individual land through tree growing (afforestation, reforestation, and agroforestry) as follows:

- At total target of 20 Kilometers of river bank was successfully demarcated and restored, the project supported communities to demarcate 10km of one side of river Nyamwamba bank and another 10 km of the opposite side totaling to all the 20 km required by the project. The restored river bank area covered the 30-meter buffer from the highest water mark which was restored by planting 35,000 bamboo seedlings,

2,000 mangoe seedlings, 7,000 *Bathidavia spp*, 20000 *Grevellia spp*, 3,000 *Misopsis eminii*, 4,000 Mahogany and 3,700 *Melia volkensi*

- 1200 farmers were mobilized and recruited to participate in River bank management
- 788 farmers were trained in River bank stabilsation and management.
- 200 hoes incl. handles, 200 Spades 200 Pangas 200 Pick axes 200 Gum boots, 20 hummers, 45 kg of assorted nails, 7019 fencing poles, 54 rolls of barbed wire, 30 gloves were procured and distributed to buffer community farmers and youths to demarcate the river buffer.
- 150 tipper lorries of Euphobia turicari species were procured and planted as live marker/fence on the all the 20 km (10km each side of the river).
- A fencing infrastructure comprising of 2450 fencing posts and 18 rolls of barbered were fixed in critical hotspots along the demarcated buffer line to prevent and protect the planted bamboo and indigenous trees from damage by animals and humans, The project as well supported communities to restore deforested and degraded communal and individual land (Task3) through tree growing in the Chonjojo and Rukoki micro catchment (afforestation, reforestation, and agroforestry).
- 825.7 hectares of the project target for 700 hectares of degraded communal and individual land have been restored through tree growing (afforestation, reforestation, and agroforestry)
- Mobilized and recruited 700 households to engage in tree growing initiatives
- The project supported training of 651 households to engage in tree growing initiatives
- 2085 Hoes incl. handles, 2085 spades, 2085 Pick axes incl. handles have been procured and distributed to 2085 households to engage in tree growing.
- A total of 712,950 assorted seedlings have been procured and have been distributed and planted by farmers
- A total 416.7 hectares were planted in July -September 2022 current planting season. Current assessment of the survival percentage of the trees planted for last planting season (April-May 2022) stands at 75%, others died off due to the severe prolonged droughts that followed during the dry months of June -August 2022. This means that some of these restored / planted areas shall need beating up/infilling and maintenance in subsequent fain seasons in order to maximize restoration benefits and impacts to both communities and the river ecosystem.

5.5 Ecological Monitoring

5.5.1 Procurement of new equipment for ecological monitoring

A detailed ecological monitoring plan for Rwenzori Mountains National Park was developed in 2010 through a consultative and participatory approach with UWA staff and key stakeholders. The monitoring program is currently focusing on the key issues

identified in the plan such as monitoring impact of climate change, human threats, and key wildlife species. Uganda Wildlife Authority (UWA) in collaboration with WWF Uganda Country Office developed RMNP management capacity in the use of Information Technology (IT) to carry out biodiversity monitoring using new technology such as drone **(Plate 6)**, SMART, Geographical Information System (GIS) and remote sensing. 20 Camera traps, 1 high quality drone, 9 SMART phones, 10 solar panels were procured for the property management for ecological monitoring. Currently RMNP is using advanced SMART 6.3 version and Planning to upgrade it to SMART connect 7.5.3 version.

Plate 6: Staff capacity building on use of Drone technology

5.5.2 Impacts of climate change on distribution of large mammals

Site Management Staff continued to monitor animal distribution within the site using Ranger based data collection approach during patrols and camera traps. Special monitoring program of Elephants, chimpanzees and other species was also done in the specific areas of Mahoma ridge, Nyabitaba, River Mubuku and Peripe during the reporting period of 2022. The result indicates that most of the animals are found in the forest zone more especially the primates- Chimps and monkeys. 5 Elephants were observed around mahoma ridge, Rwenzori Duikers and Rock hyrax were found even up to the alpine zone. Elephant distribution was also seen to be limited to the forest zone and localized to the central zone of the Park, between Lake Mahoma, Nyabitaba and River Mubuku down to the Park boundary in Mihunga. Generally, there is not yet significant impact of climate change noticed on mammals.

5.5.3 Vegetation monitoring:

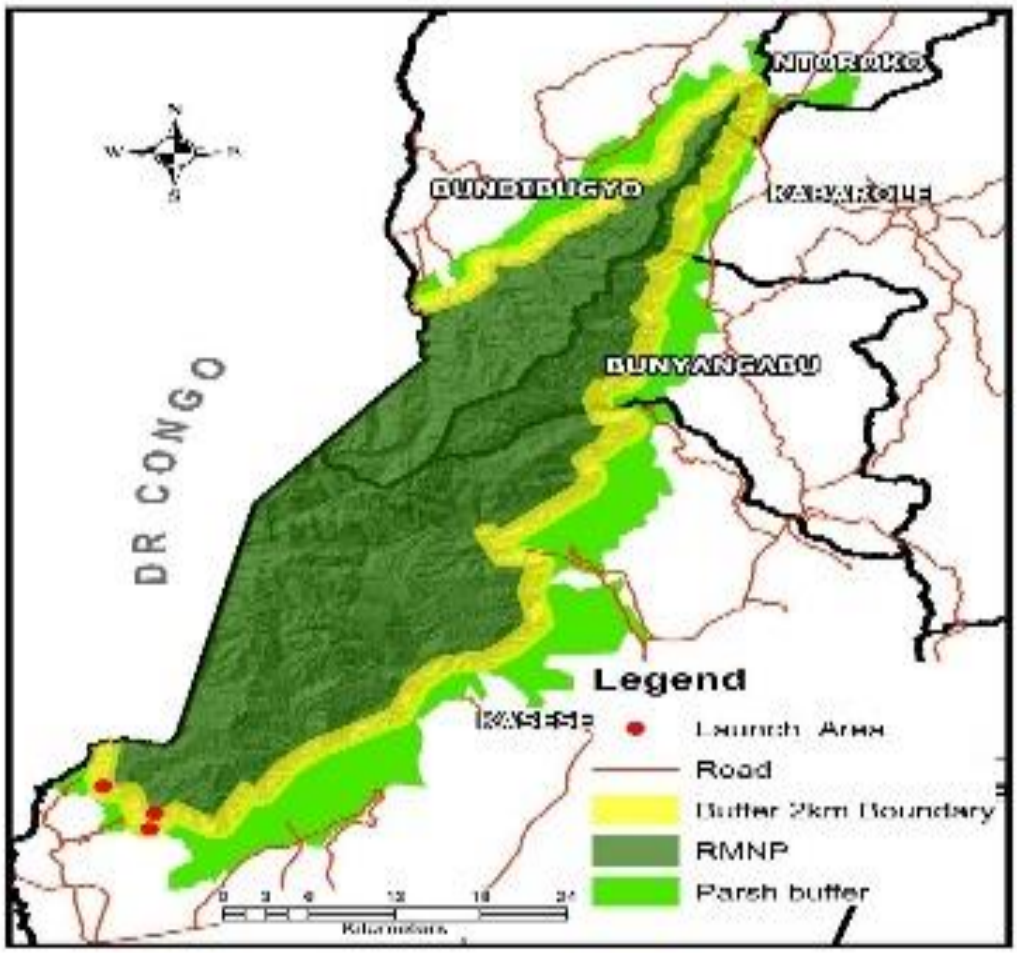
During the reporting period, vegetation monitoring was done in the bamboo and forest zone of the PA with a focus on key plant species (Mahogany Kayah, *Podocapus, Prunus africana,* bamboo). Site Management staff noted that there were no significant changes in the vegetation zones. Site management will continue to monitor the site for any

vegetation changes resulting from global warming. A separate vegetation survey report is hereto attached as **Annex II.**

5.5.4 Buffer zone identification and mapping

The site management also mapped the buffer zone of 2km along the entire park boundary in the districts of Kasese, Bunyangabu, Kabarole, Ntoroko and Bundibugyo. This was done using remote sensing and Matrice 300 RTK Drone technologies to generate the spatial data maps. A total area of 308km^2, at a 2km swath (0.5km inside the park and 1.5km on private land) within a geographic scope, was realized. This serves as the basis for restoration work that is ongoing in the area identified as buffer zone **(Figure 4).**

Figure 4: buffer zone map for RMNP



5.5.6 Water catchment and water Quality Monitoring:

RMNP's noble conservation value is its role as a water catchment site. A number of glacial lakes exist in the alpine zone, and a multiple of rivers originate from the mountain to feed important life supporting activities (agricultural irrigation, domestic use, mini-hydro power generation, and industrial use) in the plains occupied by millions of people, industries and national parks. The Mountains are a key source of water that contributes to the Nile River as it flows to Sudan and Egypt. Water quality is monitored using a bio-monitoring approach. Bio-monitoring activities are conducted on the five main rivers of Nyamughasani, Nyamwamba, Mubuku, Rwimi, Ndughutu and Sindila. **Annex 1** has a set of analytical results that confirm RMNP's ability as a source of clean and quality water.

5.5.7 Wildlife Monitoring and 2021 census exercise

The site management continued to monitor animal distribution within the site using Ranger Based Data (RBD) collection approaches and camera trap method during the period. Specific monitoring programs for elephants, chimpanzees, Rwenzori duikers and Rwenzori leopard were also implemented. The results indicate that most of the primates and elephants are found in the forest zone, while Rwenzori duikers are common in the Alpine zone.

Elephants were observed around Mahoma ridge, Rwenzori duikers and rock hyrax were encountered in the alpine zone. Elephant distribution was also seen to be limited to the forest zone and localized to the central zone of the Park, between Lake Mahoma, Nyabitaba tourist camp and River Mubuku down to the Park boundary in Mihunga. **Plate 7** below contains photos for some of the rare sightings made during the reporting period. WWF-UCO, with funding from HEMPEL Foundation, supported Uganda Wildlife Authority to conduct the census for the key animal species (Chimpanzee, elephants, Rwenzori duikers and Rwenzori leopards) in the 2020/2021 **(Annex III)**. The census was done by UWA staff after gaining skills from the training conducted by WWF in biodiversity survey techniques. Results indicate that RMNP could be hosting 6,109 individuals of Black and White Colobus monkey, 576 Chimpanzees, 25,832 Blue Monkeys, 7 elephants and 7,877 Red duikers. Through direct observation, the monitoring teams were able to directly sight and count the following individuals **(Table 5)**:

Plate 7: photos of animals sighted inside the Park

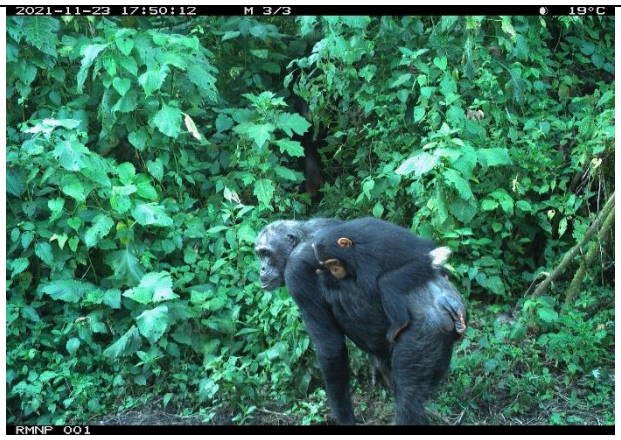
Elephant	Chimpanzee
	
Rwenzori Duiker	Blue monkey
	

Table.5: wildlife direct observation during monitoring

Observation	Count	Sum
Blue monkey	68	386
Chimp	61	173
Rwenzori duiker	29	50
Black & White Colobus monkey	18	157
Rock hyrax	10	16
Tree Squirrel	9	10
Bush pig	7	15
Red Tailed Monkey	4	12
L'hoesti monkey	2	2
Elephant	1	1
Giant forest hog	1	1

The animal census focused on key species in the Park (Chimpanzees, Elephants, Rwenzori duikers, Leopards, Lo'hest monkey and other primates) using Line transects and Camera trap method. Past wildlife surveys in Rwenzori focused on specific taxa or areas, but the last species census covered the entire protected area and evaluated the intensity of sampling required to determine the population change. Using line transect sampling and camera trap method, we found that the distribution of medium to large mammals was nonrandom but related to habitat-type. Population estimates revealed that much more intensive sampling was required to detect changes in population density since it was the first of its kind to be conducted in the entire protected area. A summary of results of this census exercise is shown below in table **Table 6**.

Table.6: Summary of animal census results

Animal Species	Density	95% Confidence		Est. Population	95% Confidence	
		Lower CL	Upper CL		Lower CL	Upper CL
Black and White Colobus (*Colobus guereza)*	9.5	5.0	18.1	6,109	3,220	11,589
Chimpanzees (*Pan troglodytes*)	0.90	0.6	1.5	576	353	938
Blue monkey (*Cercopithecus mitis)*	40.25	28.4	57.0	25,832	18,247	36,571
Rwenzori Duiker (Cephalophus rubidus)	12.27	7.0	21.5	7,877	4,488	13,823
Elephants (Loxodonta cyclotis)	DD	DD	DD	7	5	10
Rwenzori Leopard	DD	DD	DD	DD	DD	DD

DD: Data deficient and could not be included in the analysis

7.0 Fire management

Fire is identified as a potential threat to the park' delicate ecosystems. In the pasts, wild fires were relatively few within RMNP because of the ever-green vegetation. However, due to climate change conditions, fire incidents started increasing; the worst being the 2012 fire that burnt a big patch of the park. Most of the fires are set by the community close to the park boundary while preparing their gardens for planting, or poachers activities and honey collectors. These fires cause damage to ecosystem properties and leave negative impacts on the fragile mountain ecosystem hence calling for urgent and concerted efforts to prevent them.

In a bid to ensure that the illegal fires are controlled, a fire management plan was developed for 2017 - 2021. With guidance from the Fire Management Plan, site management applied various strategies to control and fight fires in and outside the protected area to minimize negative impacts. Strategies implemented included community sensitization and mobilization using media in firefighting techniques, opening and maintaining of external fire lines to stop fire spread from community land to the site **(Plate 8)**, Media sensitization and meetings. The PA also adapted the use of Global Forest Watcher system to monitor the fire outbreak in the PA this is in addition to communities who help to report any fire sighted in the Park from their areas. Rangers are now able to use "global forest watch" to detect deforestation and fire incidents in and around the PA. The rangers can now also fly the drone to survey, monitor and/or map areas of interest in the PA.

Plat 8: External fire lines on community land to deter fire spread into the Park

During the period, the PA management implemented fire management plan activities as follows:

Community sensitization meetings are conducted in the Park adjacent villages to prepare communities to control and report any fire that may occur in their area of jurisdiction. Fire-fighting crews were formed from the community villages bordering the Park and these were helpful in extinguishing fire in the gardens before it caused damage to the World Heritage property. The frontline mobilized community (boundary management committees and Resources use committee) and equally cultural Institutions have been instrumental in fire awareness campaigns.

Meanwhile, monitoring of the regeneration process in the earlier reported burnt areas within the Nyamwamba valley was done. The areas that were affected by fire inside the Park are recovering steadily with sighting of wild game especially the Rwenzori duiker. Field observations show a rapid regeneration of grass, *Alchamellan spp* shrubs, in most of the burnt areas.

8.0 Infrastructure development on the site

To improve visitor enjoyment, experience, safety and satisfaction, tourism infrastructure improvements have been done at the various places along the tourism trails. As mentioned earlier, 5 bridges were reconstructed **(Plate 9)**. **Plates 10 -11** are photos of improved tourism infrastructure along the central tourist circuit that include a completed 6 roomed dormitory, visitor dining hall and two self-contained bandas at Nyabitaba camp are complete. 01 water borne toilet on Kilembe trail is under construction **(Plate 12)** and repairs on Mahoma Lake toilet was also completed. A number of Boardwalks and ladders were installed and the central circuit trail redesigned. A full report on these developments was sent to the WHC following the WHC's support of USD. 75,000. Campsites at Lamia and Alfarosis trail along Bukurungu trail were constructed as well. Two new trails (Katebwa Chimpanzee Trail) was established and opened for tourism starting from Bunyangabu District in the areas of Katebwa. This was done with support from WWF under sustainable financing for the RMNP. Bughalitsa and Rubiliha trails were opened and 1 survey was done on Bunyandiku on Kilembe side for the trail. In the offing is the construction of accommodation facilities at Elena with support from Government of Uganda.

Plate 9: Kurt Sheiffer bridge reconstruction completed


Plate 10: 2 Self contained rooms and 6 roomed visitors dormitory at Nyabitaba


Plate 11: Double banda and Dinning facility at Nyabitaba camp


Plate 12: Water borne toilet under construction at Kilembe Gate

9.0 Tourism

During the reporting period, the Site received a total number of 1,151 tourists in 2020 and 717 in 2021. The number was low and decreased in 2021 due to Covid-19 pandemic which caused global lockdowns in different countries. After ending the lock downs, the tourists started trickling in and number has since been on the rise registering 1,944 visitors (including the King of Tooro) from January - October 2022. Efforts are in place to market the property locally and globally as well as continue to improve tourism infrastructure to attract more tourists. A number of celebrities and athletes have so far visited the property (Cheptegei, Executive Director of Uganda Tourism board and Ambassadors of EU, German and France) which will go a long way in increasing visibility of the park.

10.0 Monitoring of Hydro-power facilities Operations

Monitoring the implementation of mitigation measures identified in the EIAs for the HEP projects is being done at all the hydro power sites to ensure that the likely negative impacts of hydropower to the property ecosystem are contained. In the neighborhood of Nyamughasani, Nyamwamba, Ndugutu and Sindila **(Plate 13)**, new ranger outposts have been established to ensure presence of staff on site for patrol purposes and daily monitoring of HEP activities. It should be noted that none of the HEP projects are located within the boundaries of the property but outside the park. The WH property is located above the HEP project sites and no negative impacts arising from the operations of the HEP facilities have been noticed or experienced within the boundaries of the World Heritage Property. The positive contributions so far noticed are recorded under **Table 7** below.

Plate 13: UWA Staff accommodation constructed by Sindila and Ndugutu HEP

Table 7: Positive contributions by the HEP projects to OUV conservation in RMNP

No.	Hydro power project	Contributions to conservation
01	Sindila and Ndugutu hydro power projects	• Signed an MoU with UWA to support the conservation activities of RMNP • Procured land for RMNP ranger post at Sindila • Constructed and equipped 6-unit ranger post at Sindila • Supported RMNP to maintain and re-enforce 6km of park boundary with live markers in Kaghugu and Sindila areas • Funded the renewal of resource use MoU for Khaghugu parish • Supported the monitoring patrols of Sindila/ Ndugutu catchment area with food and allowances • Supported conduction of surveillance for illegal activity in the areas adjacent to the HEP project • Supported the assessment of water quality of River Sindila and Ndugutu
02	Frontier Energy LTD (Nyamughasani hydro power, Rwenzori Hydro power and Kakaka hydro power projects	• Signed an MoU with UWA to support the conservation activities of RMNP • Constructed and equipped 6unit ranger post at Kyondo • Supported conduction of surveillance for illegal activity in the areas adjacent to the HEP project • Support to construction of another 6-unit ranger post construction in Mbaata - Kasese
03	Nyamwamba Hydro power 1 and 2 projects	• Supported the assessment of water quality in River Nyamwamba • Established early warning system at Kalalama and Mitinda for floods • Established and supported the monitoring of water level gauge at River Nyamwamba • Supported the de-siltation and restoration of Nyamwamba river banks

11.0 OTHER CONSERVATION ISSUES THAT MAY IMPACT THE SITE'S OUTSTANDING UNIVERSAL VALUES

11.1 Financial sustainability

Lack of resources may impact negatively the maintenance of the Outstanding Universal values of the site. Currently, the property is just recovering from the effects of COVID-19 and therefore does not generate adequate revenue to cover all its operating costs. The organization has been keen on the use of financial management systems in order to bring about efficiency and better finance management. However, more resources are needed to support the site in order to implement various conservation activities. To that note, the site has been carrying out fundraising drives through proposal writing and sharing them with different partners. The site is also exploring the Payment for Ecosystem Services (PES) approach in regard to organizations /companies that use the river water from the park for production activities. Such companies will be asked to contribute financially to the conservation of the catchment.

11.2 **Human Population**

The property is surrounded by an increasing human population that is feared for pressure on the park resources. Management has already clearly marked the park boundaries to eliminate possible encroachment on the park. Patrol efforts have been stepped up with patrol posts well distributed along the property boundary to ensure that continuous monitoring of the site is achieved on a daily basis. The site management has also engaged the communities in various awareness, conservation and restoration activities including soil and water conservation, tree planting and river banks management. The site also has a fully-fledged community conservation unit that interfaces with the communities in ensuring good relations between Site Management and the community. Various community projects have been supported and implemented at household level in order to improve livelihoods and reduce pressure from the park. WWF/Hempel project and the Government's World Bank – IFPA project support have continued to commit funds to support the site in areas of collaborative resource management targeting mainly the boundary management committees, resource use and reformed poacher groups. Site management has engaged the community through negotiating multiple resources access agreements that regulate resource access as a means of avoiding over exploitation of the non-timber resources. Woodlots, water harvesting techniques and construction of energy saving stoves are also being encouraged and some of the community members have started implementing these interventions. Meanwhile, family planning strategies are being enforced by the Ministry of Health to ensure birth control.

11.3 Wild fires

A Fire Management Plan was developed and is being implemented. The implementation is participatory with communities, cultural institutions and local government as key stakeholders. The measures being taken are already mentioned under section 3 above.

11.4 Increasing Human Population

The property is surrounded by a buffer area with increasing human population capable of putting a lot of pressure on the park resources. Management has already clearly marked the park boundaries to eliminate possible encroachment of the park. Patrol efforts have been stepped up with patrol posts well distributed along the property boundary to ensure that continuous monitoring of the site is achieved on a daily basis. Site management has also engaged the community in various awareness and restoration activities including soil conservation, tree planting and river banks management. We also have a fully-fledged community conservation unit that interfaces with the communities in ensuring good relations between Site Management and the community. We have further commenced livelihood enhancement projects that are anticipated to divert community pressure from the park. A number of projects are now being funded by UWA at household/ community level for this purpose and more funds have been committed within the 2022/2023 financial year with support from partners to continue with these efforts. The site

management has engaged the community through negotiating multiple resources access agreements that regulate resource access as a means of avoiding over exploitation of the non-timber resources. Woodlot establishment on community land are also being encouraged and some of the community members have started implementing this intervention. Meanwhile, family planning strategies are being enforced by the Ministry of Health to encourage people to bear children whom they can ably support.

12.0 INFORMATION IN COMFORMITY WITH PARAGRAPH 172 OF THE OPERATIONAL GUIDELINES TO THE UNESCO CONVENTION

This section is intended to cover information related to potential major restoration programs, new major constructions within the boundaries or buffer areas where such developments may affect the Outstanding universal values of the Property, its authenticity and integrity. Uganda has no intentions to either change the boundaries of the property or develop major infrastructure related to site management that may negatively impact the property's Outstanding Universal Values, its authenticity and integrity. The boundaries have been entirely marked and Uganda continues to uphold protection of the site as a World Heritage Site and Ramsar site.

13.0 CONCLUSION

Uganda has done everything possible to maintain and protect the Outstanding Universal Values of the property. The water catchment values and integrity of the site are being adequately protected despite the effects of global warming that cannot be fully addressed locally at site level and the recent outbreak of COVID-19 which have negatively continued affecting community conservation and tourism activities. Mitigation measures on a number of areas that have a likelihood of impacting the site have already been outlined. The community relations are good and management issues are adequately being handled. In general terms, the site values, integrity and site protection are all being addressed.

Signed

John Makombo
FOR EXECUTIVE DIRECTOR - UWA

Annex 1: Water quality monitoring Certificates for Nyamwamba, Ndugutu and Sindila Rivers

Republic of Uganda

MINISTRY OF WATER AND ENVIRONMENT
NATIONAL WATER QUALITY REFERENCE LABORATORY - ENTEBBE

Certificate of Analysis

Client Name : Mpanga Hydro Power Uganda Limited
Client Address : Kampala
Sample Location :Surface water from R Nyamwamba Upstream and down streamof weir
Sampled by : Client
Date received :13th December 2021
Analysis start date :13th December 2021
Analysis Completion date :23rd December 2021

TEST RESULTS

Source Name	Units	R.Nyamwamba Upstream of Weir	R.Nyamwamba Downstream of Weir	Drinking water standards (DEAS12:2018 Maximum permisible for Natural potable Water)
District		Kasese	Kasese	
Lab Identifier code		E51627	E51628	
pH	units	5.9	5.8	5.5-9.5
Electrical Conductivity	µS/cm	22	23	2500
Total disolved Solids	mg/l	15	16	1500
Chemical Oxgyen Demand	mg/l	65	65	
Oil and Grease	mg/l	<0.5	<0.5	

Notes;

- Samples are analyzed on as received basis.
- The client does bear sampling responsibility as to the representative characters of the sample delivered.
- Results are therefore based on the sample delivered and analyzed.
- mg/l-stands for milligrams per liter

Checked by

LABORATORY MANAGER
NWQRL 23 DEC 2021 NWQRL
NATIONAL WATER QUALITY REFERENCE LABORATORY - ENTEBBE

003536

Issued by

PRINCIPAL ANALYST LABORATORIES
★ 23 DEC 2021 ★
NATIONAL WATER QUALITY REFERENCE LABORATORY – ENTEBBE
Sign.....

Water Quality Management Department
Directorate of Water Resources Management
Waterquality.laboratory@mwe.go.ug
Plot 17,John Babiha Road, Entebbe
Tel: 041-321342

Republic of Uganda

MINISTRY OF WATER AND ENVIRONMENT
NATIONAL WATER QUALITY REFERENCE LABORATORY - ENTEBBE

Certificate of Analysis

Client Name	: Mpanga Hydro Power Uganda Limited
Client Address	: Kampala
Sample Location	:Portable water from Project water from project office
Sampled by	: Client
Date received	:13th December 2021
Analysis start date	:13th December 2021
Analysis Completion date	:23rd December 2021

TEST RESULTS

Source Name	Units	Portable drinking water from project office	Drinking water standards (DEAS12:2018 Maximum permisible for Natural potable Water)
District		Kasese	
Lab Identifier code		E51634	
pH	units	6.6	5.5-9.5
Electrical Conductivity	µS/cm	67	2500
Total disolved Solids	mg/l	47	1500
Chemical Oxgyen Demand	mg/l	<5	
Oil and Grease	mg/l	<0.5	

Notes;

- Samples are analyzed on as received basis.
- The client does bear sampling responsibility as to the representative characters of the sample delivered.
- Results are therefore based on the sample delivered and analyzed.
- mg/l-stands for milligrams per liter

Checked by

LABORATORY MANAGER
NWQRL 23 DEC 2021 NWQRL
NATIONAL WATER QUALITY REFERENCE LABORATORY -ENTEBBE

009585

Issued by

PRINCIPAL ANALYST LABORATORIES
★ 23 DEC 2021 ★
NATIONAL WATER QUALITY REFERENCE LABORATORY -ENTEBBE
Sign:.....

Water Quality Management Department
Directorate of Water Resources Management
Waterquality.laboratory@mwe.go.ug
Plot 17,John Babiha Road, Entebbe
Tel: 041-321342

NATIONAL WATER & SEWERAGE CORPORATION

CENTRAL LABORATORY- Plot M11, Old Portbell Rd, Bugolobi

P.O BOX 7053 KAMPALA, Email: external.services@nwsc.co.ug

CERTIFICATE OF ANALYSIS

Client: SINDILA HYDRO CONSTRUCTION LIMITED
Address: Bundibugyo, Uganda.
Sample Description: River Ndugutu- Above Weir
Sample Received Date: 07.12.2021
Sampled By: Client's Staff
Sample Number : 50/3657/2021/C/B

Document No: NWSC/WQ/QF/21.2A
Invoice No:131/INV/2021/1028_QUO

Parameters	Units	Test Results	National Standards for Waste Water	Test Method
Alkalinity: Total	mg/L	60	800	APHA - 2320B
Ammonia-N	mg/L	0.19	10	Hach 8038
B.O.D	mg/L	20.19	50	APHA-5210-B
Bact: Escherichia coli	CFU/100mL	0	Not Specified	Colilert – 18
Bact: Faecal coliforms	CFU/100mL	0	5000	Colilert – 18
Chloride	mg/L	10	500	Hach 8206
Dissolved Oxygen (DO)	mg/L	6.66	>2	APHA-4500-O-C
Electrical Conductivity (EC)	uS/cm	105.4	1500	APHA-2510
Fat, Oil & Grease (FOG)	mg/L	0.68	10	APHA-5210-B
Fluoride	mg/L	0.10	Not specified	Hach 8029
Hardness: Total	mg/L	42	Not Specified	APHA-2340C
Iron:Total	mg/L	0.115	10	APHA-3111A
Nitrate-N	mg/L	0.00	20	Hach 8192
Ortho-Phosphate: Reactive	mg/L	0.635	5	APHA-4500-P- E
pH (Physical-Chemical)	--	7.823	6.0-8.0	APHA- 4500-H+ B
Sulphate	mg/L	2	500	Hach 8051
Temperature	0C	25	20-35	APHA-2550B
Total Dissolved Solids (TDS)	mg/L	67.456	1200	APHA-2540C
Total Suspended Solids (TSS)	mg/L	0	100	APHA-2540D
Turbidity	NTU	2.97	300	HACH 8195

Remarks:

Biology :The sample tested showed complying bacteriological characteristics as provided for by the National Standards for Effluent Discharge.

Chemistry :The water sample tested showed complying physiochemical characteristics as provided for by the National Standards for Effluent Discharge.

AUTHORISED BY: Manager Central Labaratory Services.....

APPROVED BY: Senior Manager - Water Quality Management .....

NATIONAL WATER & SEWERAGE CORPORATION
ES
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Tel:+256631315111 / 715
Email:external.services@nwsc.co.ug
REF. NO.: 0021/1028
SIGN:
DATE: 07/12/2021
EXTERNAL SERVICES

NATIONAL WATER & SEWERAGE CORPORATION

CENTRAL LABORATORY- Plot M11, Old Portbell Rd, Bugolobi

P.O BOX 7053 KAMPALA, Email: external.services@nwsc.co.ug

CERTIFICATE OF ANALYSIS

Client: SINDILA HYDRO CONSTRUCTION LIMITED
Address: Bundibugyo, Uganda.
Sample Description: River Sindila- Above Weir
Sample Received Date: 07.12.2021
Sampled By: Client's Staff
Sample Number : 50/3660/2021/C/B

Document No: NWSC/WQ/QF/21.2A
Invoice No:131/INV/2021/1028_QUO

Parameters	Units	Test Results	National Standards for Waste Water	Test Method
Alkalinity: Total	mg/L	44	800	APHA - 2320B
Ammonia-N	mg/L	0.18	10	Hach 8038
B.O.D	mg/L	19.47	50	APHA-5210-B
Bact: Escherichia coli	CFU/100mL	0	Not Specified	Colilert – 18
Bact: Faecal coliforms	CFU/100mL	0	5000	Colilert – 18
Chloride	mg/L	13	500	Hach 8206
Dissolved Oxygen (DO)	mg/L	6.63	>2	APHA-4500-O-C
Electrical Conductivity (EC)	uS/cm	95.9	1500	APHA-2510
Fat, Oil & Grease (FOG)	mg/L	0.99	10	APHA-5210-B
Fluoride	mg/L	0.20	Not specified	Hach 8029
Hardness: Total	mg/L	48	Not Specified	APHA-2340C
Iron:Total	mg/L	0.172	10	APHA-3111A
Nitrate-N	mg/L	0.01	20	Hach 8192
Ortho-Phosphate: Reactive	mg/L	0.5	5	APHA-4500-P- E
pH (Physical-Chemical)	--	7.764	6.0-8.0	APHA- 4500-H+ B
Sulphate	mg/L	1	500	Hach 8051
Temperature	0C	25	20-35	APHA-2550B
Total Dissolved Solids (TDS)	mg/L	61.376	1200	APHA-2540C
Total Suspended Solids (TSS)	mg/L	0	100	APHA-2540D
Turbidity	NTU	1.83	300	HACH 8195

Remarks:

Biology :The sample tested showed complying bacteriological characteristics as provided for by the National Standards for Effluent Discharge.

Chemistry :The water sample tested showed complying physiochemical characteristics as provided for by the National Standards for Effluent Discharge.

AUTHORISED BY: Manager Central Labaratory Services.....

APPROVED BY: Senior Manager - Water Quality Management .....

NATIONAL WATER & SEWERAGE CORPORATION ES P.o. Box 7053,Kampala,Uganda Tel:+256(0)3331911/1715 Email:external.services@nwsc.co.ug REF. NO.: SIGN.: DATE: EXTERNAL SERVICES

RWENZORI MOUNTAINS NATIONAL PARK

"A WORLD HERITAGE SITE"

ANIMAL SURVEY PROGRESS REPORT

SUBMITED TO

World Wildlife Fund (WWF – UCO)

By:

Nelson Enyagu
Warden Ecological Monitoring and Research
Email: nelsonenyagu37@gmail.com.

Thru: Senior Warden Incharge – RMNP
May/ 2021

SENIOR WARDEN IN-CHARGE
RWENZORI MOUNTAINS
NATIONAL PARK
A WORLD HERITAGE SITE
UWA

TABLE OF CONTENTS

1. INTRODUCTION

Rwenzori Mountains National Park undertook animal survey for keystone species using line transect DISTANCE method and Camera Trap method as approved as approved by WWF and UWA. This is to help generate scientific information on the presence, absence, distribution, populatin and abundance of keystone species in RMNP. Data on the population of key animal species is lacking to inform management decision making during the implementation of biodiversity conservation for Rwenzori Mountains National Park. Information on the state of biodiversity in terms of species, distribution, abundance, number and movement pattern is lacking thus, need to carry out survey in RMNP to generate scientific information for management planning and decision making. It is against the above challenges that WWF funded the biodiversity survey of these keystone species in RMNP

The first stage of animal survey started with capacity building of UWA staff and 30 staff were trained in animal survey technique using line transect and camera trap methodology.

The second stage of transect was also completed and 68 line transect measuring 2km each was done during the first face of animal survey. During this second face of animal survey, the survey team walked 68 line transects to collect data on animals, reptiles and threats observed along transects. The team also set and downloaded 38 camera traps for animal survey in the field that lasted for 30days each before downloading. This was done in line with the survey methodology agreed upon by both parties.

2. OVERALL OBJECTIVE

To generate scientific information on existing rare, threatened, endangered and endemic animal species for management use to enhance the conservation of Rwenzori Mountains National Park, “a World Heritage Site” with its outstanding Universal Values.

3. SPECIFIC OBJECTIVES

1. To Collect data that will form baseline information on key stone animal species and threats affecting the conservation of Outstanding Universal Values.
2. To deploy 38 camera traps in the field for data capture of animal species present in RMNP
3. Develop UWA staff capacity on biodiversity survey to under take animal survey in RMNP.

1. METHODOLOGY

The survey was done using two methods and this were

1. Line transects method using DISTANCE program.
2. Camera trap method using ground cameras and Arboreal settings

During the survey, 8 teams were formed and deployed to collect data from the line transects established and cleared and sett camera traps for animal survey. Each team was availed with survey equipments such as GPS, data sheets, SMART phones, pangas, clipboards, ribbons, tape measure, ropes, pencils, touch, spares GPS batteries, tapeline, umbrella, back pack to use in the field. Communities were recruited to provide labour of carrying luggage and preparing food for the survey team in the field during the survey.

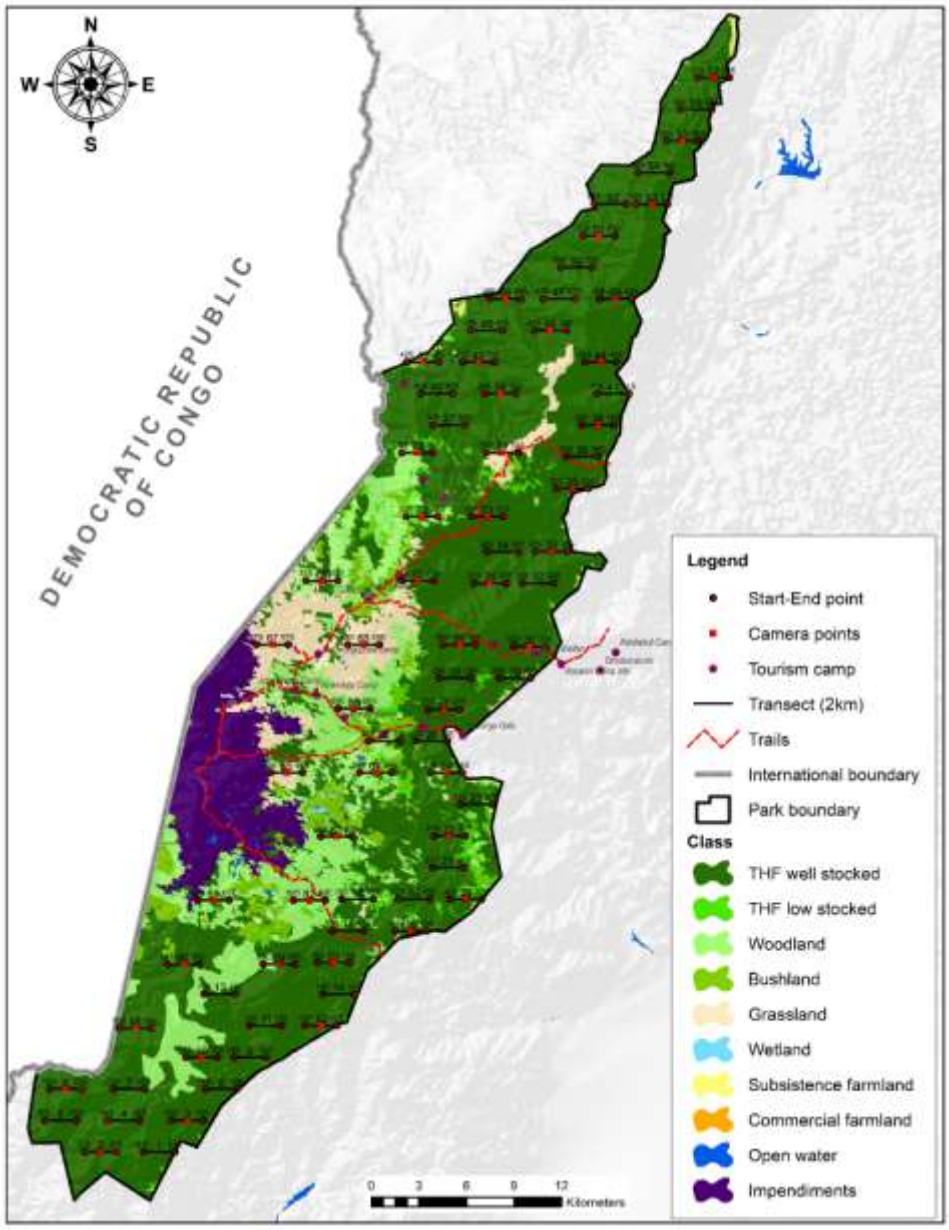
4.1 Line Transect Survey design

RMNP area was stratified into three altitudinal zones ranging from 1600m – 2500m, 2500m – 3000m, 3000m – 3500m.a.s.l. DISTANCE 6.0 (Laake et al. 2009) was used to design transects survey maps to show where they would be located within the three zones of the park. Using the DISTANCE software and the altitudinal layers, a survey design was developed for line transects, positioning them evenly using the Systematic Segmented Track line Sampling.

The survey design generated 75 transects in the survey zone. Each transect is 2km in length and the spacing between individual transects is 2 km in each altitudinal zone.

The start and end point coordinated of transects were generated and provided to each team to use during the survey to track transects. Survey standard Data sheets were provided to each team for data recording during the survey. The teams recorded signs, direct observation and even mad arrests of illegal does during the survey.

Figure.1: Map of animal survey using line transects:



4.1.1 Data collection using Line transect method

Eight survey teams each headed by a team leader who is experienced in animal surveys using ground transect *Distance* sampling method were used to collect the data along transects.

Owing to the forested nature of the RMNP area, 68 line transects were cleared and walked, covering the total distance of 136km during the survey. Both direct and indirect survey methods were used during the line transects survey. Direct method is actual direct sighting of the animal species seen and recoded and Indirect method for the animal species is by use of spoors such as; animal dung/droppings, nests, calls and footprints. These will help establish presence

or absence of different animal species as well as their distribution pattern. Each transects was visited once during the survey due to budget constraints.

Figure 2: rangers collecting data during animal survey in the RMNP

All observations were recorded in standard data sheet provided to each group by the survey leader. Attributes like species name, sex, age, were recorded for analysis use. Some of the observations made included the reptiles like snakes and dead animals as shown bellow here.

Figure.2: photos of reptiles and dead animal observed during the survey

Transect "start" and "end: points coordinates were uploaded into the GPS units every morning and used for navigation to the start and through transect to end point. After reaching the starting point for each transect, the survey crew walked quietly along transect line collecting data on different mammal species encountered. The mammal species spotted on either side of transects was counted and the perpendicular distance from the observation to the centerline of transect measured with the help of a 100m tape measure or range finder. All the information was recorded on specially designed data sheets.

From the line transect data collected, the preliminary analysis on keystone animal species distribution pattern was generated using GIS and the result indicate that, most key stone animal species are within the forest zone between 1500m – 2500m .a.s.l. The other species like Rwenzori Duikers, leopards are found in the hire altitude between 2500m – 3500m.a.s.l. this is due to the vegetation characteristics in the mountains. It was also observed that most of the illegal activities ocure within these ranges due to the presence of wildlife, easy access by poachers and other illegal actors. These then put at risk the wildlife and calls for serious monitoring and patrols. The map bellow shows the locations of key animal species observation sites during the survey.

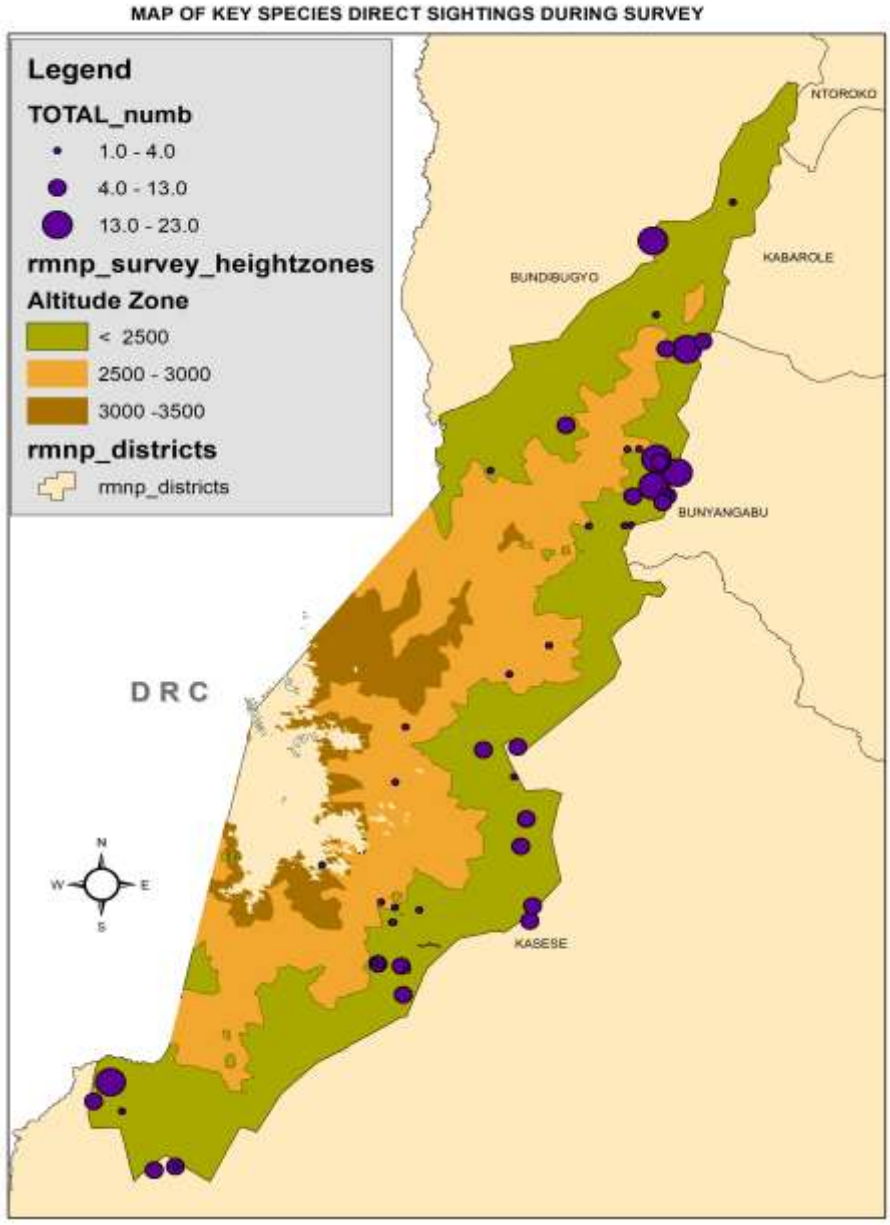


Figure: 2: Map showing key stone animal species observation during survey

Threats: all signs of illegal activities or threats affecting the biodiversity were recorded during the day to day field data collection in the field during the survey. This will help in understanding the stators of conservation and will guide in the management approach. Other observations such as illegal activities were also collected and recorded.

Results of the survey will be used to evaluate the conservation effort and the impacts affecting the Outstanding Universal Values of Rwenzori World Heritage. They will also be used to identify gaps for areas that need funding. From the data collected during the survey, a preliminary analysis on illegal activities was done and it indicates that there is increase in poaching around ranger post. see map bellow;

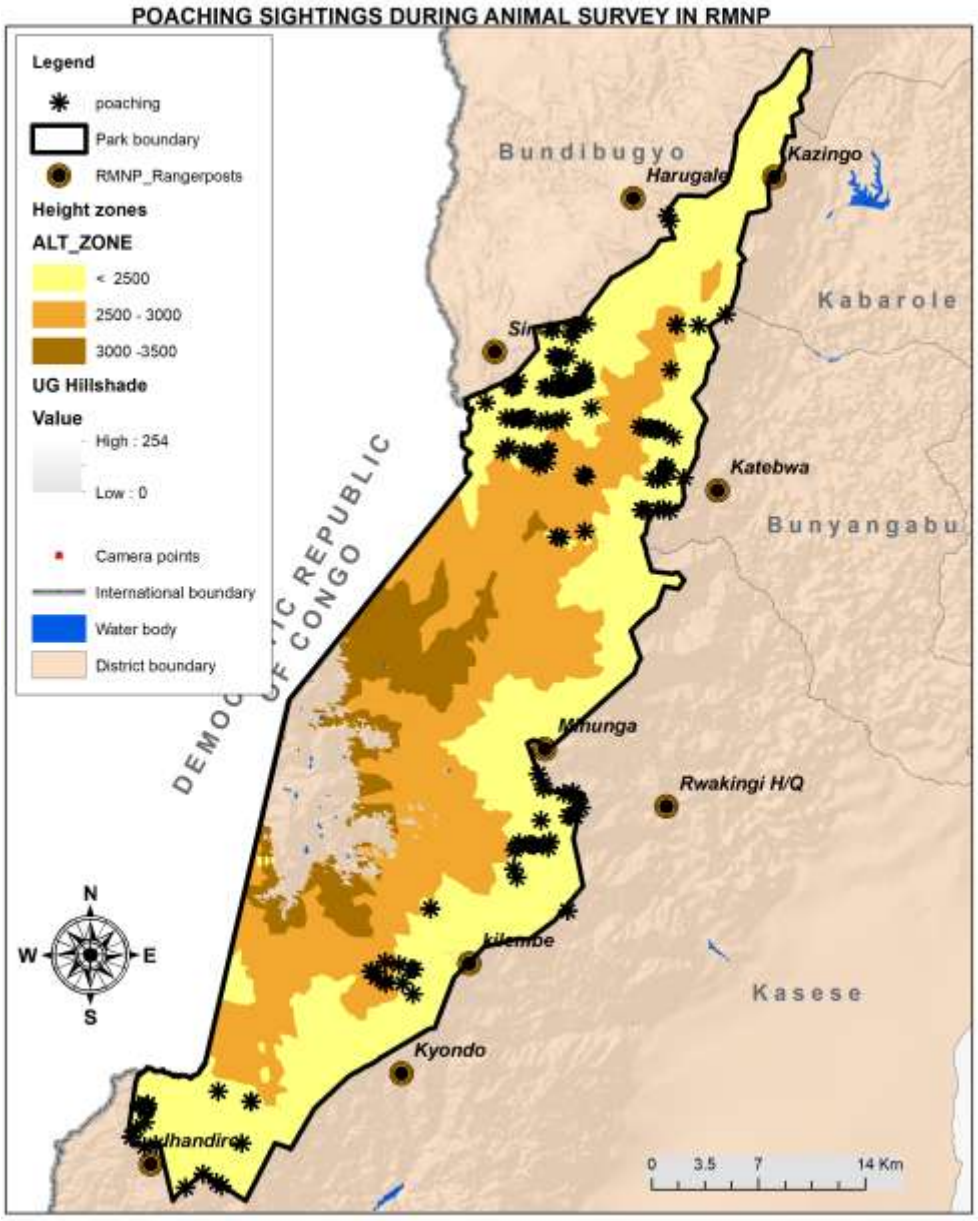


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Figure.3: Map of RMNP showing poaching sightings during survey

4.2 Camera Traps survey design

Camera trapping is a method increasingly being used in animal surveys to establish the present species, estimate relative abundance and distribution of wildlife. The method is powerful and efficient to inventory multiple species simultaneously and count rare and secretive individuals across landscapes. Camera traps were therefore be set in a grid as another mode of data collection to support the ground survey data. Still using DISTANCE software and the RMNP survey zone layer, a survey design was established for camera points, using systematic grid sampling. The design generated 45 grid points at a pacing of 2.5 km. The points acted as centers where the camera traps were set /stationed. The coordinates of the grid are shown in the map provided for the survey.

WWF procured 20 Camera traps and UWA borrowed 18 camera traps from Bwiindi Impenetrable National park for use during the survey. The PA did not meet the expected camera traps for the survey as planed earlier. This led to data capture gap during the survey. A total of 38 camera were set in the field out of 45 planed for the survey.

Both Arborio and ground cameras were set along the grids specified in 1600m – 3000m.a.s.l as shown in the map bellow. This mode will give a clear picture of animal distribution, presence and movement pattern in the PA. There is an increasing trend of using cameras.

During camera trap setting, 8 teams deployed in the field setting up camera traps in the PA during the survey and cameras lasted 30 days (1 month) in each point after setting. These were later picked for down loading and photos uploaded to the system for analysis. 30 ground camera and 8 arboreal camera traps were set in different planed sites as per the plan.

Figure.2: Arboreal Camera trap setting photo Ground Camera trap setting in the field

4.2.1 Camera Trap data downloading:

30 Ground Camera trap set in the field lasted for 30 days. 10 cameras captured photos of 7 animal species, 2 Birds species while 3 cameras captured photos of poachers during the survey. The species captured in the camera traps are as listed bellow;

1. Chimps
2. Blue monkeys
3. Black and white colobus
4. Tree squirrel
5. Genet cat
6. Cane rat
7. Honey Badger

4.2.2 LOCATION OF CAMERA TRAPS

The location of ground cameras as set is as shown in the map bellow.

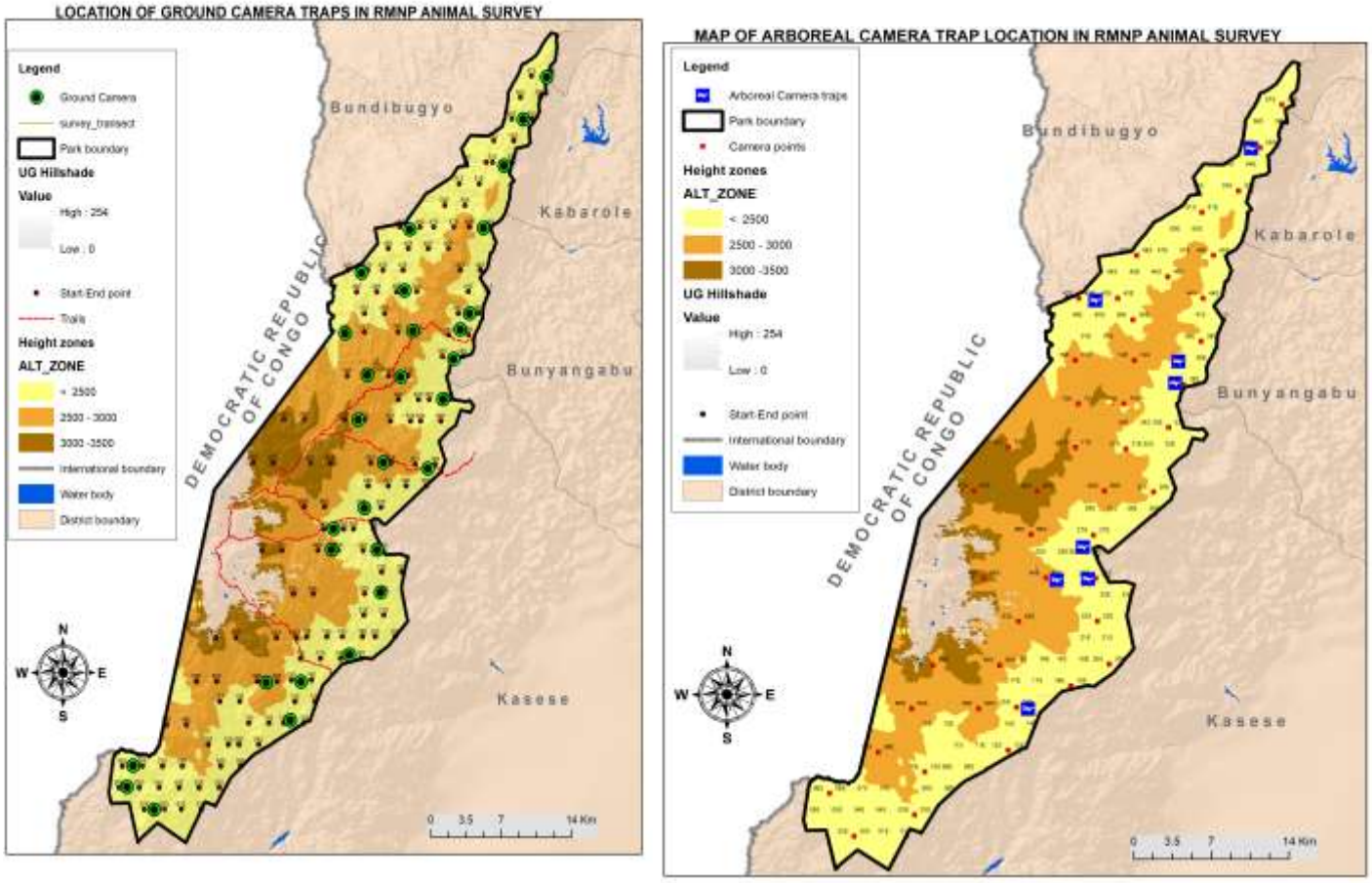

Figure.5: Map showing ground camera trap location

5 CONCLUSION:

Animal survey in Rwenzori was done by UWA staff trained in biodiversity techniques using line transects and Camera traps. The survey team was divided in to 8 groups each led by staff with experience in animal survey. The survey was done during the dry season of February to March 2021 which made it possible for staff to reach most of the areas planed.

Due to ragged terrain, some transects were not reached hence data was not collected in such transects however over 80% of the survey target was mate.

Data collected was recorded in the standard data sheets and waiting for the final stage of analysis by team of experts to come up with the final report of this survey.
The recommendation from this survey will be shared with the management and stake holders for decision making and planning.

In a nut shell, this survey was very important for the management of RMNP. Staff reached money areas that they had never reached before and it was the first time to reach with the guide of generated coordinates. Poaching caps were discovered; traps recovered, destroyed and patrol planning enhanced. We wish to thank WWF for the support provided for this animal survey.

6 FINANCIAL REPORT:

During the survey, funds received from WWF for this activity was spend as shown in the table bellow.

BIODIVERSITY SURVEY EXPENDITURE

Tools and Food for staff during field data collection and Camera trap laying in the field

Activity	**Requirements**	**Total Cost**
Data collection along line transects during animal survey in RMNP	Field Food and Items	3,956,000
	Staff and porters subsistence allowance	28,514,000
Total		**32,470,000**
Camera trap setting and downloading during the survey	Field Items	2,575,000
	Subsistence allowance for staff and porters while in the field	24,625,000
Total		**27,200,000**
GRAND TOTAL		**59,670,000**

7 ANNEX.1. PHOTOS CAPTURES IN CAMERA TRAPS

Figure.6: photos of some of the captured animals and birds:

7.1 ANNEX.2: GROUND SURVEY DATA SHEET – RWENZORI MOUNTAINS NATIONAL PARK

Survey Area: _____

Observer (Team Leader): ……..….	Date: ……...	Other observers 1.……
Transect No.: ……	Transect length: ……..…...	2.……..……
Start time: ……..……	End Time: ……..……	3.……

Way Point No.	N	E	Time	Altitude	Animal species	Perp. Dist. (m)	Group Size	Species structure			Remarks
								M	F	Young	

REMARKS: ***G****=Grassland;* ***M****=Montane Forest*, ***B****=Bamboo;;* ***P****=Poaching*, ***H****=Heather Forest* ***CT****=Cultivation*,

ANIMAL SPECIES: **BF**=Buffalo, **BN**=Baboon, **EL**=Elephant, **BP=**Bush pig, **LPD**=Leopard, **CN**=Chimp nest, **ED**=Elephant dung, **RDK**=Rwenzori Duiker, **CZ**= Chimpanzee, **BWC**=Black and white colobus, **BM**=Blue monkey, **RTM**=Red-tailed monkey, **RH**=Rock hyrax, **LHM**=L'hoest monkey

VEGETATION SURVEY REPORT

DIVERSITY, DISTRIBUTION and ABUNDANCE OF TARGET PLANT SPECIES IN A WORLD HERITAGE SITE: RWENZORI MOUNTAINS NATIONAL PARK

UGANDA WILDLIFE AUTHORITY & WORLWIDE FUND FOR NATURE UGANDA COUNTRY OFFICE

SUPPORTED BY HEMPEL FOUNDATION PROJECT TO RWENZORI MOUNTAINS NATIONAL PARK

September/ 2020

CONTENTS

AUTHORS AND FIELD TEAM

This work was led by Nelson Enyagu (Assistant Warden Ecological Monitoring and Research Rwenzori Mountains National Park).

Associate Prof. Gerald Eilu guided the data collection and writing of this report.

Mr. Fred Wanyama (Senior Warden Ecological Monitoring and Research) supported Spatial data analysis for this report.

Other UWA staff, specifically the Rangers took part in training on plant surveys and carried out the vegetation survey.

Citation: Enyagu Nelson, Eiru Gerald, Wanyama Fred, Ndizihiwe Daniel, Asiimwe Martin, Drew McVey; Jenifer Moore; 2020. Species diversity, distribution and abundance of target plant species in a world heritage site: Rwenzori mountains national park.

Corresponding author: Nelson Enyagu

nelson.enyagu@wildlife.go.ug

ACKNOWLEDGEMENTS

The study was funded by the Worldwide Fund-Uganda Country Office (WWF-UCO) under Hempel Foundation project titled "A sustainable Future for Uganda's unique World Heritage". The Uganda Wildlife Authority (UWA) partnered with WWF-UCO to implement the survey. Mr. Daniel Ndizihiwe (WWF) provided comments on the draft report and helped to improve the quality of this report.

Associate Professor Gerald Eilu for training UWA staff to carry out this vegetation survey that has yielded this baseline information on key plant species of concern in Rwenzori Mountains National Park and for providing guidance during the preparation of this report. Also Mr. Fred Wanyama Senior Warden Ecological Monitoring and Research for his technical support during the Spatial data analysis.

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LIST OF ABBREVIATIONS AND ACRONYMS

BU	Bukara
CC	Central Circuit
DBH	Diameter at Breast Height
DRC	Democratic Republic of Congo
CBD	Convention on Biological Diversity
CITES	Convention on International Trade in Endangered Species of Wild Flora and Fauna
GMP	General Management Plan
IH	Ihandiro
KB	Kabarole
KT	Kateebwa
IUCN	International Union for Conservation of Nature
MDG	Millennium Development Goal
M&E	Monitoring and Evaluation
NBSAP	National Biodiversity Strategy and Action Plan
NGO	Non Governmental Organisation
PNV	Parc National des Virunga
RMNP	Rwenzori Mountains National Park
RMS	Rwenzori Mountaineering Services
SDGs	Sustainable Development Goals
UNESCO	United Nation Educational Scientific and Cultural Organisation
UWA	Uganda Wildlife Authority
WCS	Wildlife Conservation Society
WWF	World Wide Fund for Nature

EXECUTIVE SUMMARY

Importance of the Rwenzori Mountains National Park

The Rwenzori Mountains constitute the most important water catchment area in western Uganda. The mountain ecosystem is of global importance as a UNESCO World Heritage site and is habitat to several species of Conservation Concern some of them are Globally, others Nationally and the rest within the Albertine rift (UWA, 2010). These include the endemic, endangered, threatened and rare species, some of them with restricted ranges. The Rwenzori Mountains constitute a cross-border ecosystem shared with the Democratic Republic of Congo (DRC). The entire mountain region covers about 4,800 km^2. Three quarters of this range lie in Uganda where land above 1,700 meters is within the RMNP covering 996 km^2. The mountains form part of the Parc National des Virunga (PNV), which runs contiguous to Rwenzori Mountains National Park (RMNP on the Ugandan side) for approximately 50 Km.

Globally important flora such as the Giant **Lobelias** and **Dendrosenecios** occur on the Rwenzori Mountains. There are other fauna of global conservation significance such as the Chimpanzee (*Pan troglodytes*) and Elephant (*Loxodonta africana*). The RMNP has 54 Albertine Rift endemic species including 18 species of mammals, 21 species of birds, 9 species of reptiles and 6 species of amphibians. Five species are endangered, 14 are threatened and four have restricted ranges.

Objectives of the study: The overall objective of the study is to generate and contribute baseline information on the diversity status in terms of abundance and distribution of the target plant species for effective management.

The specific objectives are:

1. To determine the abundance and distribution of selected plant species targeted for utilization
2. To generate abundance and distribution maps of the target plant species in the Rwenzori Mountains National Park.
3. To assess the threats to the conservation of target plant species in the Rwenzori Mountains National Park

Data collection and analysis: Sampling for bamboo inventory was done in the bamboo forest types within 30 plots of 10 x 10m. Assessment of trees was conducted in 40 plots of 20 x 20 m located within the tree dominated forest types. The target forest types were selected from current vegetation maps available within the Research and Monitoring Unit.

Results: The main results are as follows:

Bamboo: The abundance of bamboo within the study is even within the specific vegetation type 'the bamboo zone'. However, its abundance also depends on the extent to which the illegal harvesting for commercial purposes will be controlled.

Prunus africana: The species occurrence is mainly concentrated in the northern parts of the park (Butama and Nyakitokoli). It is less abundant in the southern and central parts of the park. Similarly, illegal harvesting was common in the northern areas where Prunus is common. Protection of this species requires intensified patrols within the **'Prunus Hotspots' (Butama and Nyakitokoli)** in Bundibugyo and Kabarole respectively.

Mahoganies: Two species were recorded *Khaya grandifoliola* and *Entandrophragma angolense*. The two occur only occasionally. It is likely that the occurrence is mainly within sites that are difficult to access i.e. the Mubuku valley and Nyakitokoli.

Podocarpus latifolius:This was recorded only in the southern (Bubotyo) and central areas of the park (Nyakalengijo / Mubuku valley). Populations are likely to have been depleted from the rest of the more accessible areas due to logging for timber which occurred during forest department before it was gazetted a National Park.

Conclusion and Recommendations: The populations of the target species are facing excessive pressure of utilization. It is clear that the occurrence of the target species is mainly in sites that are difficult to access. Effective regulatory measures are required to save the wild populations of the targeted species. We therefore recommend the following actions:

1. Strengthening patrols to ensure that the illegal activities are minimized. Sites where the target species are relatively abundant, should be considered 'hotspots' and offered better protection.
2. Promoting on-farm planting of these species by supporting the multiplication of planting materials within the nurseries around the park and thereafter encouraging farmers to plant.
3. Reviewing and implementing mechanisms for regulated resource use that are in place to plug the loopholes.
4. Sensitizing communities on the risks associated with unregulated bark harvesting and felling of high value species such as *Prunus africana*. In addition, training the communities on sustainable methods of harvesting Prunus bark and other plant resources as they prepare to utilize on-farm populations when planted.
5. Conducting detailed studies on the regeneration of target species and monitoring within the Permanent Sample Plots earlier established.

1.0. INTRODUCTION

1.1. Conservation Value

Rwenzori Mountains National park, is a World Heritage Site and fragile ecosystem of Global interest ecologically, economically and culturally. It is an important source of resources for local communities and the globe at large. The communities, who live on the slopes of the Mountain, derive their livelihood from the Park resources through, Tourism activities, use of medicinal plants, mushrooms, water, firewood, honey, fibers, dry bamboo stems and bamboo sheath. To enhance the integrity of the Park, a number of interventions need to be implemented.

Rwenzori Mountains National Park is a habitat to several endemic, endangered, threatened and rare species of the Albertine Rift and also an Important Bird Area (IBA). The Rwenzoris are renowned for its Outstanding Universal Values including species of conservation concern such as endangered species, threatened species, endemic and restricted range species. in terms of Fauna, the park has 54 Albertine Rift endemics which include 18 species of mammals, 21 species of birds, 9 species of reptiles, 3species of plants and 6 species of amphibians. Five species are endangered, 14 are threatened and 4 have restricted range.

The patterns of tree species richness in the montane forest, are a consequence of many interacting factors, including productivity, elevation, competition, geographical location, history or evolution, environment and human activity (Woodward, 1988; Palmer, 1991; Eriksson, 1996; Zobel, 1997; Criddle et al. 2003). Climatic variables are critical in vegetation species patterns along different elevations. The distribution range restrictions of individual species are controlled directly or indirectly by climatic factors.

Human population growth in the region and climate change has a direct impact on the Rwenzori species of concern, park resources and its ecosystem at large. The current pressure on park resources by neighboring communities such as use of *Prunus africana* bark for medicinal value, use of *Podocarpus latifolius* and Mahoganies(*Entandrophragma* spp. and *Khaya* spp) for timber and Bamboo for domestic and commercial purpose is on the rise hence affecting the conservation of the species (State of Conservation Report 2017, SMART Reports 2018).

Bamboo is a major forest product for the people leaving adjacent to RMNP. Bamboo is used in different forms by the communities for example, mature and dry culms/ stems are used in construction of houses and as supports to leaning banana stems. Large quantities of dry bamboo culms are used for firewood

particularly during ceremonies. These are preferred because they are easy to harvest, collect and carry out of the forest. Dry bamboo is also used for construction of houses, fences, pubs and planting tomatoes. Bamboo sheaths are used as thatching material, but this is reported to be declining.

Frontline communities living adjacent to Protected Areas (PA's) such as the Rwenzori Mountains National Park (RMNP) are key stakeholders in the management of PA's but they utilize the resources found in the PA, sometimes illegally or legally. The distribution and species richness of these plants of concern is not well known. Therefore, continuous use of these resources without information on the abundance and distribution may lead to depletion of some of these key stone plant species. Managing Protected Areas therefore requires data that should be collected regularly and analyzed to guide management interventions. Mechanisms are therefore needed to regulate access and use of such resources.

This study therefore was conducted with the aim of generating scientific information on the status (abundance and distribution) of the plant species of Conservation Concern within the montane forests and bamboo zones of Rwenzori Mountains National Park. Subjective sampling methods were used to collect data on the distribution and abundance of *Prunus africana, Podocarpus latifolius,* Mahoghanies (*Entandrophragma* spp. and *Khaya* spp.) and Bamboo. This generated baseline data from which references have been made on the effect of climate change and human activities on vegetation for management decision making.

1.2. Problem statement

The Rwenzori Mountains is a biodiversity hotspot with a diverse landscapes and species providing essential ecosystem services such as carbon storage and a water catchment. The vegetation of Rwenzori is Stratified on the bases of elevation ranging from: grassland (1000m – 2000m); montane forest (2,000 – 3,000 m); bamboo/*Mimulopsis* zone (2500 – 3,000 m); heather/Rapanea zone (3,000 –4,000 m); and Afro – Alpine zone (4,000 – 5,000 m). Hence, several iconic species of flora and fauna that are unique to the Rwenzoris and require utmost protection. However, the high population growth in the western Uganda region and climate change has a direct impact on the flora and fauna within the Rwenzoris and the mountain ecosystem in general. Currently, the demand for park resources such as *Prunus Africana* whose bark harvested for medicine and bamboo that is harvested for commercial (and subsistence) purposes is on the rise. This is likely to lead to the depletion of target species in the park. Information on the status of these species is lacking. It is against this background that the management undertook this survey to generate scientific information on species richness, distribution and abundance for proper management

and decision making.

1.3. Objectives

The overall objective of the study is to generate and contribute baseline information on the diversity status in terms of abundance and distribution of the target plant species for effective management.

The specific objectives are:

1. To determine the abundance and distribution of selected plant species targeted for utilization
2. To generate abundance and distribution maps of the target plant species in the Rwenzori Mountains National Park.
3. To assess the threats to the conservation of target plant species in the Rwenzori Mountains National Park

2.0. METHODS

2.1. Study Area

The study was carried out in the Rwenzori Mountains National Park (RMNP), that was selected because of its diverse montane habitats and plant species. The RMNP is a World Heritage Site and a Ramsar Site due to its Outstanding Universal Values. It is located in Western Uganda (Figure 1) bordering the Democratic Republic of Congo (DRC) in the West. It is within the five Uganda districts of Kasese, Bunyangabu, Kabarole, Ntoroko and Bundibugyo. The park lies between latitude 0˚ 06' South and 0˚ 46' North and longitudes 29˚ 47’ West and 30˚ 11' East. The mountain ranges cover about 80 Kilometers in the North - South direction and 40 Kilometers in the East - West direction. The park has an altitudinal range of 1670m on to 5,109m above sea level (ASL at the Margherita Peak).

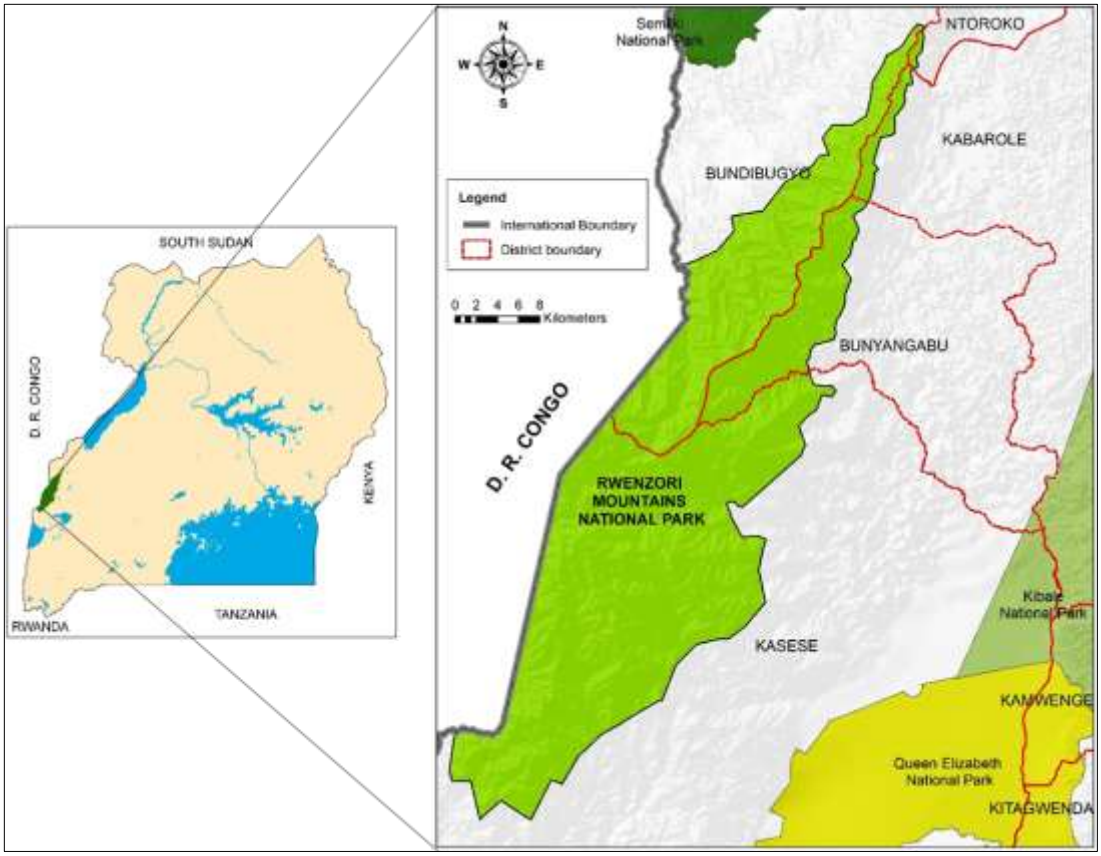


Figure 1Rwenzori Mountains National Park and administrative boundaries of districts in which the park is located

2.2. Methods

2.2.1. Sampling Design

This survey was undertaken to determine the status of selected plant species of conservation concern in the Rwenzori Mountains National Park. Sampling was subjectively done within the bamboo forest and Montane Forest types. Transects were established at least 20m off the access route and marked with GPS running perpendicular to the access routes for at least 200 m with the direction recorded. A maximum of four plots of 10 x 10m was established on alternate sides of each transect for assessment of bamboo. Ranging rods, distance tape, hand held compass and flagging tapes were also used to establish and mark the plots. A distance of 50 m separated the plots. The plots were geo referenced with GPS and later mapped for monitoring. Each team assessed and recorded all the bamboo trees. Each team assessed approximately 10 transects making a total of 30 plots for bamboo (Table 1). The total area assessed was 3000m^2. The plots were located within the altitudinal range of 2000 – 3000m.a.s.l. (Figure 2)

Assessment of trees was conducted in plots of 20 x 20 m located within the tree dominated forest types established on alternate sides of transects established as mentioned above. Tree dominated forest types were selected from current vegetation maps available within the Research and Monitoring Unit. Each team assessed and recorded all the trees >5cm. Data collection was conducted in 40 plots established within the altitudinal range of 1500m – 3000 m.a.s.l giving a total sampling area of 16,000m^2.

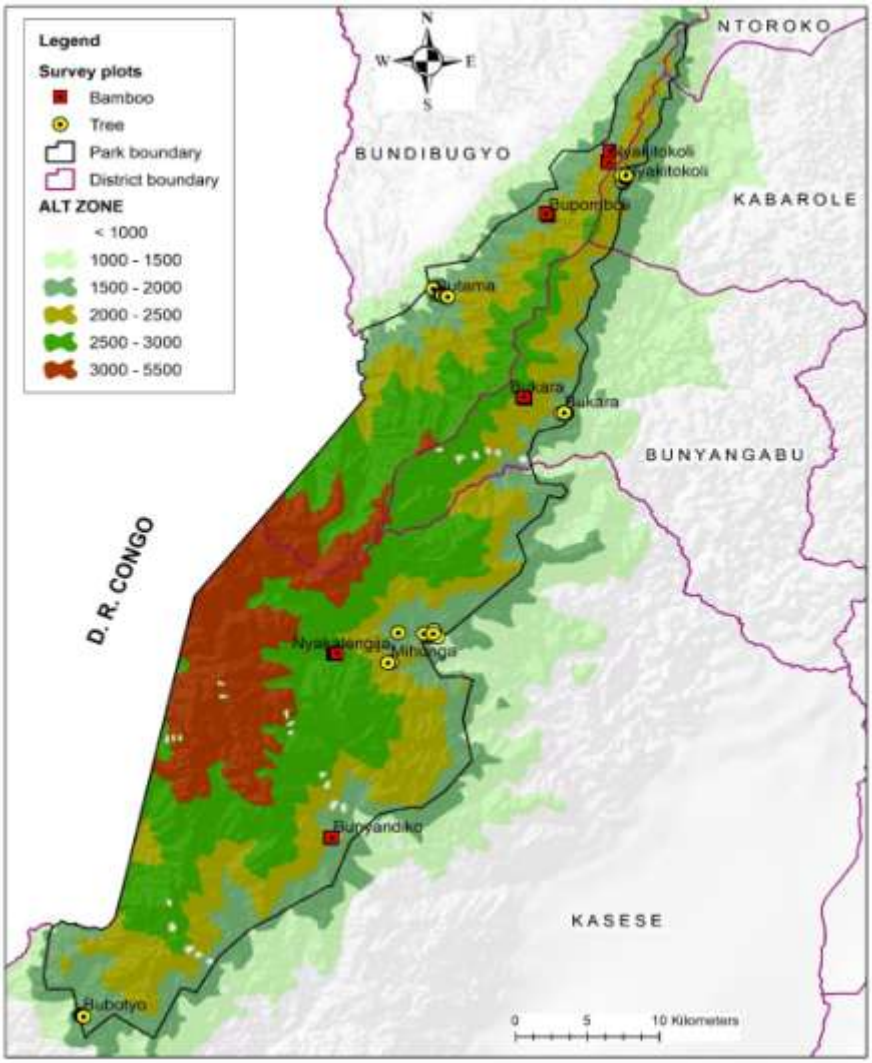


Figure 2. Sampling points for the assessment of trees and bamboo in Rwenzori Mountains National Park (the red points are sampling plots for bamboo and yellow points are sampling plots for trees in forest zone).

Table 1. Sampling plots for tree and bamboo assessments in the Rwenzori Mountains National Park

Site/Location	District	Number of 10x10m plots in Bamboo zone and elevation	Number of 20x20m forest plots and elevation
Site 1. Butama and Bupomboli	Bundibugyo	6 plots 2500 to 2600m	6 plots 2000 to 2200m
Site 2. Nyakitokoli	Kabarole	8 plots 2400 to 2530m	10 plots 2000 to 2300 m
Site 3. Bukara	Bunyangabu	6 plots 2900 to 3000m	6 plots 2000 to 2300m
Site 4. Nyakalingijo/ Mihunga	Kasese	6 plots – Nyabitaba area 2800 to 3000m	9 plots – Mubuku Valley 1700to 2600m
Site 5. Bunyandiko	Kasese	4 plots 2540 to 2650m	
Bubotyo/ Ihandiro	**Kasese**		6 plots 1500 to 2500
Total		**30 plots**	**40 plots**

Additional descriptions of the plots are as follows:

Site 1. Bupomboli: The site is located in Bundibugyo District in the northern spar of Rwenzori Mountains National Park within bamboo zone. The area is within the resource use zone for which there is an MoU with communities to access resources (e.g. bamboo, mushrooms, medicinal plants and traditional foot paths). The site was selected for bamboo assessment during this survey.

Site 2. Nyakitokoli: The site is located on the northern spar of Rwenzori Mountains National Park within Kabarole district. Two site falling within Forest and bamboo zones were established for tree species and bamboo assessment during the survey.

Site 3. Bukara: This is located in Katebwa sub-county in Bunyangabu district. Two sites were assessed where 12 Plots were established in the bamboo zone and Forest zone for this survey.

Site 4. Nyakalengijo / Mihunga/Nyabitaba: The site is located within the area of the central circuit trail along Mubuku Valley in Kasese district. Two sites were assessed where 15 plots were established in the bamboo zone and Forest zone for this survey.

Site 5. Bunyandiko: The site is located along the Kilembe trail in Nyamwamba valley. 4 plots were established in this area within bamboo zone during this survey.

Site 6. Bubotyo/ Ihandiro: This site is located on the southern part of RMNP within the forests zone. The area is relatively flat with open forest.6 plots were established in this site during this survey.

2.2.2. Data Collection

Bamboo: Within the plots, the number of live (fresh) and dead or dry bamboo culms rooted within the plots were counted to assess the abundance and distribution. The number of clumps (groups of bamboo growing together) was recorded. Diameter at breast height (dbh, 1.3 m high) for the live and dead or dry culms was done using Millimeter Vernier Calipers. The record indicated also whether the individual was shoot, young, mature or old culms/ stems. The number of cut stems was also recorded to obtain estimates of the current levels of harvesting in terms of intensity. Standard data sheets were used to record the data in readiness for analysis to assess the abundance and distribution.

Trees: Trees of diameter at breast height (dbh, 1.3 m) ≥5 cm were assessed. Diameter was measured with Calipers or diameter tapes as appropriate. In cases where a diameter tape was used, one reading was made and recorded. In cases where the Vernier calipers were used, two readings were taken (dbh 1 and dbh. 2), whereby dbh 1 was the smallest axis and dbh 2, the largest axis. In cases where the tree was branched below 1.3 m high, each stem was measured and recorded. Diameter measurements were done above any anomalies found at the base of the stem. Specimens were collected and pressed to keep vouchers of plants for further reference

Shrubs/ Lianas/ Climbers and Herbs: These were not measured during the current exercise, but could be recorded in terms of density/cover.

Identification: Identification was based on vegetative field characteristics, floras, and keys (mainly the Field Guide to the Forest Trees of Uganda – Hamilton, A.C.). The focus was on the target species (*Prunus africana*, *Podocarpus* sp., and *Mahoganies* (*Khaya* spp. and *Entandrophragma* spp.). Local names and scientific names were recorded. Regeneration (young individuals at least 0.5m high and < 5cm dbh) were not enumerated within the 20 x 20 m plots hence the number was not recorded due to the difficulty of identification. Specimens showing the leaf type and arrangement were collected for the newly recorded species.

Field Team and Effort

The team included UWA staff (Figure 3)that had earlier undergone training in vegetation survey methods. They were assisted, in plant identification, by five botanists hired from Makerere University Biological Field Station Kanyawara. The survey teams worked in five groups that altogether covered 70 plots (in five sites) within RMNP.

2 Figure 3. Data collection by UWA Ranger in the Rwenzori Mountains National Park

2.4.1. Spatial Distribution

The spatial distribution of the target plant species within bamboo and forest zone was analyzed using GIS (Geographical Information System and Inventory Modeling using Mapping Studies). Based on the data of precipitation, terrain, stream systems, elevation and vegetation, the map of key plant species distribution in RMNP vegetation was generated. We studied the factors influencing the spatial distribution of vegetation and particularly the selected plant species.

2.4.2. Tree Species Diversity

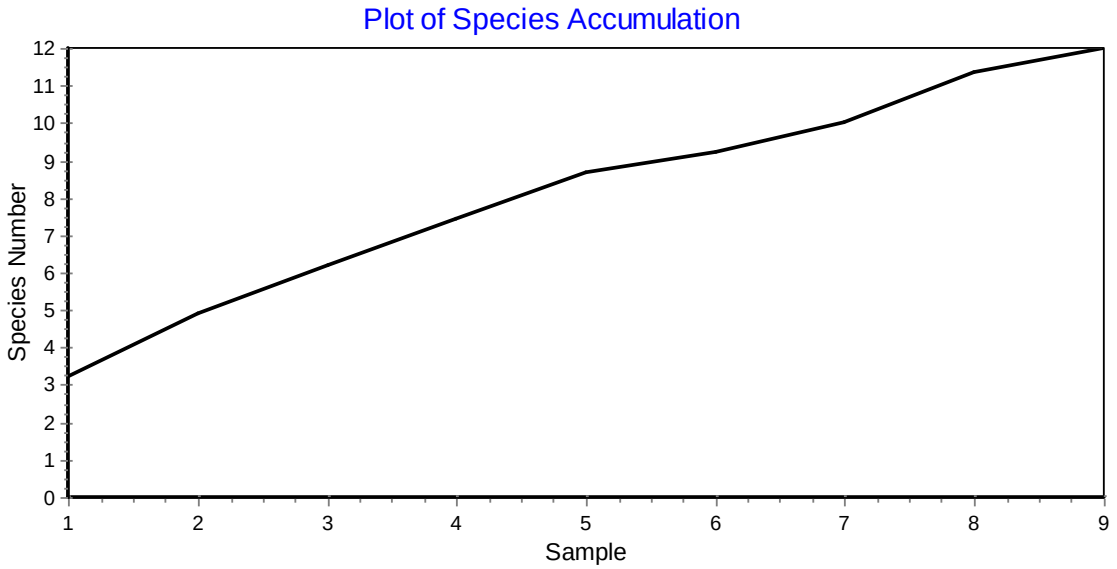
The data were analyzed using various diversity measures e.g. Species richness, Diversity(Simpson's, Fisher's Alpha and Shannon Wiener) and Distribution. Rank Abundance based on the DAFOR Scale (Dominant, Abundant, Frequent, Occasional or Rare), Population Structure, Similarity Analyses were also carried out. The computer program, Species Diversity and Richness (SDR version 4.1) was used. Based on UWA patrol reports, resource use trends related to bamboo harvest by communities and status of target tree species were analyzed using descriptive statistics.

The findings may be used to enable identification and selection of appropriate parameters to use as indicators for monitoring and evaluation of the impact of human activities on the resources in RMNP in general.

3.0. RESULTS AND DISCUSSION

3.1. Species Accumulation

Adequacy of the effort deployed in sampling may be judged based on shapes of the species accumulation curves. Within individual sites, it appears that leveling off of the species accumulation curves was not attained in the majority of cases (Figure 4a, b, c, d and e). This means that the expected numbers of tree species for those sites may not have been attained. However, the curve for the pooled dataset, for all the plots in all sites (Figure 5) shows that a reasonable level of sampling was reached. Hence, the dataset may be considered good enough estimate of the total number of species present.



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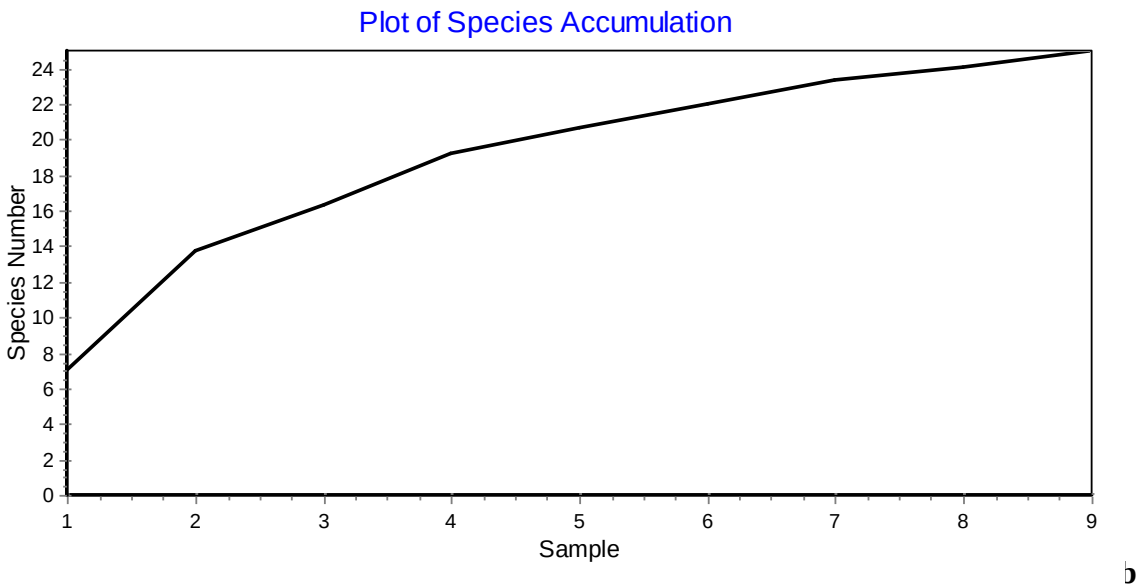
Plot of Species Accumulation
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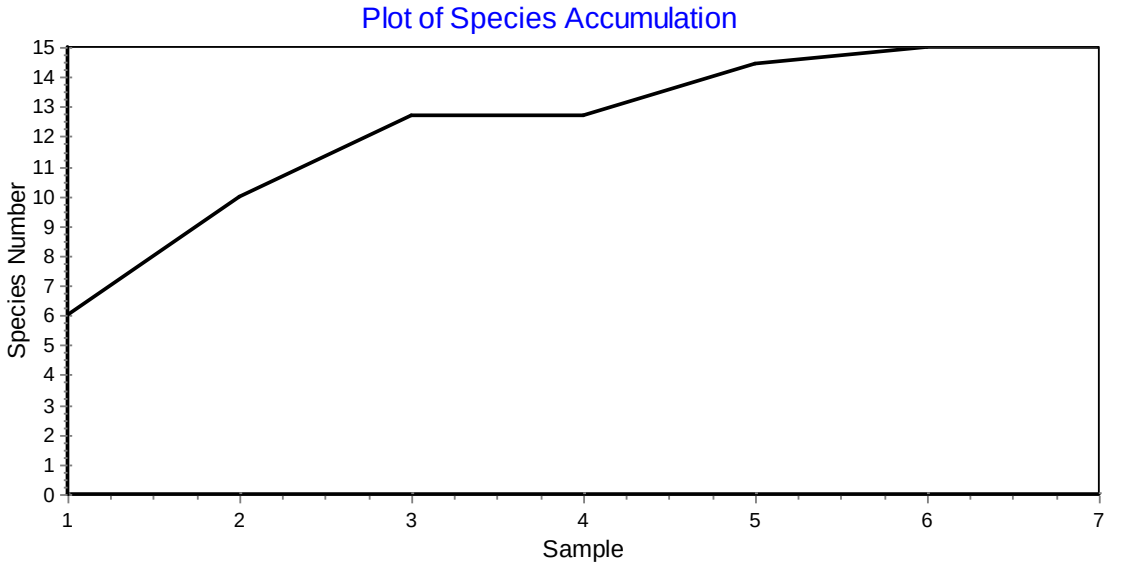
Plot of Species Accumulation
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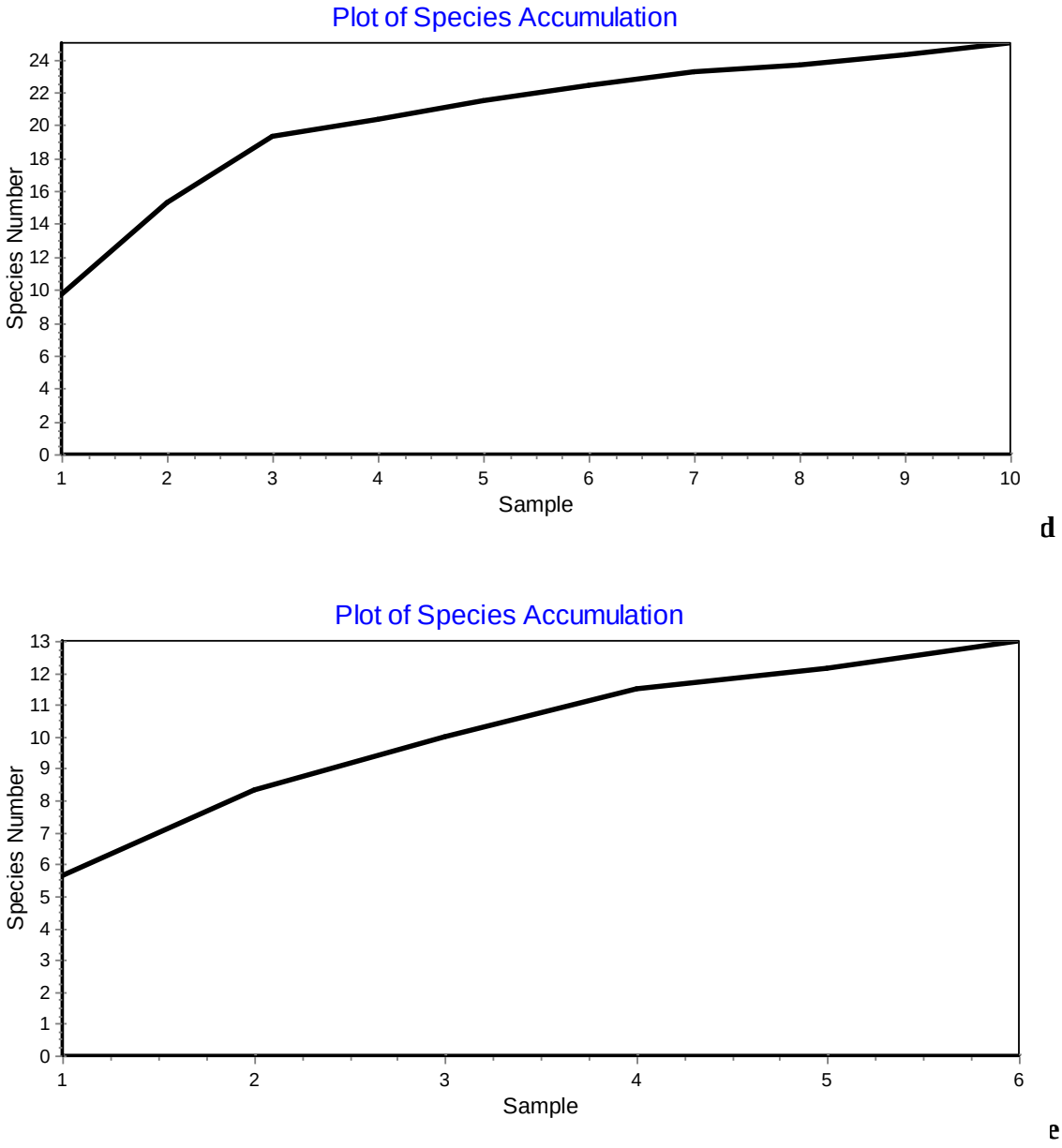

Figure 4. Species Accumulation Curves for the sampling sites in the Rwenzori Mountains National Park (a=BU, b=CC, c=IH, d=KB and e=KT)

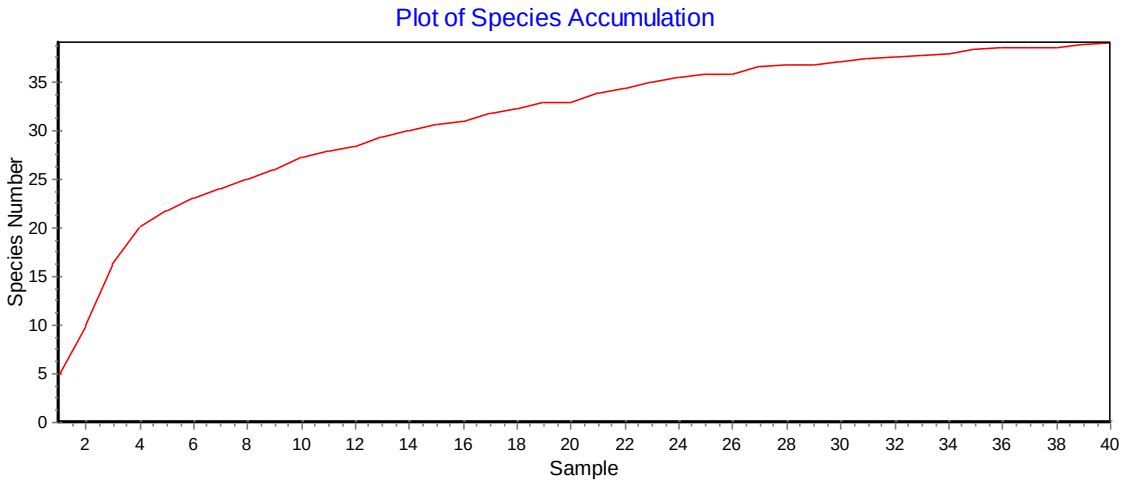

Figure 5. Species Accumulation Curves for the pooled sampling sites for the Rwenzori Mountains National Park

3.2. Species Richness

We recorded 39 tree species (Appendix 1) from 40 plots of 20 x 20 m. In total however, we report 40 species including the Bamboo. Out of these, four species were not conclusively identified due to the difficulty in collecting identifiable specimens. Within the dataset, these are treated as morpho-species for the sake of the analyses and to confirm that these were sufficiently different to be considered different species.

3.3. Rank Abundance

The Rank Abundance Curves of the tree species show generally a similar trend for all sites with a few species being Dominant or Abundant, some of them with intermediate abundance (Frequent), and the rest of them relatively uncommon i.e. Occasional or Rare (Figure 6). This trend of the curve is generally expected of the trees in a natural forest considering their relatively their random occurrence due to the heterogeneity of the forest as well as the growth characteristics of species.

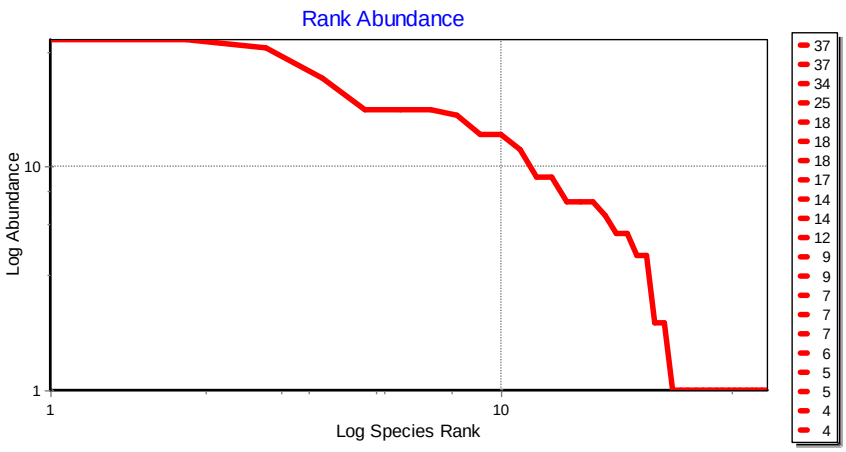

Figure 6. Tree Species Rank Abundance Curve for BU in the Rwenzori Mountains National Park

3.4. Species Diversity

On the basis of three indices (Simpson's, Fisher's Alpha and Shannon Wiener) the plot with the highest diversity was KB09 (Simpson's = 19.0, Fisher's Alpha = 10.9), Table 1. Based on Shannon Wiener's Index, the most diverse plot was KB03 (2.55). The plots with the lowest diversity differed between the indices (BU06, Simpson's = 2.5; BU01, Fisher's Alpha = 1.453; IH04, Shannon Wiener = 0.693). The all sample index by each of these indices is as follows: Simpson's Index (18.42), Fisher's Alpha Index (8.693) and Shannon Wiener's Index, (3.171). Overall, the sampling shows that the Rwenzori Mountains National Park is generally diverse in tree species.

In terms of species diversity, the top three plots were: KB09 and CC01 (Figure 7). The lowest were BU09 and IH04. There is considerable variation between plots in terms of diversity.

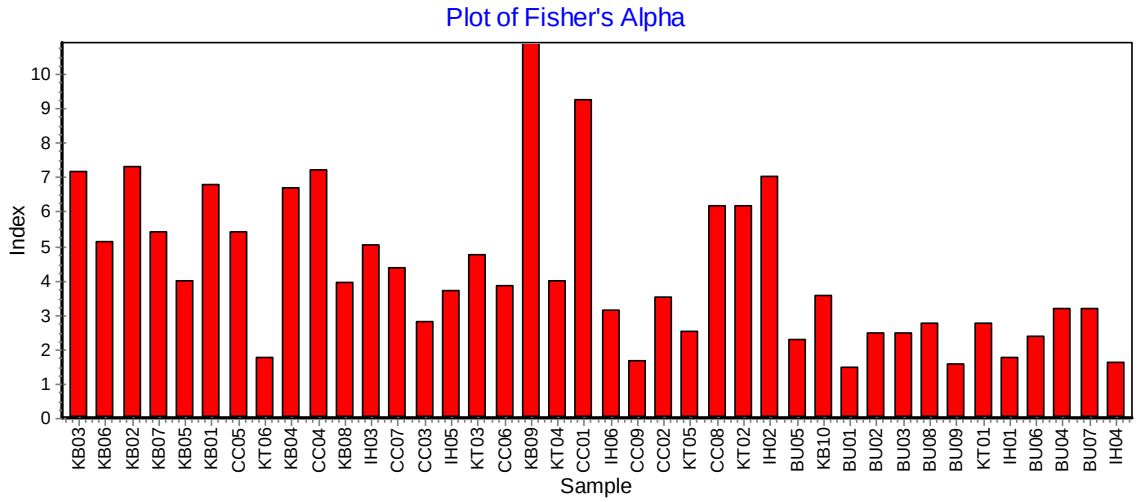

Figure 7. Tree Species Diversity in sampled plots of the Rwenzori Mountains National Park based on the Fisher's Alpha Diversity Index

3.5. Cluster Analysis

In terms of species occurrence, the most similar sites were KT and IH. The site BU was close to these two, and then CC (Figure 8). The site KB was the least similar to the rest of the sites. This has implications for conservation there might be a need to make decisions on sites to be permitted for resource use.

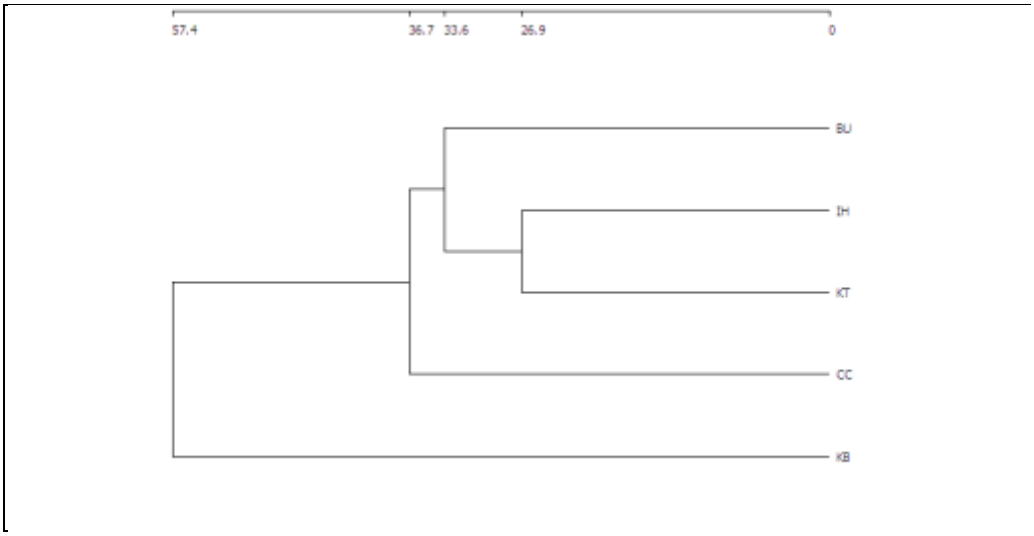

Figure 8. Similarity of sampling sites for plant inventories conducted in the Rwenzori Mountains National Park: (BU=, CC=, IH=, KB= and KT=)

3.6. Occurrence of Target Species within Sampling Sites

Within sampling sites, there were cases where by some species were not encountered. On Central Circuit) we encountered all the tree species listed in the pooled data set. However, there was no record of three of the target species (*Entandrophragma angolense*, *Khaya grandifoliola* and *Podocarpus latifolius*) in Kateebwa. Similarly, *E. angolense* and *P. latifolius* were not encountered in Bukara, and *E. angolense* as well as *Khaya grandifoliola* were not encountered in Ihandiro Bubotyo area. In Nyakitokoli /Kabarole, the species that was not encountered was *P. latifolius*.

The human activities could be one of the main factors affecting the distribution of target species in sampled sites of the Rwenzori Mountains National Park. This does not demean the role of abiotic environmental factors such as precipitation, hydrology, altitude, soils and temperature. The roles of the environmental factors and human activities were not distinguished in the present study because of the need for a more detailed study that would, for example, assess the soils as well.

Bamboo: The data from 30 plots were analyzed using GIS to generate distribution and abundance maps. A total of 1688 individuals recorded in 3000m^{2}was used for the analyses. The survey enabled us to determine the abundance, distribution and status of Bamboo in RMNP specifically in Nyakitokoli Kabarole district, Bupomboli in Bundibugyo district, Bukara in Bunyangabu district, Nyabitaba and Bunyandiko in Kasese district (Table 2).

Table 2. Bamboo stems in 3000 m^2 within Rwenzori Mountains National Park

Name of area	Dry	Mature	Stem	Stump	Young	Total number
Bukara	79	375	0	0	0	454
Bunyandiko	29	82	0	0	0	111
Bupomboli	35	168	14	0	0	217
Nyabitaaba	97	317	0	0	43	457
Nyakitokoli	61	202	48	6	17	449
TOTAL	**301**	**1,144**	**62**	**6**	**60**	**1,688**

The abundance of bamboo is more or less uniform within the study sites apart from one site,

Bunyandiko (Figure 9).

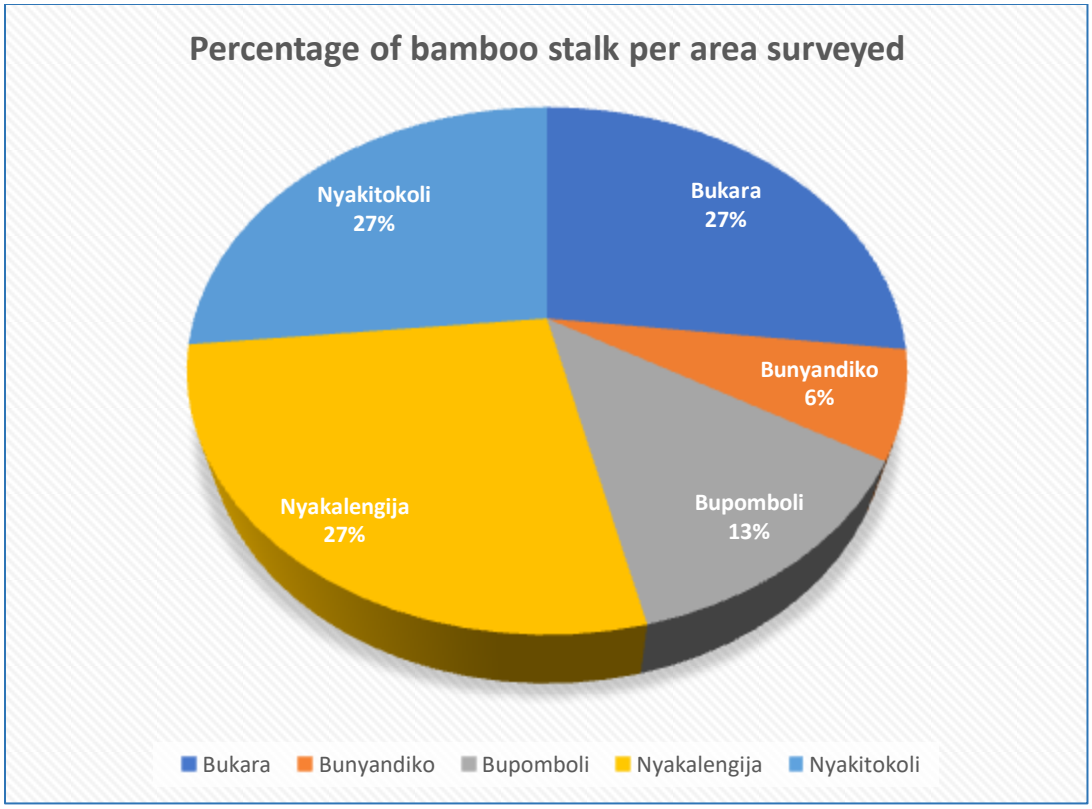

Figure 9. Proportions of bamboo stems within the study sites of the Rwenzori Mountains National Park

However, when evaluated per unit area, the bamboo was in general, most abundant in Nyakitokoli (in the northern part of the park) as compared to the rest of the sites (Figure 10). This pattern may be attributed to the environmental factors or the human impacts in terms of illegal harvesting.

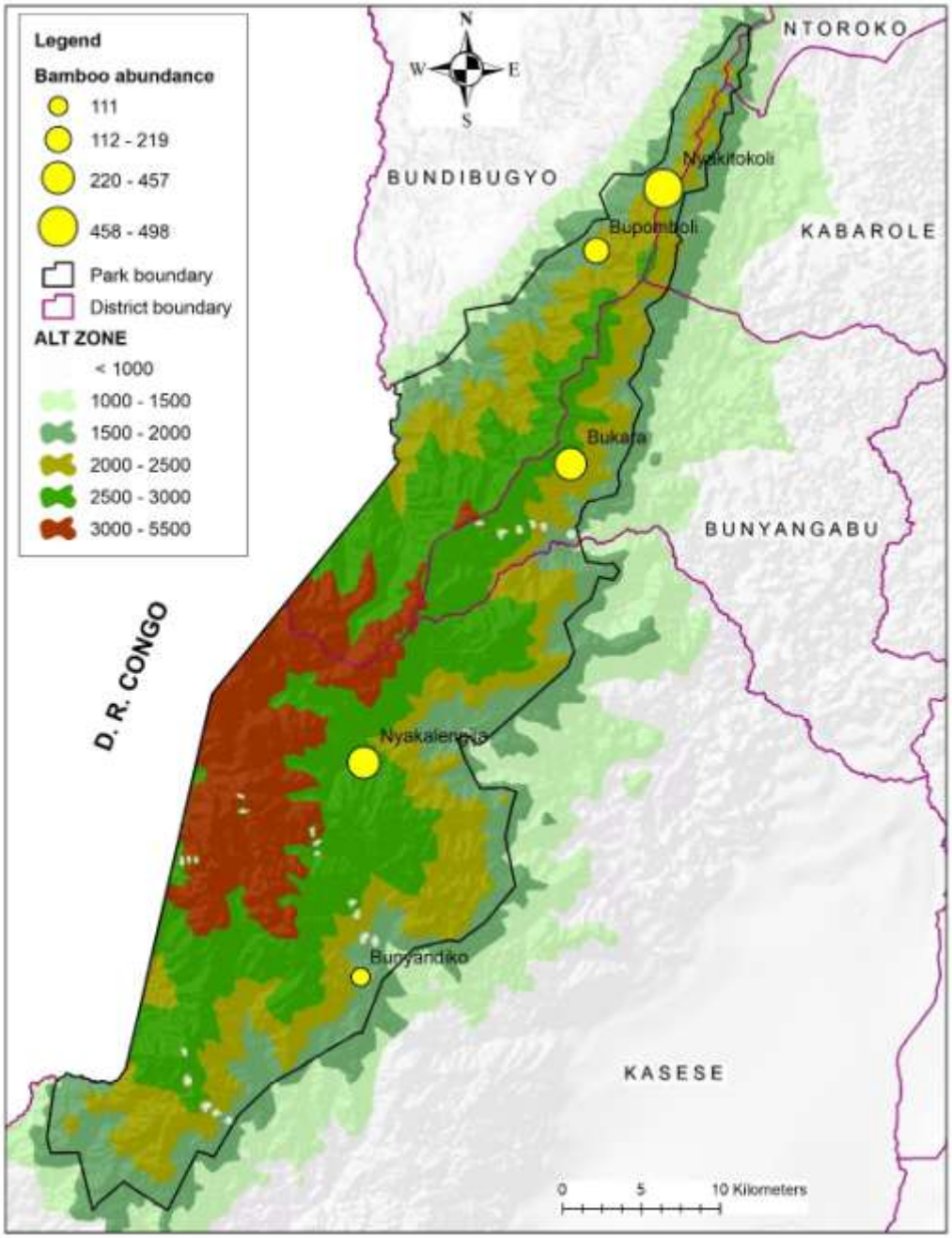

Figure 10. Abundance of Bamboo within the study sites of RMNP.

The yellow dots on the Map represent the number of bamboo stalk counted per site. The biggest yellow dot represents 458 – 498 bamboo stems counted while the small yellow dot represents 111 stems of bamboo counted in the site.

In terms of condition of Bamboo stems, up to 19% weredry, 73% mature, 4%shootsand 4% harvestable stems (Figure 11). This implies that only 19% of bamboo could be permitted for resource access while 73% will be available for regulated harvestable beginning the next dry season.

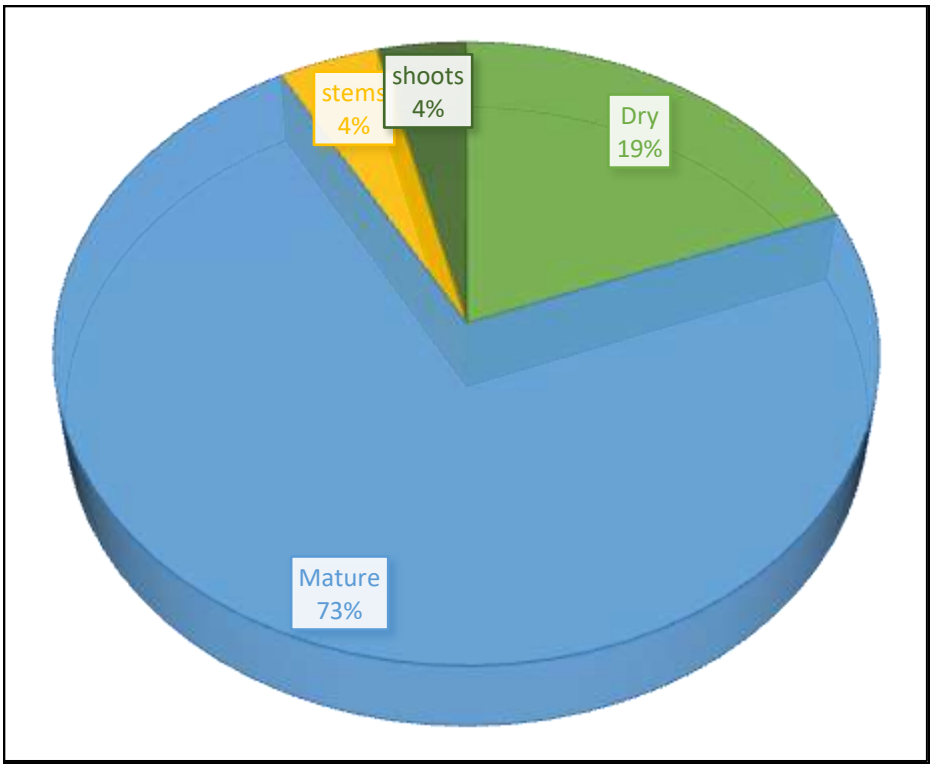

Figure 11. Chart of bamboo stems in Rwnzori Mountains National Park

The survival of Bamboo within the RMNP is a lot dependent on the extent to which the illegal harvesting for commercial purposes (Figure 12) will be regulated. Illegally harvested Bamboo poles have previously been impounded and there is a need to strengthen enforcement. The level of illegal harvesting generally exceeds what would be permissible within the resource use arrangements.


Figure 12. Illegally harvested Bamboo poles impounded within Rwenzori MNP.

The harvesting patterns show that Bamboo is mainly collected during the dry season. Up to 70% of the collectors have previously reported that they strictly do so in the dry season (the rest collect any time of the year, driven by the needs). The dry season is preferred because then a lot of bamboo is dry and the ground and vegetation easier to walk on. Where bamboo is collected illegally for sale, seasonal variations in the prices were reported. A bundle of bamboo that costs UGX 2,000 (Two thousand shillings) in the dry season was sold at UGX 2,500 (Two thousand five hundred shillings) in the wet season (1 USD = 3760 UGX). The higher price in the wet season is perhaps due to the fact that there are few collectors during the rainy season because the population is involved in other labour intensive activities such as farming.

There is a wide variation in the quantity of bamboo collected by individual collectors. One resource user had collected 10 culms within a year, while another had collected as much as 480 culms during the same time period. Time spent on a single trip varied from 2 to 12 hours. At least 50% of the bamboo users had used 180 bundles of bamboo; each of about 12 culms which gives an average of 42 culms per resource user per year. These estimates may be used during negotiations with communities to determine harvesting quotas for resource use.

Trees

Prunus africana: This tree species is locally threatened in the RMNP and globally (IUCN Red List) due to its medicinal value (treatment of prostate cancer). The species is targeted by harvesters who debark it on a large scale to sell to the buyers who trade it globally. Based on the UWA monitoring reports 2019/2020, over 200 bags of *P.africana* from the park, have been impounded during patrols and over 10 trees recorded felled by illegal bark harvesters. This survey has analyzed the distribution of *P.africana,* in order to identify the hot spots for better management.

The results show that *P. africana* is mainly concentrated in the northern parts of the RMNP within Kabarole and Bundibugyo districts (Figure 13). The sites include Butama in Bundibugyo district followed by Nyakitokoli in Kabarole district. There is relatively lower abundance of *P. Africana* in the southern and central parts of RMNP forest. Similarly, the harvesting was

common in the same areas. Signs of felling and debarking were common in those sites (Figure 14). During the survey, one illegal harvester was arrested in Butama.

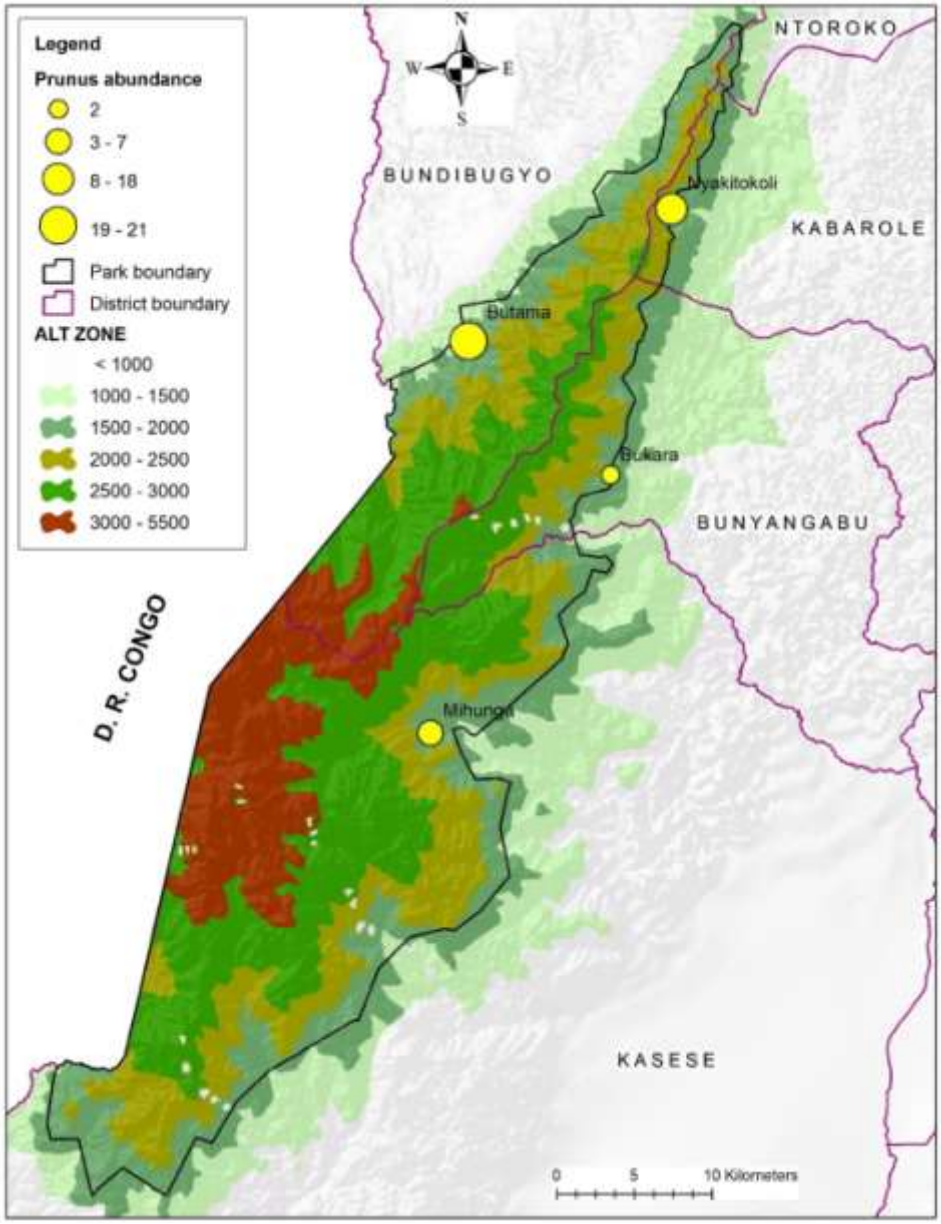

Figure 13. Relative Abundance of *Prunus africana* in sampled sites of Rwenzori Mountains National Park*(Large yellow dots show higher abundances than small dots)*

Figure 14. Sites of illegal Prunus harvesting within the Rwenzori Mountains National Park, Butama area

Mahoganies: The African Mahoganies such as*Khaya, Entandrophragma, Guarea*and *Lovoa*from Meliaceae familyare among tropical timber trees that are important in the local and international markets that contributed about 15-30% of the total export of timber Globally (Styles, 1975; Lamb, 1996). They are mostly found in the dry and moist semi deciduous forest zones of Ghana and are found in Uganda, Cameroun, Nigerand Guinea (Frimpong, 2008; Oteng-Amoako, 2006). Among the most valuable Mahogany species are *Khaya grandifoliola*and *Khaya ivorensis* (Oteng-Amoako, 2006) with the former recorded in RMNP).

The Mahoganies are threatened mainly by habitat loss and over-harvesting for timber (Ofori et al. 2007; Nikles et al. 2008). The demand for Mahogany timber continues to rise as a result of reduced supply of native mahogany timber from the Natural forest (Elliot and Pleydell, 1992). Hence, the International Union for Conservation of Nature has listed them as endangered species (IUCN, 2004).Currently illegal timber harvesting within the Rwenzori Mountains National Park, continue to be challenge. Some of the findings are as shown in Figure 15 below.

Figure 15. Sites of illegal Mahoghani timber harvesting within the Rwenzori Mountains National Park, Mihunga area

Efforts are being made to regenerate the Mahogany in the natural forest. Nevertheless, natural regeneration has not been very successful due to the fact that seeds lose their viability within a short period under natural conditions. (Taylor, 1960; Wilson, 1988;)

Within the RMNP, *Khaya* spp. are uncommon, it is concentrated in the Mubuku valley within the central part of the park and Nyakitokoli in the northern parts of the park (Figure 15).

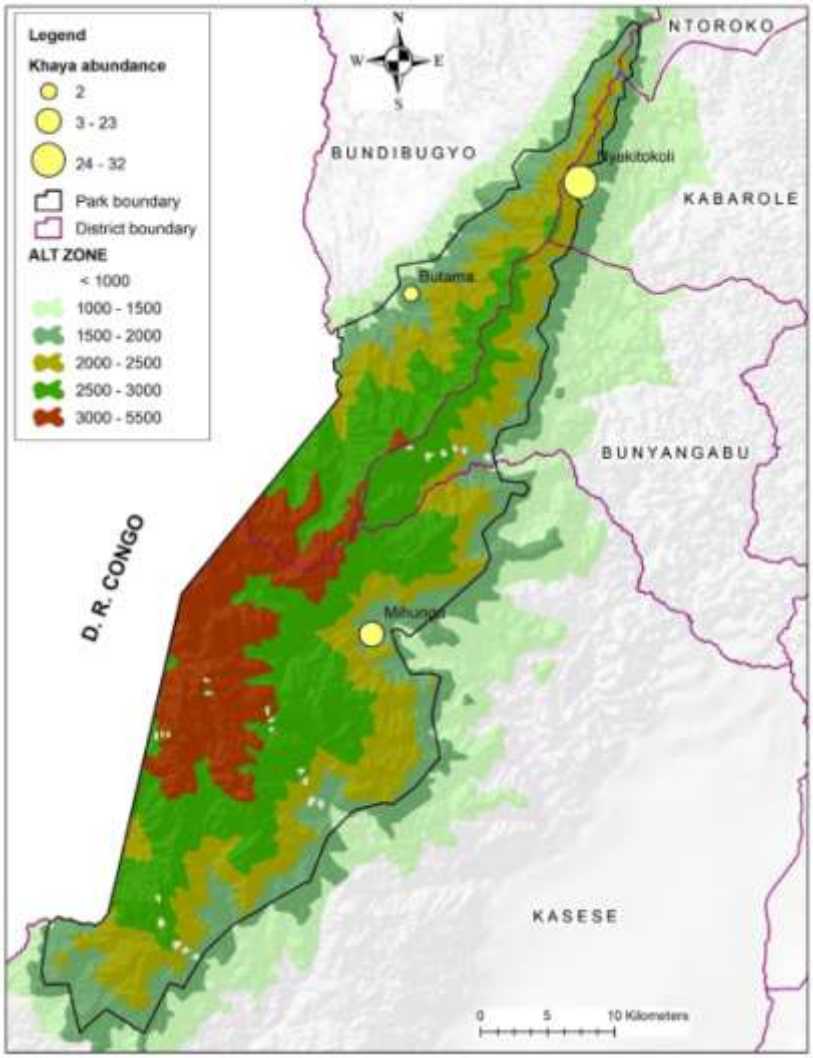

Figure 15. Relative Abundance of*Khaya grandifoliola* in sampled sites of Rwenzori Mountains National Park. *(Large yellow dots show higher abundances than small dots)*

Podocarpus latifolius: *Podocarpus s*sp., were recorded only in the southern and central areas of RMNP. It is mainly concentrated within central areas along Mubuku ridge up to Nyabitaba between 2000m – 2500m.a.s.l and also in Ihandiro within1500 – 2000m.a.s.l(Figure 16). It is likely that populations have been depleted from the rest of the more accessible areas.

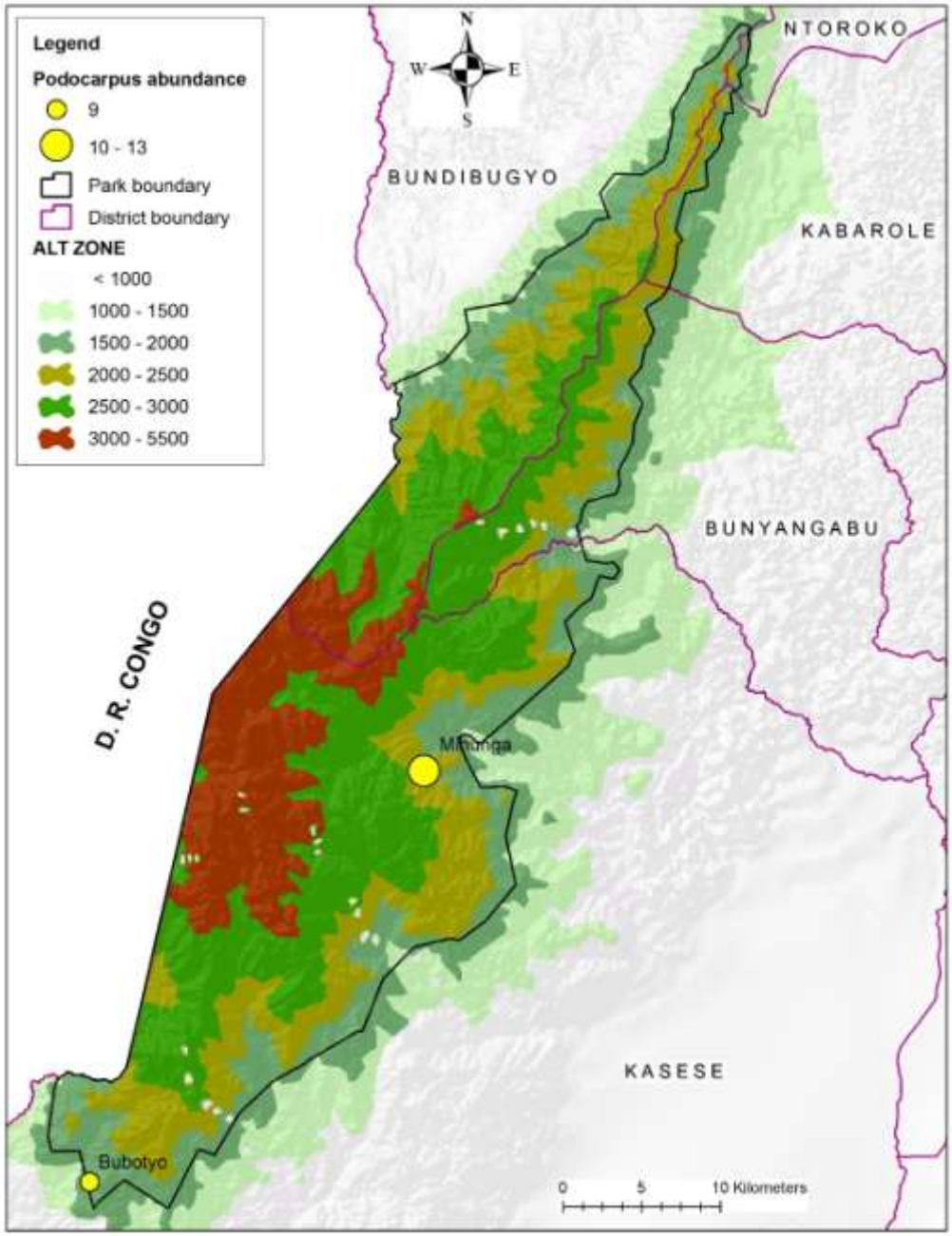

Figure 16. Relative Abundance of *Podocarpus latifolius* in sampled sites of Rwenzori Mountains National Park. *(Large yellow dots show higher abundances than small dots)*

4.0. CONCLUSION AND RECOMMENDATIONS

4.1. Conclusion

This plant survey therefore has enabled UWA to determine the abundance of target species in the sampled sites. The main conclusions are as follows:

In the case of Bamboo, **t**he data from 30 plots covering a total area of 3000m^2 recorded a total of 1688 stems. It is noted that the abundance of bamboo within the study sites is more or less uniform given that it occurs within a specific vegetation type 'the bamboo zone'.

Bamboo: In terms of condition of Bamboo stems, up to 19% were dry and 73% mature. This implies that up to 19% of bamboo could be permitted for resource access while 73% will be available for regulated harvestable beginning the next dry season. However, the survival of Bamboo is a lot dependent on the extent to which the illegal harvesting for commercial purposes will be regulated. It was also noted that, only 4% of bamboo was young implying that there is less regeneration of bamboo in the forests as compared to harvest rate.

Prunus africana: The species is mainly concentrated in the northern parts of the RMNP within Kabarole and Bundibugyo districts. The species is much less abundant in the southern and central parts of the park. Similarly, the harvesting was common in the same areas and indeed signs of felling and debarking were common. Protection of this species requires intensified patrols within the **'Prunus Hotspots'**.

Mahoganies: Two species were encountered *Khaya grandifoliola* and *Entandrophragma angolense*. The two species are generally uncommon, only concentrated within the Mubuku valley in the central part of the park and Nyakitokoli in the northern parts of the park. It is likely that these species survive in sites that are difficult to access for illegal harvesting. Indeed they require intensified patrols to protect the surviving populations. It would be necessary to conduct additional studies within these sites to ascertain the relationship between the occurrence of *P. africana* and the environmental factors.

Podocarpus latifolius: *Podocarpus* sp., was recorded only in the southern and central areas of RMNP. It is likely that populations have been depleted from the rest of the more accessible areas due to logging for timber. The sites of surviving species require intensified patrol efforts.

4.2. Recommendations

Indeed, the populations of the target species appear to be facing excessive pressure of utilization. There is a likelihood that the wild populations will be depleted unless effective regulatory measures are put in place. The study therefore recommends the following actions:

1. Strengthen the patrols within the park to ensure that the illegal activities are minimized. Sites where the target species are relatively abundant, should be considered 'hotspots' and offered better protection.
2. Promote the multiplication of planting materials of the target species within the nurseries in the areas in the vicinity of the Rwenzori Mountains National Park. These will then be distributed to the communities for planting on farm.
3. In the case of Bamboo, mechanisms of regulated resource use that are in place need to be reviewed to plug the loopholes. Where there are no mechanisms in place, efforts should be made to sign the required agreements with the communities. In such cases, the user groups should be helped with enforcement to deter commercial harvesters.
4. In the case of species such as *Prunus africana* for which the bark is harvested, the communities should be sensitized on the risks associated with unregulated bark harvesting and felling such high value species. In some cases, sustainable methods of bark harvesting have been developed and the communities may be trained in these as they prepare to utilize on-farm populations when planted.
5. Detailed studies covering the regeneration of target species should be commissioned to ensure that the population size class structures can be meaningfully assessed. In the present case, the lower limit was 10 cm DBH based on constraints in time and resources.

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APPENDIX

Appendix 1. Complete list of tree species recorded in the study sites

Taxon	KB03	KB06	KB02	KB07	KB05	KB01	CC05	KT06	KB04	CC04	KB08	IH03	CC07	CC03	IH05	KT03	CC06	KB09	KT04	CC01	IH06	CC09	CC02	KT05	CC08	KT02	IH02	BU05	KB10	BU01	BU02	BU03	BU08	BU09	KT01	IH01	BU06	BU04	BU07	IH04
Alangium chinense	3	0	1	0	0	1	0	0	3	0	0	0	0	0	0	0	0	1	3	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0
Albizia gummifera	4	0	2	1	0	5	3	7	2	2	2	1	1	0	0	4	2	2	0	3	2	0	0	0	0	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Allophylus macrobotrys	0	5	3	6	4	0	0	0	4	0	1	0	0	0	0	0	0	2	2	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Anningeria adolfifriedericii	4	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Blighia unijugata	0	0	0	0	0	0	4	0	0	3	0	0	3	0	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cassine aethiopica	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Celtis africana	0	0	0	0	0	0	2	0	0	5	0	0	5	0	0	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Croton megalocarpus	0	0	4	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Cyathea manniana	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	3	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
Dombeya goetzei	0	0	3	0	0	0	4	0	0	4	0	0	4	0	5	0	0	0	0	1	0	0	0	0	0	0	0	3	3	3	2	0	1	0	1	0	4	2	0	0
Dracaena afromontana	4	4	0	4	0	5	2	0	0	0	0	0	0	3	1	4	0	0	0	0	0	0	1	0	0	1	0	0	0	0	0	0	0	3	0	0	0	0	0	0
Entandrophragma angolense	0	0	0	0	0	0	3	0	0	2	0	0	2	0	0	0	0	0	0	1	0	0	0	0	1	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0
Erythrococca bongensis	1	1	5	0	0	5	0	0	0	0	0	0	0	0	0	0	0	2	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ficalhoa laurifolia	1	0	1	1	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0
Ficus exasperata	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ficus mucuso	0	0	0	0	0	0	3	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Ficus natalensis	2	0	0	1	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Galiniera saxifraga	4	9	4	4	2	4	0	8	4	0	3	3	2	3	2	4	2	2	4	0	4	4	2	4	3	2	3	0	1	0	0	0	0	0	4	2	0	0	0	0
Khaya grandifoliola	4	0	4	0	0	3	0	0	1	0	0	0	5	0	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0
Lepidotrichilia	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0

volkensii																																									
Macaranga kilimandscharica	0	1	0	0	0	0	0	3	1	2	0	2	0	4	3	4	3	0	1	4	0	5	3	4	0	0	1	3	0	0	3	0	3	2	0	0	1	0	2	2
Maesa lanceolata	0	4	0	9	5	0	0	0	4	1	10	0	0	0	3	1	0	2	2	0	0	0	0	0	0	2	0	2	0	4	0	0	0	0	3	0	0	0	0	0
Myrianthus arboreus	0	0	0	0	0	0	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2
Podocarpas latifolius	0	0	0	0	0	0	0	0	0	0	0	9	0	4	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Polyscias fulva	0	6	0	3	4	1	2	0	3	3	0	1	0	0	0	1	0	1	0	0	2	4	0	1	0	0	1	0	0	0	0	0	0	0	1	0	0	0	0	0
Prunus africana	2	1	2	1	6	0	0	0	1	0	2	0	1	0	0	0	6	2	0	0	0	0	0	2	0	0	0	3	1	3	0	4	3	4	0	0	1	1	2	0
Psychotria mahonii	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	3	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rapanea rhododendroides	0	0	0	0	0	0	0	0	0	0	0	0	0	4	0	0	0	0	0	0	0	0	5	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhus vulgaris	1	0	1	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Rhytigynia kigeziensis	5	3	4	4	4	1	0	6	4	0	4	1	0	3	0	2	0	3	0	2	3	0	3	5	0	1	0	0	5	0	4	0	0	0	0	3	0	0	0	0
Shirakiopsis elliptica	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	1	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
sp1	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sp2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sp3	9	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
sp4	0	0	0	0	4	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Strombosia scheffleri	4	1	0	0	0	2	2	0	0	0	0	2	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Tabernaemontana holstii	0	0	0	0	0	0	4	0	0	0	0	0	0	0	2	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	2	2	0	0	0	0	0	0	0
Trema orientalis	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Xymalos monospora	3	4	0	2	2	0	0	0	0	1	3	0	0	0	0	1	0	0	4	1	4	0	0	0	0	0	4	0	0	0	0	2	0	0	0	3	0	0	0	0

Appendix 2.Tree species Diversity in Sample Plots within the Rwenzori Mountains National Park

Sample	Simpson's Index	Fisher's Alpha Index	Shannon Wiener's Index
BU01	3.75	1.453	1.089
BU02	4.5	2.471	1.28
BU03	5	2.471	1.332
BU04	5	3.167	1.055
BU05	5.5	2.261	1.373
BU06	2.5	2.388	0.868
BU07	5	3.167	1.055
BU08	5.143	2.759	1.311
BU09	3.6	1.576	1.061
CC01	12.75*	9.265*	2.168
CC02	6.667	3.487	1.684
CC03	7.778	2.807	1.782
CC04	12.5*	7.193*	2.269
CC05	13.1	5.401	2.261
CC06	7.037	3.828	1.808
CC07	8.161	4.352	1.931
CC08	9.75	6.182	1.845
CC09	4.857	1.649	1.381
IH01	4	1.743	1.082
IH02	7.333	7.029*	1.748
IH03	6.25	5.043	1.908
IH04	3	1.592	0.693
IH05	7.5	3.677	1.832
IH06	7.65	3.151	1.754
KB01	12.28*	6.784	2.329*

KB02	14.65*	7.304*	2.445*
KB03	14.17*	7.163*	2.55*
KB04	12.19*	6.677	2.255
KB05	10.39	3.997	2.143
KB06	9.037	5.099	2.163
KB07	8.63	5.4	2.143
KB08	5.508	3.948	1.799
KB09	19.0*	10.9*	2.333*
KB10	4.231	3.538	1.367
KT01	4	2.759	1.215
KT02	6.5	6.182	1.733
KT03	8.4	4.717	1.922
KT04	8.55	4.003	1.868
KT05	5.217	2.496	1.49
KT06	5.273	1.741	1.562
All Sample Index	18.42	8.693	3.171
Jackknife Std Error	1.782	0.6363	0.08215

Appendix 3.Tree species not recorded in each of the respective sites

Species not recorded in Kateebwa Plots
Anningeria adolfifriedericii
Blighia unijugata
Cassine aethiopica
Celtis africana
Croton megalocarpus
Cyathea manniana
Entandrophragma angolense
Erythrococca bongensis
Ficalhoa laurifolia
Ficus exasperata
Ficus mucuso
Ficus natalensis
Khaya grandifoliola
Lepidotrichilia volkensii
Myrianthus arboreus
Podocarpas latifolius
Rapanea rhododendroides
Rhus vulgaris
Shirakiopsis elliptica
sp1, sp2, sp3, sp4s
Strombosia scheffleri
Tabernaemontana holstii
Trema orientalis

Species not in the Central Circuit plots
Alangium chinense
Allophylus macrobotrys
Anningeria adolfifriedericii
Cassine aethiopica
Cyathea manniana
Ficalhoa laurifolia
Ficus exasperata
Ficus natalensis
Lepidotrichilia volkensii
Myrianthus arboreus
Psychotria mahonii

Rhus vulgaris
sp3, sp4

Species not in the Bukara Plots
Albizia gummifera
Allophylus macrobotrys
Anningeria adolfifriedericii
Blighia unijugata
Cassine aethiopica
Celtis africana
Croton megalocarpus
Cyathea manniana
Entandrophragma angolense
Erythrococca bongensis
Ficus exasperata
Ficus mucuso
Ficus natalensis
Galiniera saxifraga
Myrianthus arboreus
Podocarpas latifolius
Polyscias fulva
Psychotria mahonii
Rapanea rhododendroides
Rhus vulgaris
Shirakiopsis elliptica
sp1, sp2, sp3, sp4
Strombosia scheffleri
Trema orientalis

Species not in the Ihambiro Plots
Alangium chinense
Allophylus macrobotrys
Anningeria adolfifriedericii
Blighia unijugata
Cassine aethiopica
Celtis africana
Croton megalocarpus
Entandrophragma angolense
Erythrococca bongensis

Ficalhoa laurifolia
Ficus exasperata
Ficus mucuso
Ficus natalensis
Khaya grandifoliola
Lepidotrichilia volkensii
Prunus africana
Psychotria mahonii
Rapanea rhododendroides
Rhus vulgaris
sp1, sp2, sp3, sp4
Trema orientalis

Species not in the Kabarole Plots
Blighia unijugata
Celtis africana
Cyathea manniana
Ficus mucuso
Lepidotrichilia volkensii
Myrianthus arboreus
Podocarpas latifolius
Psychotria mahonii
Rapanea rhododendroides
Shirakiopsis elliptica
sp1, sp2
Tabernaemontana holstii
Trema orientalis