

Project Title: Identifying Environmental factors affecting the habitat of Grey Crowned Crane (*Balearica regulorum*) in and around Nyungwe National Park, Rwanda



Final Report to The Rufford Foundation

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Introduction

Grey Crowned Crane (*Balearica regulorum*) population is declining in the world mainly as a result of increasing human population, habitat loss, trade, and the illegal removal of birds and eggs from the wild (BirdLife International. 2016). There are two sub-species of Grey Crowned Crane: The Eastern African Grey Crowned-crane (*B.r.gibbericeps*) and the Southern African Grey Crowned-crane (*B.r.regulorum*). In 2014, the populations of Grey Crowned Crane is estimated between 17,700-22,300 mature individuals across 16 African countries including Rwanda, Uganda, Kenya among others from > 100,000 individuals in 1985 . Because of the population decline, Grey Crowned Crane is listed as Endangered on the IUCN Red Data List due to the decline of the species of up to 80% over the period of less than 50 years (BirdLife International. 2016). Grey Crowned-cranes have low reproduction rates and relatively high mortality rates, especially in captivity making them difficult to recover from population decline. Across their natural habitat in Africa, the populations of cranes suffer a constant pressure from chicks for trade and eggs collection. Habitat degradation and conversion of wetland in agriculture land is also a big contributor to reduced success cranes breeding. It reduced the capacity of adult cranes from tending to nests and their chicks. Threats to cranes are further exacerbated by habitat loss and degradation of the wetlands on which they depend, most often caused by agricultural encroachment, changes in hydrology, mining and siltation.

Grey Crowned-cranes require a mixed wetland-grassland habitat mainly in wetlands, on riverbanks, around dams, in open savannas and in short to medium height grasslands and can forage agricultural lands. They can nest within or on the edges of permanent or temporary wetlands within partly disturbed wetlands, severely disturbed or intact wetlands. Grey Crowned-cranes forage in short to medium height open grasslands, feeding on grass seeds, small toads and frogs, insects and other invertebrates as well as ripening cereal crops including soya beans, ground nuts, millet, potatoes and maize. Unfortunately, foraging on agricultural lands and crops is often translated into conflict between them and farmers, which can result into retaliate injuries or killing. In Rwanda, wetlands, which are parts of major habitats of Cranes, are experiencing many challenges as a result of land use conversions mainly for agricultural intensification and energy production, over utilization of and exploitation of natural resources (Nile Basin Initiative, 2019). Although Rwanda wetland ecosystems served as soft refuge for biodiversity and genetic resources (Kanyamibwa, 1998), pressure on them have been intensified in last 2 decades. The increased human population (9.708 million in 2008 and 12.63 million in 2018) with high population densities new wetlands, high agriculture production potential, and availability of water especially in dry seasons, high siltation rate coursed by erosion and unsustainable mining from mountainous zones of the country, expending agriculture land, and overharvesting of wetland resources altogether affect and threaten wetland biodiversity and jeopardize their ecological values ecological integrity.

Rwanda's four national parks namely Akagera National Park, Volcanoes National Parks, Nyungwe National Park and Gishwati-Mukura National Park are the most areas set aside for

conservation of biodiversity. Taken together, these protected areas are home and provide suitable habitats for 703 bird species as reported (Gaël 2018). However, there are also many avifauna species, which forage, and breed at the forest edges and in farmlands. Among the birds found at the edge of natural habitat and farmlands include The Endangered Grey Crowned Crane (*Balearica regulorum*). This species was classified as Vulnerable in 1996, and Endangered (2016) on the IUCN red list of Threatened species. In Rwanda, Grey Crowned Crane is classified as Endangered and protected by Law governing biological diversity (Official Gazette n° Special of 11/11/2021) with an estimated of 487 individuals (Nsengimana & Becker, 2017). Conservation activities of Grey Crowned Crane in Rwanda are mainly conducted by Rwanda Wildlife Conservation Association (RWCA). The effort of RWCA to conserve Grey Crowned Crane Rwanda is significant (Nsengimana & Becker, 2017). The association managed to remove from captivity and reintroduce 166 individual cranes in the wild, carrying out surveys and conservation education activities in last decade. WCS (2008) lists Grey Crowned Crane as scarce non-forest bird species, but, the distribution, habitat, and population of this species in the swamps in and around Nyungwe National Park is unknown or little known.

Through, Rufford Small Grants, I received generous grant to implement one year research project entitled “Identifying Environmental factors affecting the habitat of Grey Crowned Crane (*Balearica regulorum*) in and around Nyungwe National Park, Rwanda”.

The goal of this study was to provide scientific information necessary for park managers to make decisions on the conservation of Grey Crowned Cranes (*Balearica regulorum*), and prevent local extinction of this Endangered species. Four specific objectives were to: (1) assess the quality of habitats for Grey Crowned Cranes (*Balearica regulorum*), (2) identify spatial distribution range of Grey Crowned Cranes in wetlands in and around NNP, (3) assess the threats facing the Grey Crowned Cranes and its habitat in and around Nyungwe National Park, and (4) conduct population size survey of Grey Crowned Cranes (*Balearica regulorum*) in selected wetlands around NNP. This final project report describes the achievement, finding, and recommendations from the implementation of this project study.

1. Planned activities and achievement of planned activities

1.1. Acquisition of research permit and administrative contacts

We processed application and acquired research permit from Nyungwe Management Company/African Parks, the company, which is managing Nyungwe National Park on behalf of the Government of Rwanda. We made contacts and meeting with Rwanda Environmental Management Authority (REMA) officer at Nyamasheke district, and executive secretaries of Rangiro, Kagano, Kanjongo and Bushekeri to inform them about the project before field data collection was started. They all appreciated, supported, and continuously facilitated the implementation of this project.

1.2. Training of field research assistants in data collection techniques

We hired and trained 7 field assistants to collect field data. Two-day training covered major topics including vegetation plot sampling techniques, reconnaissance transects walk and point count sampling for birds, and conducting qualitative interview and Focus group discussion techniques with key

informants in the communities. We developed and discussed datasheet, key guiding question developed for interview to make sure the team have the same understand and interpretation of datasheet and questions. We also trained field assistant how to use GPS to collect geographical locations, and the use of binoculars to collect bird data.



Claver and team during the training exercise at Kamiranzovu swamp, Kagano sector © Claver

1.3. Acquisition of field equipment

Our research activities required field equipment. We purchased machetes, raincoats, jangle boots, pencils, clipboards, binoculars, gradient metric ruler quadrates metal and data sheets (printed) for implementation of this project activities. We developed datasheet for vegetation and bird count, key guiding questions to guide interview. We also hired a vehicle to facilitate movements from site to site for field data collection, and contacts with administrative local authorities.

2. DATA COLLECTION

Different methodology and approach was used to collect data presented in this project report.

2.1. Methodology

Different methodologies were applied to collect data presented in this report including transect walk and point bird sampling, circular plot for vegetation, key informant interview, and qualitative interview with community around studied swamps. This study was conducted in 8 sites: Banda, Gahisi, Kimiranzovu inside NNP, Kamiranzovu edge NNP, Kimiranzovu REMA protected swamp, Kirambo, Munini, and Rangiro (Figure 1).

Figure 2. Photos of field team sampling resource availability of Grey Crowned Crane in Kamiranzovu swamp, Nyungwe National Park. © Claver. Claver and the team sampling vegetation plots in Kamiranzovu swamp inside the park (left) and near the Lake Kivu (right)

2.1.2. Counting Grey-Crown Cranes.

We used point count methodology along reconnaissance transects (following existing pathway in the swamps). We walked the transects twice a month from February to June 2022 and counted and recoded all Grey Crown-Crane on our sight. We recorded number of individuals sighted, activity, structure, distance from observer, geographical location, whether, and habitat types. We also recorded other bird species we encountered in these sites. Ad-labutum/opportunistic data was used to record bird species encountered while walking in the swamp to make a checklist of birds in surveyed sites



A couple of Grey Crowned Crane foraging in a rice harvesting farm at Kamiranzovu swamp. © Claver
Nest of Grey Crowned Crane with a hatched egg observed in KARUNDURA swamp (Kirambo) near Lake Kivu. © Claver

2.1.3. Interview and Focus Group

We conducted qualitative interviews with 69 people (18 years old and above) in February 2022 from 7 cells in 4 sectors in which habitat and bird counts were sampled. The interview lasted between 10 and 15 minutes and was based on 7 pre-defined questions on historic highlighting of cranes, abundance, and threats to the cranes. We organized 3 focus group discussion to probe more data on cranes and threats to them.



Interview with farmers in wetlands/habitats of cranes in KARUNDURA



2.2. Data analysis

Descriptive statistics and mainly frequencies were used to summarize the data that was then presented in the form of tables and graphics. Excel was used to summarize data whereas QGIS was used to produce distribution maps for crane.

3. RESULTS

3.1. Demographic information of the respondents

We interviewed 69 people, of which 52.2% were male and 47.8% were female, and all of them reside or do their daily activities in the wetland/swamp near them. Age group of respondents ranged from 18-30 (20.2%), 31-40 (30.43%), 41-50 (21.7%), and older than 50 years (27.5%); and lived in the area from 6 to 10 years (7.2%) to more than 20 years (66.6%).

Although we did not ask respondents about their main occupation, most of them were reached in their farms. The major crops they grow are rice, vegetables, roots among others.

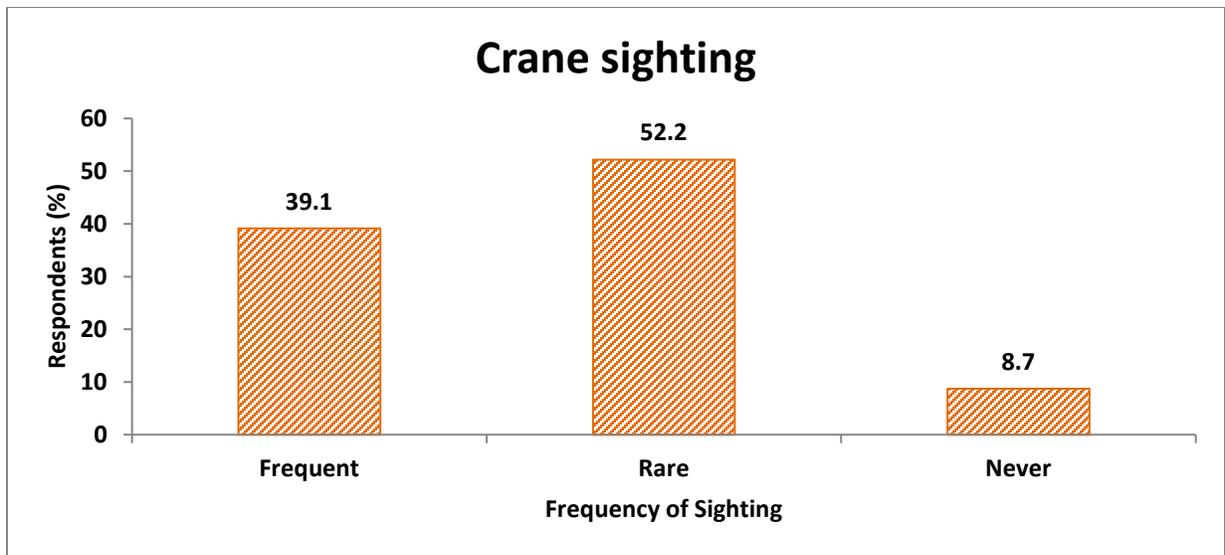
3.2. Population and spatial distribution of cranes

Cranes were sighted in 3 sites (Kirambo, Kamiranzovu REMA protected swamp, and Rangiro. On very few occasions, we recorded 2 flocks of cranes (4 individuals), 16 occasions of pairs, and 4 occasions of single individual cranes. In total, we recorded 44 individuals, with the majority being recorded in Kirambo followed by Kamiranzovu REMA protected swamp, and Rangiro (Table 1). We spotted 1 nest with hatch remains indicating that the survey was conducted in breeding season. Cranes were sighted throughout the months of the study (February – June 2022). However, there was no crane sighting in Kamiranzovu (inside Nyungwe National Park). We were also informed by the local people (91% of respondents) that they have seen cranes in their village. The majority of respondents said they saw cranes in the same month of the survey (32%) or the year of the survey (22%). Most people (82.5%) told us that they saw cranes in pair whereas few people (6%) said that they saw crane flock of 4 individuals or 1 individual. None of our respondents saw more than 4 cranes at the same time.

When asked how often they see cranes, 36 (52%) respondents said they see crane rarely whereas 26 (39%) said they see crane more often. Most people (85.4%) saw cranes feeding, 12.9% flying over.

Table 1 Numbers of *Balearica regulorum* recorded in the different sites

Sites	Months					
	February	March	April	May	June	Total
Kamiranzovu REMA protected	2	0	2	4	4	12
Kirambo	2	8	11	2	4	27
Munini	0	0	0	0	0	0
Gahisi	0	0	0	0	0	0
Rangiro	1	2	2	0	0	5
Kamiranzovu edge NP	0	0	0	0	0	0
Kamiranzovu inside NP	0	0	0	0	0	0
Banda	0	0	0	0	0	0
Total	5	10	15	6	8	44



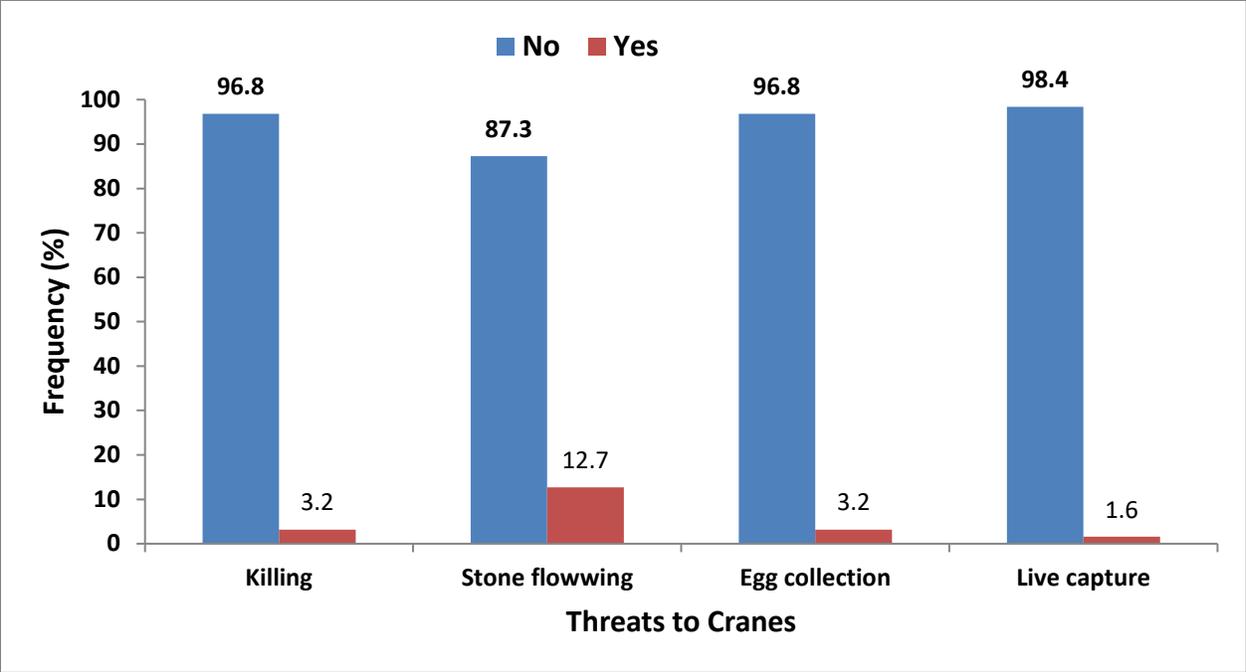
Frequency of *Balearica regulorum* sighting

3.3. Threats affecting *Balearica regulorum* in wetlands around Nyungwe National Park

We assessed threats to cranes in their natural habitats using direct observation and qualitative interview. The results showed that the main threats to this species are habitat loss and disturbances. The majority (95.5%) of people interviewed said that they use wetlands for agriculture, and 4.3% use the wetlands for fodder collection. Also, 78.4% of 57 sampled plots were marked for fodder collection followed by agriculture (19.6% of plots). Also 54.4% of sampled habitat was fallow cropland, followed by relatively undisturbed swamp (26.3%), and agriculture (17.6% of total sampled plots). We also observed natural hazards, especially flooding caused by erosion from surrounding uphill topography, and mining practices. It seems that direct threats to cranes were not common in surveyed sites. The percentage of people who mentioned crane killing, live capture, egg collection and stone throwing was relatively low stone throwing mentioned by 12% of respondent (Figure 2). One key informant said that he saw a couple of cranes of which 1 was limping possibly because it was injured, and subsequent days, he saw only 1 individual (possible its partners died).



Flooded along KARUNDURA swamp © Claver



Threats to Cranes in studied wetlands





Grey Crowned Crane foraging in vegetable growing farm in Rwakina swamp (Kirambo) © Claver

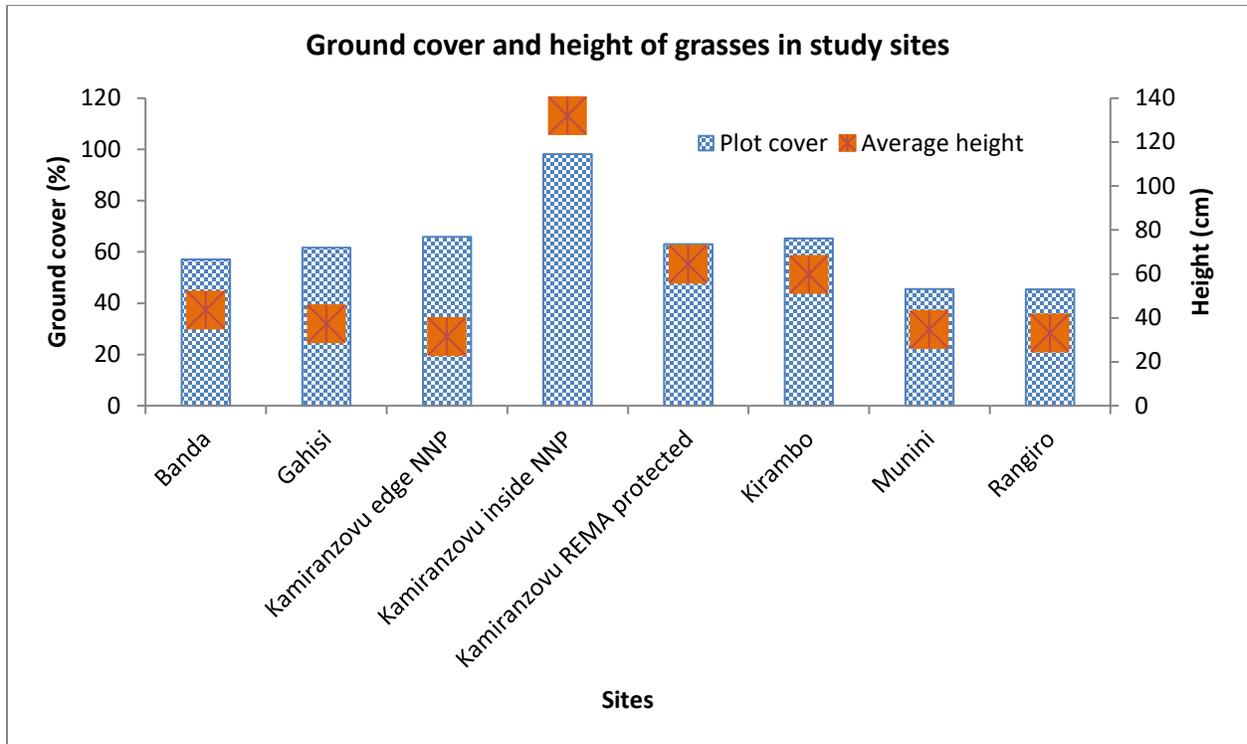
3.4. Perception of Grey Crowned Crane on Crop Raiding

The majority of respondents (72%) said that cranes did not damaged/raided crops whereas 28% said that cranes raided their crop especially maize. However, the severity of crane crop raiding was low. Out of 14 people who experienced crop raiding by cranes, 11 (78.4%) said that the severity of crop raiding was low while 3 (21.4%) said that crane crop raiding was high. None of rice grower said that cranes are rice raiders.

3.5. Habitat quality assessment for cranes

Habitat quality was collected in 57 quadratic plots (0.5 x 0.5 m) inside the habitat of cranes. We measured 3 dominant grass/herbaceous species in a plot, and we measured their height. Overall, wetland vegetation (less disturbed) occupied 25% of all sampled plots and was in 3 (33.3%) sites. Fallow cropland and cropland occupied 38.3% and 22.9% respectively (Table 2).

We measured ground cover for surveyed plots and sub-plots (Figure 6). Average plot ground cover ranged from 55% (Rangiro) to 89% (Kamiranzovu swamp inside the NNP). In regard to the height of herb/grasses, the average height ranges from 31.5 cm (Kamiranzovu edge NNP) to 132 cm (Kamiranzovu inside NNP).



Ground cover and average height of grasses

Table 1. Proportion of habitat types in surveyed sites

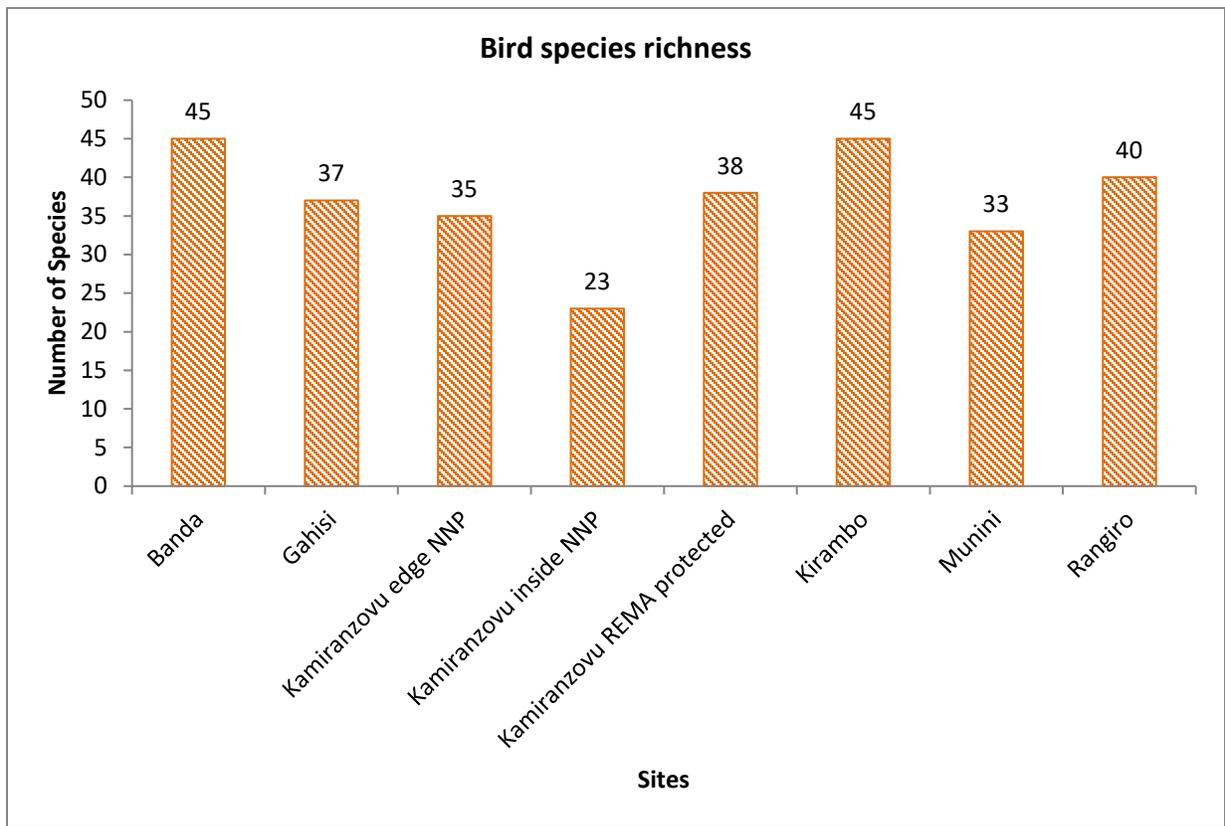
Sites	# plot	Percentage (%) of Habitat type			
		Bare ground	Cropland	Fallow cropland	Wetland vegetation
Banda	12	0	0	100	0
Gahisi	6	0	0	6	0
Kamiranzovu edge NNP	6	16.7	16.7	66.7	0
Kamiranzovu inside NNP	6	0	0	0	100
Kamiranzovu REMA protected	9	0	66.7	0	33.3
Kirambo	6	0	33.3	0	66.7
Munini	6	0	50	50	0
Rangiro	6	0	16.7	83.3	0
Average		2.1	22.9	38.3	25.0

3.6. Other bird species

In total, 104 bird species including cranes were recorded in surveyed sites. The majority of bird species was water/wetland or using both water and upland habitat. Common wetland bird species recorded. Thirty-four (34) species of birds (~1/3 of recorded species appeared in 50% or more sites we surveyed. These species include chronological order *Bostrychia hagedash*; *Buteo augur*; *Cisticola chubby*; *Colius striatus*; *Lanius collaris*; *Lanius mackinnoni*; *Motacilla capensis*; *Ploceus baglafecht*; *Pycnonotus barbatus*; *Ardea melanocephala*; *Centropus monachus*; *Eminia lepida*; *Motacilla aguimp*; *Ploceus cucullatus*; *Ploceus xanthops*; *Chalcomitra senegalensis*; *Cinnyris venustus*; *Corvus albus*; *Cossypha*

heuglini; Estrilda nonnula; Lonchura cucullata; Muscicapa adusta; Psalidoprocne pristoptera; Scopus umbretta; Streptopelia semitorquata; Terpsiphone viridis; Turdoides jardineii; Bycanistes subcylindricus; Cyanomitra verticalis; Estrilda astrild; Laniarius aethiopicus; Melaenornis fischeri; Nectarinia kilimensis; Streptopelia capicola.

Other hand, 37 species appeared in only one site and include *Actophilornis africanus; Amaurornis flavirostra; Amblyospiza albifrons; Apalis jacksoni; Batis molitor; Bradypterus baboecala; Bradypterus cinnamomeus; Bradypterus graueri; Cisticola galactotes; Corythaeola cristata; Cuculus clamosus; Estrilda kandti; Estrilda paludicola; Estrilda quartinia; Euplectes ardens; Gallirex johnstoni; Graueria vittata; Hirundo smithii; Indicator variegatus; Lagonosticta senegala; Melaenornis ardesiacus; Mesopicos griseocephalus; Muscicapa aquatic; Onychognathus walleri; Oreolais ruwenzorii; Oriolus percivali; Passer griseus; Phalacrocorax africanus; Phalacrocorax carbo; Ploceus alienus; Ploceus ocularis; Polyboroides typus; Rallus caerulescens; Serinus striolatus; Spizaetus africanus; Telophorus dohertyi; and Turdus abyssinicus.*



4. DISCUSSION

We are living in a human dominated landscape where land conversion accelerated animal population to decline and lose their habitat. Although Rwanda has many wetlands that support biodiversity including bird species, human activities pressure threatens these wetlands mainly because they are transformed into agriculture farmlands (Kanyamibwa, 1998). Pressure on Rwanda wetlands causes a heavy concern for the loss and decline of species population and diversity. Grey Crowned Cranes (*Balearica regulorum*) is dependent to wetlands for breeding and foraging (Mutunga & Mitau, 2017). We studied Grey Crowned Cranes in 8 sites of wetlands in and outside Nyungwe National Park to assess the quality of habitat, estimate the population size and their spatial distribution, and threats to them and their habitat. We used

Crane Counts, quadratic vegetation plot sampling to estimate the population and habitat quality of Cranes, and qualitative Focus Group Discussion and Key informant interview to assess community awareness and threats of Cranes and their habitat. The results for this study made clear that the wildlife conservation efforts should not overlook wildlife, especially bird community outside traditional protected areas. Our six-month efforts to collect data on avifauna species in wetlands inside and outside of Nyungwe National Park, almost 1/3 of bird species found in Nyungwe National Park were also found in wetlands outside of this relatively well national park. However, we expected to see more Cranes sight inside NNP because it is well protected. Contrary, Gray Crowned Cranes were sighted in 3 out 7 wetland sites sampled outside NNP, and 2 of them being the sites where the habitat has at least less disturbed wetland vegetation and agriculture coexist together.

The local farmers in wetlands outside NNP know the Grey Crowned Crane that they refer to as ‘Umusambi’. In the past, the cranes visited different areas more often, but this has changed gradually with the numbers declining as witnessed by farmers who said that the number of the cranes had reduced for the past few years as they now see only few individuals, and less often. Although we could not get a reference number to compare in this particular area, it is obvious that the population of Cranes has declined and ± 20 individuals remain in wetlands we surveyed with the largest Crane flock sighted was 6 individuals.

The primary threat facing the Grey Crowned Crane in wetlands outside NNP is habitat loss. Although there seemed to be no apparent risk for the cranes being killed due to hunting, wetland conversion for agriculture lands, and fodder collection to feed and bedding for livestock put Cranes’ habitat at higher habit loss, and higher risk for breeding sites. It seems there is no major issue of direct human-crane conflict in wetlands outside NNP as reported by farmers saying that Cranes do not raid crop rice, which is the main crop grown in these wetlands. This contradicts what has been reported elsewhere in Kenya that Cranes raid crop rice grains (Mutunga & Mitau, 2017). However, presence of food, shelter and breeding sites are vital determinants of presence or absence of these birds in any region. Fodder collection and habitat conversion to agriculture farm significantly reduced the habitat requirement for Cranes breeding. These anthropogenic activities put pressure on wetland vegetation height under 60–90 cm required for Crane breeding (Wamiti et al., 2022). Habits for Cranes remain marginal in wetlands outside NNP. Even though we are not certainly sure why there was no Crane sighted in Kamiranzovu swamp inside Nyungwe National Park, the height (~130 cm) of vegetation is higher than a required, and higher level of water could be the reasons limiting Cranes distribution in this swamp. Finally, the wetlands outside NNP are worth for conservation of very important avifauna species richness and deserve conservation measures. Most of these species are wetland dependent bird species or agriculture and forest edge adapted species. These wetlands can be potential sites for community birding as birding tourism market segment is being developed and increasing in Rwanda.

5. CONCLUSION

The main purpose of this study was to assess the population, quality of habitat and threats to the Grey Crowned Crane in the wetlands in and around Nyungwe National Park. Our field records evidence the presence of Cranes and the population estimate is less than 20 individuals. The remaining Grey Crowned Cranes are constrained by habit loss due to habitat conversion into agriculture farmlands, and fodder collection which significantly modified and reduces breeding sites of this Endangered species. This study found out that these wetlands are dominated by crop farming (mainly rice, maize and roots) and are used as a source of fodder to feed and make bedding for livestock. Hence, there is an urgent need to protect and conserve the remaining margin suitable habitat as breeding sites of this species. Protecting these wetlands might ensure the recovery of Grey Crowned Crane as well as other bid species found in these wetlands outside NNP.

6. CRANE CONSERVATION RECOMMENDATIONS

The results presented in this report were presented (Power Point presentation) to the key stake holders in the conservation and management of NNP and its surrounding wetlands. Nearly 100 people attended our presentation including conservationists, environmental managers, local authorities (Nyamasheke district and sector level), sector technicians (agronomists and veterinarians) and farmer representatives. The objective of this presentation was to share the results from this study and raise awareness for the conservation and protection of Grey Crowned Crane in their natural habitats. After the presentation, participants used their time and position in the communities to develop the following conservation and management recommendations.

1. Enforcement of conservation of habitat for Grey Crowned Crane by limiting human activities to limit continuous and growing habitat destruction and reduction for cranes and other birdlife.
2. Growing indigenous tree species within 50m of protected buffer zone along the Kivu in order to restore and sustain the habitat of cranes and other birdlife in the area
3. Sensitization and awareness raising of community about the wildlife protection including birdlife and their habitat especially suitable breeding ground.
4. To conduct more research focusing different wild species outside of protected areas.
5. Share the results with higher conservation institutions, policy and decision makers
6. Education of young generation about conservation of endangered species including cranes
7. Develop awareness about the threats of Grey Crowned Crane to the different levels of environmental protections and decision makers.
8. To develop community birding in these sites so that the community will economically benefit from the bird species found there and contribute in protection and conservation of that site.

7. CHALLENGES

During the data collection we faced some challenges that interfered with the scheduled research activities; these include: the long process of acquiring the research permit and weather conditions affected our transportation to the field due the bad roads.

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Appendix. A list of bird species recorded in wetlands in Nyungwe National Park and surrounding wetlands

Species	Banda	Gahisi	Kamiranzovu edge NNP	Kamiranzovu inside NNP	Kamiranzovu REMA protected	Kirambo	Munini	Rangiro	Frequency
<i>Bostrychia hagedash</i>	①	①	①	①	①	①		①	87.5
<i>Buteo augur</i>	①	①	①		①	①	①	①	87.5
<i>Cisticola chubbi</i>	①	①	①	①	①		①	①	87.5
<i>Colius striatus</i>	①	①	①		①	①	①	①	87.5
<i>Lanius collaris</i>	①	①	①		①	①	①	①	87.5
<i>Lanius mackinnoni</i>	①	①	①		①	①	①	①	87.5
<i>Motacilla capensis</i>	①	①	①		①	①	①	①	87.5
<i>Ploceus baglafaecht</i>	①	①	①		①	①	①	①	87.5
<i>Pycnonotus barbatus</i>	①	①	①	①	①		①	①	87.5
<i>Ardea melanocephala</i>	①	①	①		①	①		①	75
<i>Centropus monachus</i>	①	①		①	①	①		①	75
<i>Eminia lepida</i>	①	①			①	①	①	①	75
<i>Motacilla aguimp</i>	①	①	①		①		①	①	75
<i>Ploceus cucullatus</i>	①	①	①		①		①	①	75
<i>Ploceus xanthops</i>	①		①		①	①	①	①	75
<i>Chalcomitra senegalensis</i>	①	①	①		①		①		62.5
<i>Cinnyris venustus</i>	①	①	①	①				①	62.5
<i>Corvus albus</i>	①		①		①	①	①		62.5
<i>Cossypha heuglini</i>		①	①			①	①	①	62.5
<i>Estrilda nonnula</i>	①	①	①				①	①	62.5
<i>Lonchura cucullata</i>	①		①		①		①	①	62.5
<i>Muscicapa adusta.</i>	①	①	①	①			①		62.5
<i>Psalidoprocne pristoptera</i>	①	①	①				①	①	62.5
<i>Scopus umbretta</i>	①		①		①	①		①	62.5
<i>Streptopelia semitorquata</i>	①		①			①	①	①	62.5
<i>Terpsiphone viridis</i>	①	①				①	①	①	62.5

Species	Banda	Gahisi	Kamiranzovu edge NNP	Kamiranzovu inside NNP	Kamiranzovu REMA protected	Kirambo	Munini	Rangiro	Frequency
<i>Turdoides jardineii</i>	①				①	①	①	①	62.5
<i>Bycanistes subcylindricus</i>	①	①	①					①	50
<i>Cyanomitra verticalis</i>	①	①	①				①		50
<i>Estrilda astrild</i>		①	①			①		①	50
<i>Laniarius aethiopicus</i>	①	①	①					①	50
<i>Melaenornis fischeri</i>	①	①					①	①	50
<i>Nectarinia kilimensis</i>	①	①	①				①		50
<i>Streptopelia capicola</i>					①	①	①	①	50
<i>Ardea cinerea</i>	①				①			①	37.5
<i>Chrysococcyx klaas</i>	①	①						①	37.5
<i>Euplectes orix</i>					①	①	①		37.5
<i>Lonchura bicolor</i>						①	①	①	37.5
<i>Lophaetus occipitalis</i>		①	①					①	37.5
<i>Milvus migrans</i>					①	①		①	37.5
<i>Mycteria ibis</i>					①	①	①		37.5
<i>Prinia subflava</i>		①	①					①	37.5
<i>Saxicola torquatus</i>	①		①					①	37.5
<i>Vidua macroura</i>		①			①			①	37.5
<i>Actitis hypoleucos</i>						①	①		25
<i>Alcedo cristata</i>					①	①			25
<i>Anas undulata</i>					①	①			25
<i>Balearica regulorum</i>					①	①			25
<i>Bubulcus ibis</i>					①	①			25
<i>Casmerodius albus</i>					①	①			25
<i>Cercococcyx montanus</i>	①			①					25
<i>Ceryle rudis</i>					①	①			25
<i>Cinnyris regia</i>		①		①					25

Species	Banda	Gahisi	Kamiranzovu edge NNP	Kamiranzovu inside NNP	Kamiranzovu REMA protected	Kirambo	Munini	Rangiro	Frequency
<i>Cuculus solitarius</i>		①					①		25
<i>Elminia albicauda</i>			①				①		25
<i>Euplectes axillaris</i>					①	①			25
<i>Eurillas latirostris</i>			①	①					25
<i>Hirundo rustica</i>					①	①			25
<i>Merops apiaster</i>					①	①			25
<i>Musophaga rossae</i>			①			①			25
<i>Serinus sulphuratus</i>	①						①		25
<i>Tauraco schuettii</i>			①	①					25
<i>Tchagra senegala</i>	①	①							25
<i>Threskiornis aethiopicus</i>					①	①			25
<i>Zosterops senegalensis</i>	①	①							25
<i>Actophilornis africanus</i>						①			12.5
<i>Amaurornis flavirostra</i>						①			12.5
<i>Amblyospiza albifrons</i>						①			12.5
<i>Apalis jacksoni</i>				①					12.5
<i>Batis molitor</i>		①							12.5
<i>Bradypterus baboecala</i>					①				12.5
<i>Bradypterus cinnamomeus</i>				①					12.5
<i>Bradypterus graueri</i>				①					12.5
<i>Cisticola galactotes</i>						①			12.5
<i>Corythaeola cristata</i>				①					12.5
<i>Cuculus clamosus</i>	①								12.5
<i>Estrilda kandti</i>		①							12.5
<i>Estrilda paludicola</i>						①			12.5
<i>Estrilda quartinia</i>								①	12.5
<i>Euplectes ardens</i>						①			12.5

Species	Banda	Gahisi	Kamiranzovu edge NNP	Kamiranzovu inside NNP	Kamiranzovu REMA protected	Kirambo	Munini	Rangiro	Frequency
<i>Gallirex johnstoni</i>				①					12.5
<i>Graueria vittata</i>				①					12.5
<i>Hirundo smithii</i>					①				12.5
<i>Indicator variegatus</i>								①	12.5
<i>Lagonosticta senegala</i>	①								12.5
<i>Melaenornis ardesiacus</i>				①					12.5
<i>Mesopicos griseocephalus</i>						①			12.5
<i>Muscicapa aquatica</i>						①			12.5
<i>Onychognathus walleri</i>				①					12.5
<i>Oreolais ruwenzorii</i>				①					12.5
<i>Oriolus percivali</i>				①					12.5
<i>Passer griseus</i>	①								12.5
<i>Phalacrocorax africanus</i>						①			12.5
<i>Phalacrocorax carbo</i>						①			12.5
<i>Ploceus alienus</i>				①					12.5
<i>Ploceus ocularis</i>								①	12.5
<i>Polyboroides typus</i>	①								12.5
<i>Rallus caerulescens</i>				①					12.5
<i>Serinus striolatus</i>	①								12.5
<i>Spizaetus africanus</i>				①					12.5
<i>Telophorus dohertyi</i>	①								12.5
<i>Turdus abyssinicus</i>	①								12.5
Number of species	45	37	35	23	38	45	33	40	