Project report

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Project title: Applied Community-Based Approach and ICT Tool for Kahuzi Biega National Park Elephant Preservation

Name of the project leader: WASSO SHUKURU Dieudonné

Other team members: Dr. Akilimali Itongwa Justin (PhD)

Dr. Espoir Bagula Mukengere (PhD)

Prof Ayagirwe Basengere (PhD)

Prof Daud Kassam (PhD)

I. Introduction

The Democratic Republic of Congo (DRC) is home to two subspecies of elephants: Savannah elephants (*Loxodonta africana africana africana*) and forest elephants (*Loxodonta africana cyclotis*). In 2002, the forest elephant population in DRC was estimated at between 50,000 and 60,000 heads with the Kahuzi Biega National Park (KBNP) hosting a significant portion of it (Hart, cited after Blanc, et al. 2003). Over the past two decades, the population of forest elephants in DRC has drastically declined, with only an estimated 10% of the original population from 1900 remaining (Campos-Arceiz and Blake, 2011). The primary causes of this decline include civil wars, during which large numbers of elephants were illegally killed. Additionally, the expansion of human settlements leading to habitat loss, and the extensive poaching driven by the high value of forest elephant ivory, which is harder and more expensive than that of savannah elephants have also significantly contributed to the decline (Hillman-Smith et al., 2014). Despite global bans on the ivory trade, illegal ivory still reaches lucrative markets like China through extremely confusing lines of transportation (Geachm, 2002). The potential extinction of forest elephants would have severe ecological consequences, both in Africa and globally, as these elephants are vital for maintaining the structure of the African rainforest, a crucial CO2 absorber (Campos-Arceiz & Blake, 2011; Sekar et al., 2015). Poaching and cross-border trafficking continue to threaten elephant populations, exacerbated by the lack of a rapid intelligence system and community-based conservation approaches. Alongside our ongoing conservation efforts in Kahuzi-Biega National Park (KBNP), including addressing conflicts between the local Pygmy community and park authorities regarding resource exploitation, characterizing KBNK habitats and assessing its species diversity and population sizes, KBNP personnel training, this project aims to significantly contribute to the protection of KBNP's biodiversity, particularly the forest elephants, an endangered species.

II. Executive summary

The project's primary goals are focused on enhancing conservation efforts for forest elephants in the Kahuzi Biega National Park (KBNP), located in the eastern Democratic Republic of Congo (DRC). Forest elephants in KBNP are critically endangered, facing severe threats including habitat loss due to logging and agricultural expansion, poaching for ivory, and human-wildlife conflict. The project aims to address these challenges by enhancing data collection, community

engagement, and capacity building, thereby contributing to the long-term preservation of these vital species in DRC.

III. Project objectives

- Map the current distribution of forest elephants in KBNP.
- Develop a community-based conservation approach.
- Develop a monitoring and information-sharing network on elephants.
- Build capacity through training, conferences, internships, and mentorship.

IV. The so far conducted activities and obtained results

4.1. Preparation meetings

Given the security challenges in South Kivu, eastern DR Congo, where our study site is located, project activities required careful planning. The conflict that began in February 2025 affected the region, causing delays in the scheduled start of our activities. To address these challenges, we held several preparatory meetings with the Kahuzi Biega National Park (PNKB) team to ensure that project implementation could proceed safely and effectively.

Despite the unstable security situation, we developed alternative strategies to maintain progress, particularly during periods when conditions were relatively stable. In total, three meetings were conducted with our project implementing partners. These discussions proved highly productive, allowing us to define clear approaches for advancing project activities whenever feasible. The meetings provided crucial guidance and coordination, ensuring that the project could adapt to the dynamic context on the ground.

Figure 1. Preparatory Meeting with the Director of Kahuzi-Biega National Park

4.2.A comprehensive literature review to gather existing data from scientific papers, reports, and historical records on the forest elephant distribution.

As part of the literature review, we examined previous studies on elephant abundance in Kahuzi Biega National Park (KBNP) and surrounding regions. Hall et al. (1997) conducted a systematic

survey of *Loxodonta africana* in the tropical lowland moist forests of eastern DRC. Using transect sampling over a 15,570 km² area-including four zones within KBNP and three in the adjacent Kasese region-they estimated a population of approximately 3,720 elephants (range: 2,300-5,000 individuals). In the mountain sector, Inogwabini et al. (1996) used distance-sampling methods and a stratified random sampling design to estimate 771 individuals, with the majority (619) concentrated in stratum A (137 km²) and only 152 in stratum B (434 km²).

Subsequent monitoring revealed dramatic declines. According to a 2005 UNESCO report, a census in the highland sector confirmed the quasi-extinction of elephants in that area, where pre-war numbers had been around 400 individuals. This decline has been associated with ecological changes such as the proliferation of the vine *Sericostachys scandens*, which strangles trees and degrades forest structure. More recent assessments indicate that forest elephants (*Loxodonta africana cyclotis*) within KBNP remain highly threatened by the ivory trade (ICCN, 2009), particularly in the low-altitude sector (WCS, 2016). By 1994, the population was estimated at 3,720 individuals, but between 2000 and 2008, surveys found no traces in low-altitude areas (Amsini, 2008), and in 2015 signs were detected only in the extreme north-western part (WCS, 2015). The most recent monitoring in 2019 recorded elephant presence only in the Kasese sector of KBNP and the far eastern section of the adjacent OCR, now considered the last strongholds for the species in the region (Plumptre et al., 2019).

In addition to these population declines, studies have documented ongoing human-wildlife conflicts in and around KBNP, as highlighted by Matthieu et al. (2023). Taken together, this historical baseline provides an important reference for assessing changes in elephant populations and distribution over the past three decades, in light of persistent threats such as poaching, habitat loss, and conflict with humans.

4.3.Accurate geolocation data on the current distribution of forest elephants

4.3.1. Habitat characterization of Forest Elephants in Kahuzi-Biega National Park (PNKB)

This first phase aimed to characterize forest elephant habitat in PNKB as a basis for determining their current distribution. Two reference years were considered: 2000, marked by major socio-political disturbances in the DRC, and 2024, for recent data availability.

Key environmental variables were selected based on their ecological relevance. Dynamic variables included temperature, precipitation, and land cover, while static variables comprised elevation, slope, distance to water, and proximity to roads and human settlements. Each factor was classified into five sensitivity levels (from "very unfavorable" to "very favorable" for elephants) using literature-based ecological thresholds and remote sensing / GIS analysis. Land cover was derived from Landsat imagery (30 m resolution), classifying forest types, savannas, wetlands, and bare/built-up areas. Topography, including elevation and slope, was extracted from ALOS-PALSAR DEM (12.5 m). Water access was measured as distances to rivers and streams from the RGC dataset, analyzed via Euclidean distance in ArcGIS. Human accessibility was determined from distances to roads and settlements from open datasets, with known thresholds of elephant avoidance. Climate variables included annual rainfall and mean temperature from CHIRPS, WorldClim, and AFRICLIM, with thresholds for optimal habitat conditions.

A vector normalization method was applied to assign weights to each factor, with highest weights for water access, land use, and road proximity. For habitat suitability modeling, elephant presence data (GPS tracking, field surveys, biodiversity databases) were combined with environmental rasters in MaxEnt. Multicollinearity was tested (VIF), and model performance was evaluated using ROC/AUC (>0.8). The resulting map identifies areas of high suitability and potential distribution.

This output was then used in conservation prioritization, integrating human pressure layers and connectivity analysis in ArcGIS to classify zones as priority conservation cores (high suitability, low human pressure), buffer/managed zones (moderate suitability, moderate human use), and restoration zones (degraded but with recovery potential).

Next steps: These habitat suitability results will be combined with up-to-date geographic coordinates of current elephant locations to produce the final, current distribution map of forest elephants in PNKB and guide targeted conservation action.

Obtained results:

The maps of mean annual temperature and precipitation for 2000 and 2024 indicate contrasting trends in forest elephant habitat suitability in PNKB. Between 2000 and 2024, temperatures became less favorable overall, with previously moderately to highly suitable areas shrinking and high-altitude zones becoming increasingly unsuitable. In contrast, annual precipitation patterns improved over the same period, expanding areas with favorable and very favorable conditions for forest elephants (Figure 2)

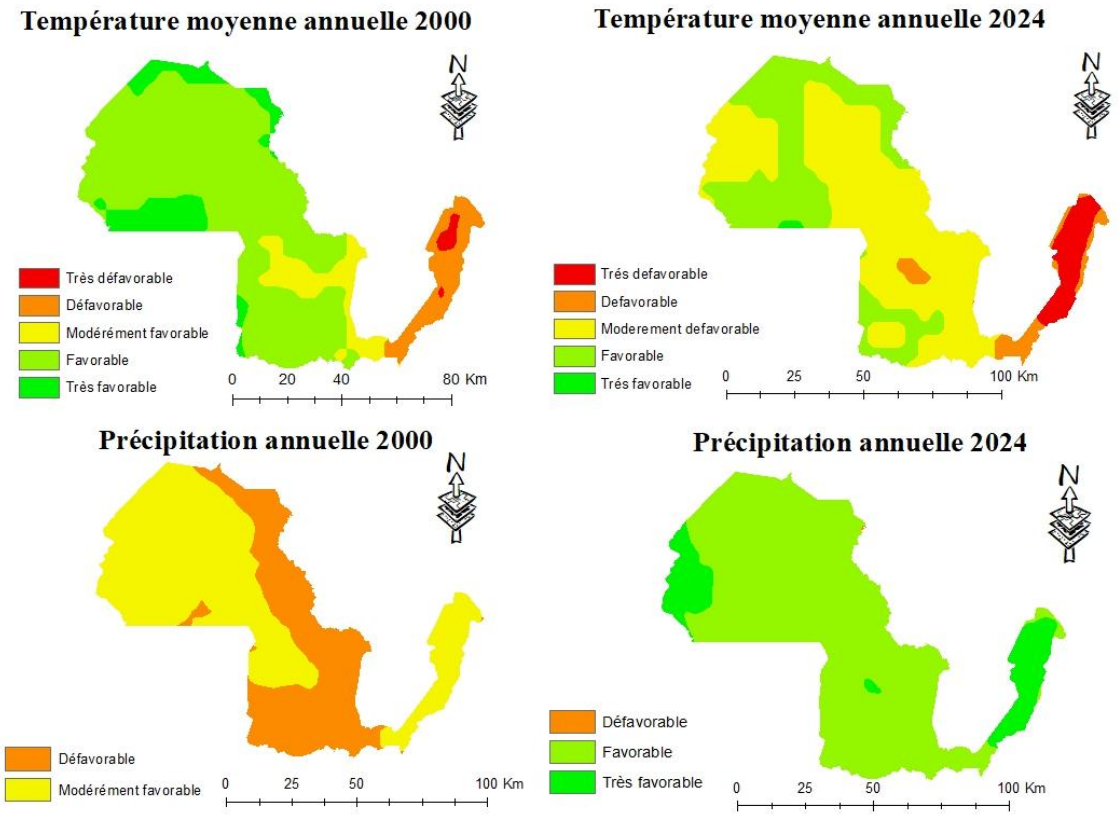

Figure 2. Characterization of forest elephant habitat based on temperatures and precipitation for the years 2000 and 2024 in KBNP.

Low-altitude areas in the northwest of the park are mostly favorable to very favorable for forest elephants, while high-altitude zones are generally unfavorable. Steeper slopes, primarily in high-altitude areas, are highly unfavorable, whereas lower slopes are more suitable. High-altitude and transitional zones have higher human accessibility, while low-altitude areas, particularly in the central part, are less impacted. Both low- and high-altitude areas have road access, but high-

altitude zones are more exposed due to closer road networks. Regarding water access, low-altitude areas generally provide good availability, except in central zones, whereas high-altitude areas have very limited access (Figure 3 and 4)

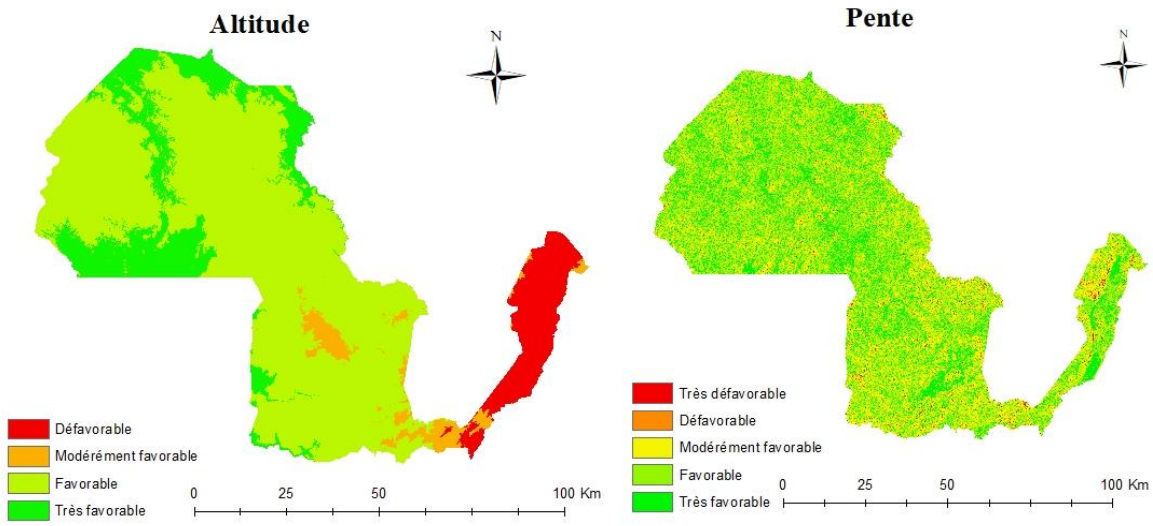

Figure 3. Static data over time: Elevation and slope

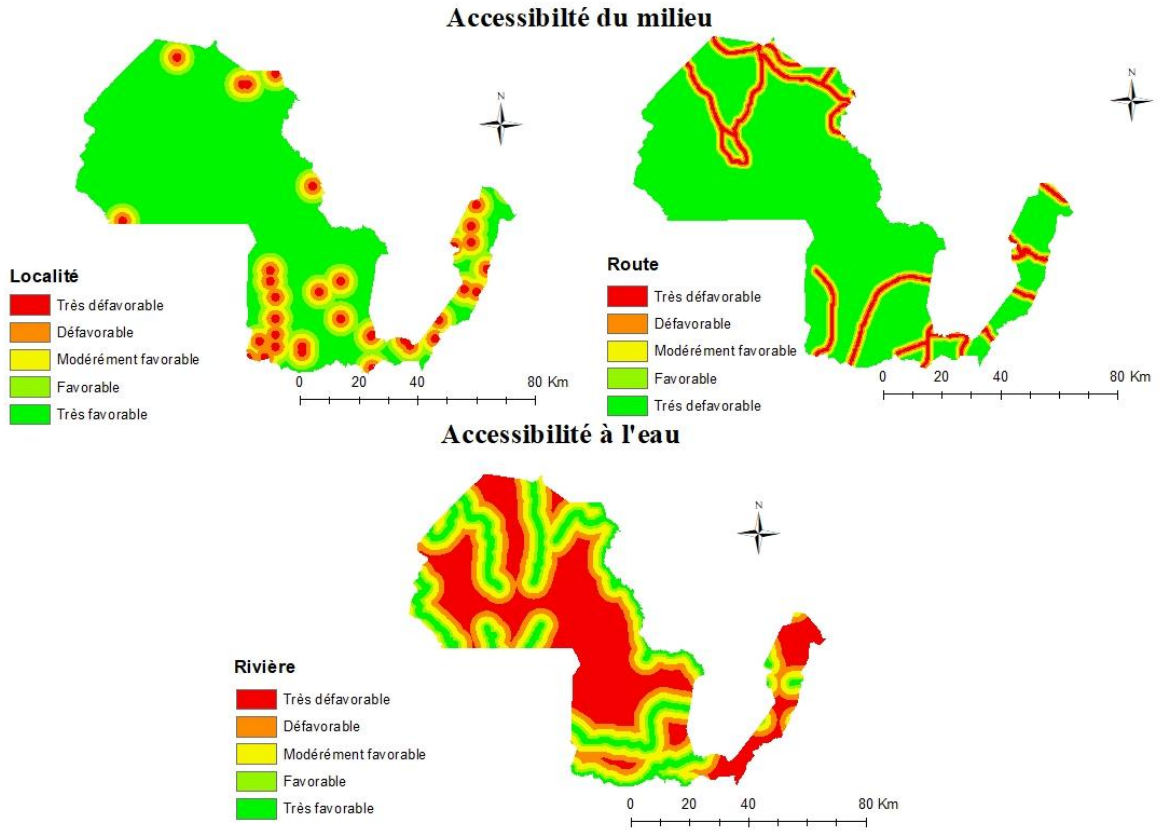

Figure 4. Static data over time: Accessibility of the environment and access to water

High-altitude areas generally provide more favorable conditions for forest elephant survival compared to low-altitude zones, which are somewhat unfavorable. Additionally, a small transitional area, though highly unfavorable, holds significant ecological importance (Figure 5).

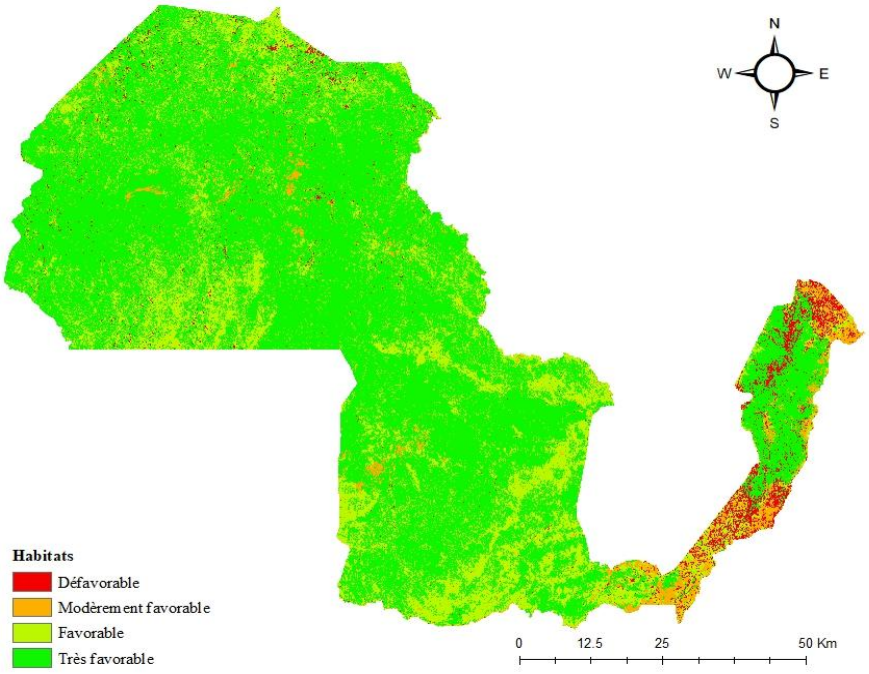

Figure 5. Habitat suitability for forest elephants

4.4.Capacity building: Educational program

As part of our capacity-building efforts, 500 educational booklets were produced for school visits targeting children attending **summer camps**. These small booklets were specifically designed for schoolchildren and contain educational content about forest elephants, their ecological role, and the importance of their conservation. During the visits, the children were sensitized on the significance of preserving forest elephants, the benefits they bring to the ecosystem, and the need for responsible stewardship of natural habitats.

A copy of the booklet is attached to this report.

Figure 6. Educational campaign

Figure 7. Educational campaign

Figure 8. Educational campaign

Figure 9. Educational campaign

Figure 10. Educational campaign

Figure 11. Educational campaign

Conclusion

The activities conducted under this project have laid a strong foundation for the conservation of forest elephants in Kahuzi Biega National Park. Despite challenges posed by regional insecurity, preparatory meetings with park authorities allowed careful planning and the development of adaptive strategies to ensure safe and effective implementation. The literature review and historical data analysis provided critical insights into population trends, highlighting the severe declines in forest elephant numbers and the persistent threats they face, including poaching, habitat degradation, and human-wildlife conflict.

Habitat characterization using up-to-date environmental data and modeling approaches has identified areas of high suitability, priority conservation zones, and regions requiring restoration or buffer management. These results provide a robust framework for guiding targeted conservation interventions and for monitoring elephant populations over time.

Capacity-building initiatives, particularly the educational program for schoolchildren, have contributed to raising awareness about the importance of forest elephants and the broader ecosystem, fostering community engagement and stewardship.

References

Hall, J. S., Inogwabini, B.-I., Williamson, E. A., Omari, I., Sikubwabo, C., & White, L. J. T. (1997). A survey of elephants (*Loxodonta africana*) in the Kahuzi-Biega National Park lowland sector and adjacent forest in eastern Zaire. *African Journal of Ecology*, 35(3), 213–223. https://doi.org/10.1111/j.1365-2028.1997.093-89093.x

Inogwabini, B.-I., Hall, J. S., Vedder, A., Curran, B., Yamagiwa, J., & Basabose, K. (2000). Status of large mammals in the mountain sector of Kahuzi-Biega National Park, Democratic Republic of Congo, in 1996. *African Journal of Ecology, 38*(4), 269–276. https://doi.org/10.1046/j.1365-2028.2000.00246.x

UNESCO World Heritage Centre. (2005). *Kahuzi-Biega National Park (Democratic Republic of the Congo)*. State of Conservation report. Retrieved August 13, 2025, from https://whc.unesco.org/en/soc/3130/

Amsini, F., Ilambu, O., Liengola, I., Kujirakwinja, D., Hart, J., Grossman, F., Plumptre, A.J. (2008). The impact of civil war on the Kahuzi-Biega National Park : Results of surveys between 2000 – 2008. Report published by ICCN and Wildlife Conservation Society.

ICCN (2009). Plan Général de Gestion du Parc National de Kahuzi-Biega.