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Habitat Suitability, Threat Assessment, and Community Perceptions in the Conservation of the Grey Crowned Crane (*Balearica regulorum gibbericeps*) in the River Rwizi Wetland Catchment, Uganda

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Abstract

This study investigates conservation challenges for the Grey Crowned Crane in Uganda's River Rwizi catchment using an integrated approach. It combines GIS-based habitat suitability modelling, field distribution mapping, and community surveys to assess ecological conditions, primary threats, and local perceptions. The study reveals a significant mismatch between optimal habitat locations and actual crane densities, finding that, while communities value the crane culturally, conflicts arise due to crop damage.

Keywords

Cranes, Habitat Suitability, Threats, Perceptions, River Rwizi

1. Introduction

The Grey Crowned Crane (*Balearica regulorum gibbericeps*) is an iconic wetland-dependent bird native to East and Southern Africa. It is currently listed as *Endangered* on the IUCN Red List due to ongoing population declines driven by habitat loss, human disturbance, and illegal capture for trade [1]. In Uganda, the species holds exceptional national value, being not only the country's official bird, featured on the national flag and currency, but also revered in cultural narratives, traditional songs, and community symbols [2] [3]. Despite this symbolic prominence, field evidence reveals that Grey Crowned Crane populations in Uganda have suf-

fered severe reductions in both range and abundance over recent decades [4]-[6].

Habitat suitability is a critical ecological parameter for the conservation of crane populations. Cranes depend on a delicate balance of wetland ecosystems for foraging, roosting, and breeding. Suitable habitats must provide open water or marshland, accessible food resources, and safety from predators and human interference [7] [8]. Changes in land use, including drainage for agriculture, conversion of wetlands to eucalyptus plantations, and expansion of settlement infrastructure, have substantially reduced the availability and quality of these habitats in Uganda's major wetland catchments [4] [9].

The River Rwizi catchment in southwestern Uganda is a region of both ecological richness and intensifying land-use pressure. Once characterized by intact wetland mosaics and seasonal floodplains, the catchment has undergone rapid degradation due to livestock grazing, smallholder farming, sand mining, and climate-related hydrological shifts [10]. Such transformations have fragmented wetland ecosystems and may be displacing Grey Crowned Cranes into marginal areas, undermining their reproductive success and long-term viability.

Equally important to habitat factors are the socio-cultural contexts within which conservation occurs. Human-wildlife interactions can significantly influence the persistence of species, especially for large, conspicuous birds like cranes that forage in agricultural areas. Although cranes are admired for their beauty and symbolism, they are also perceived by some communities as crop pests [11] [12]. These conflicting perceptions shape local attitudes toward conservation initiatives and may determine whether protective policies are embraced or resisted.

Given these dynamic socio-ecological conditions, the River Rwizi catchment provides a valuable landscape for assessing how land-use patterns, habitat suitability, and human interactions influence the distribution and conservation of the Grey Crowned Crane. Accordingly, this study adopts an integrated approach that combines ecological modeling with social science methods. Specifically, it investigates three interrelated objectives: first, to model habitat suitability and assess the spatial distribution of cranes across the River Rwizi catchment; second, to identify and prioritize the key threats impacting crane populations; and third, to explore community perceptions of the species to inform locally grounded and socially responsive conservation strategies.

2. Methods and Materials

2.1. Study Area

The study was conducted in the River Rwizi catchment in southwestern Uganda, covering approximately 8554.7 km^2 between 30.21˚E and 32.52˚E, and 0.24˚S and 0.92˚S, at elevations ranging from 1300 to 2170 meters above sea level [13] [14]. The catchment spans the districts of Buhweju, Sheema, Bushenyi, Mbarara, Ntungamo, Isingiro, Kiruhura, Lyantonde, and Rakai, draining into Lake Victoria via the Kagera River system (**Figure 1**).

The landscape is a mosaic of wetlands, hills, seasonal rivers, and floodplains,

interspersed with banana-coffee agroforestry, grazing lands, eucalyptus plantations, and peri-urban settlements. Major land uses include smallholder agriculture, livestock rearing, sand mining, and brick making, contributing to wetland degradation and habitat loss [3] [4].

The region experiences bimodal rainfall and variable hydrology, with increasing climate-induced pressures, such as droughts and flooding, affecting wetland ecosystems [15]. These conditions have critical implications for the conservation of wetland species such as the Grey Crowned Crane.

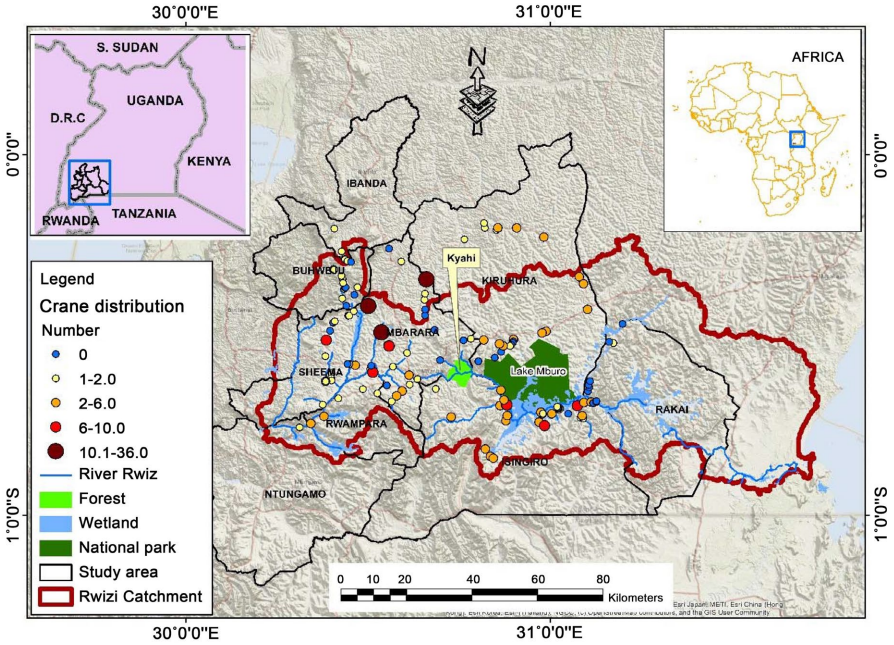

Figure 1. Location of the study area.

2.2. Habitat Suitability Modeling

Habitat suitability for the Grey Crowned Crane was assessed using high-resolution Sentinel-2 satellite imagery (10 m resolution, 2024) to map land-cover types and delineate wetland extents. These satellite-derived data were integrated with ground-truthed GPS field observations in ArcGIS 10.8 to analyze spatial relationships between crane occurrences and key environmental variables, including vegetation type, water bodies, elevation, and proximity to human land use.

A GIS-based weighted overlay analysis was employed to model habitat suitability. Input layers consisted of land cover, distance to wetlands, elevation, vegetation density, and distance from human infrastructure. Each variable was assigned a weight based on its ecological relevance to crane habitat preferences. The output was a habitat suitability map categorized into five classes: Not Suitable, Less Suitable, Moderately Suitable, Suitable, and Highly Suitable. This spatially explicit model facilitated the identification of priority areas for conservation and informed landscape-level planning to support Grey Crowned Crane protection.

2.3. Crane Distribution Mapping

Crane distribution mapping was conducted through daily field surveys between 7:00 AM and 4:00 PM, coinciding with the peak activity periods of Grey Crowned Cranes and facilitating optimal community involvement. Survey teams followed existing roads and footpaths, employing a "random meander" sampling strategy [16] to access diverse wetland habitats throughout the River Rwizi catchment. This approach involved following flexible, non-fixed routes, guided by local knowledge, accessibility, and signs of crane activity to ensure broad, representative habitat coverage while opportunistically recording crane presence.

Local community members, primarily farmers and wetland users, were engaged directly in the field. Upon obtaining informed consent, participants received a brief orientation and hands-on training in using the GPS Essentials mobile application to document crane sightings. These georeferenced records were collected systematically during fieldwork conducted from June to December 2024 and were further enriched through participatory mapping exercises with local stakeholders.

Each crane sighting was spatially recorded and categorized by group size into the following classes: 0, 1 - 2, 2 - 6, 6 - 10, and 10.1 - 36 individuals. The compiled data provided a robust foundation for the spatial analysis and visualization of crane distribution patterns across the catchment.

Behavioral Observations

Direct behavioral observations were carried out at each crane sighting to record foraging, roosting, and social behaviors. Special focus was placed on identifying roosting tree species and habitat features associated with crane activity. All behaviors were documented in field notebooks and geotagged using GPS.

2.4. Community Engagement

Community engagement played a central role in gathering local knowledge and perceptions to complement ecological data. Data collection focused on two main areas: threat assessment and community perceptions of the Grey Crowned Crane.

Threat Assessment

A total of 117 stakeholder interviews were conducted with individuals directly involved in wetland use and management, including farmers, local leaders, wetland users, and conservation volunteers. These participants were purposefully selected for their knowledge and experience related to the local environment and crane habitats. They were asked to identify and rank perceived threats to crane populations. The responses were quantified and grouped thematically to highlight key concerns such as habitat loss, wetland degradation, and crop damage. This group was chosen to provide expert and practical insights into ecological and land-use pressures affecting crane conservation.

Community Perceptions Survey

A separate survey of 83 community members was conducted to capture broader public attitudes toward cranes. Respondents provided open-ended responses and

narratives that expressed what they liked or disliked about the species. These responses were analyzed thematically, and proportions were calculated to identify dominant perceptions. This group was selected to reflect the local community's values, beliefs, and cultural associations with cranes, which are critical for shaping effective conservation messaging and fostering community support.

Using two distinct respondent groups enabled a more comprehensive understanding of both ecological threats and social perceptions of cranes by triangulating stakeholder expertise with community lived experiences.

Open Discussion Forums

To enrich the quantitative data, open discussion forums were organized with residents. Guided by key questions, the discussions covered topics such as human-crane conflict, the cultural significance of cranes, and attitudes toward conservation. Qualitative data, including emotional expressions, local narratives, and cultural interpretations, were recorded in handwritten notes and later coded and transcribed for thematic analysis.

Together, these participatory approaches provided a better understanding of community-crane connections and informed context-specific conservation forecasting.

2.5. Data Analysis Methods

The study employed both quantitative and qualitative data analysis techniques. Descriptive statistics were used to summarize habitat suitability scores, providing a general overview of the spatial variation in suitability classes across the study area. To examine the relationship between habitat suitability categories and Grey Crowned Crane group size classes, a chi-square test of independence was conducted. This test assessed whether the observed distribution of crane group sizes was significantly associated with habitat suitability levels.

For the analysis of threats, community attitudes, and perceptions towards Grey Crowned Cranes, descriptive statistics were applied to compute the percentage distribution of responses across various thematic categories. In addition, qualitative data from open-ended responses were analyzed using thematic content analysis. This approach facilitated the identification and interpretation of recurring themes, allowing for deeper insight into local knowledge, values, and conservation concerns related to the species.

3. Results

3.1. Habitat Suitability and Crane Distribution

Figure 2 shows the spatial distribution of cranes with respect to habitat suitability. Highly suitable zones were concentrated in the southeast, particularly near intact wetland systems. However, the highest crane densities were observed in moderately suitable and even less suitable areas in the central-west catchment. This mismatch suggests that cranes are adapting to degraded habitats, likely due to the loss or inaccessibility of more optimal areas.

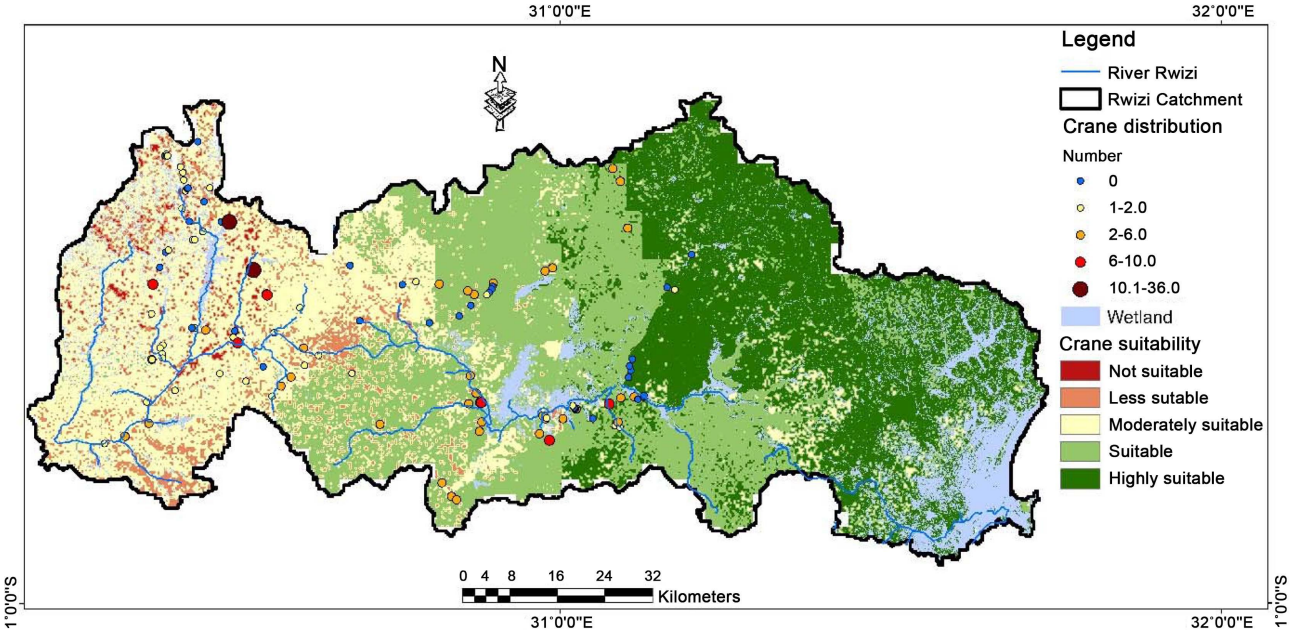

Figure 2. Grey Crowned Crane distribution and habitat suitability in the River Rwizi Catchment, Uganda.

The "highly suitable" class represents the largest area in the catchment, providing the most ideal conditions for crane habitation. In contrast, areas classified as "suitable" (light green) and "moderately suitable" (yellow) cover substantial portions of the landscape but are less optimal for cranes. Smaller areas categorized as "less suitable" (orange) and "not suitable" (red) represent environments that are suboptimal for crane presence. Wetlands, marked in blue, occupy a smaller portion of the landscape. Relatedly, high-density crane sightings are most concentrated in the highly suitable areas (dark green) and associated wetlands (blue). Moderate crane populations are found in the suitable (light green) and moderately suitable (yellow) areas, though these locations support fewer cranes than the optimal habitats. Areas categorized as "less suitable" (orange) or "not suitable" (red) show little to no crane presence, indicating that the species avoids such environments.

Correlation between Habitat Suitability and Grey Crowned Crane Distribution.

A total of 127 Grey Crowned Crane sightings were recorded across five habitat suitability classes (Table 1), with the highest frequency in suitable (39.4%) and highly suitable (32.3%) habitats.

These zones, primarily located in the central and eastern sections of the catchment, are characterized by proximity to wetlands, low elevation, high vegetation density, and reduced human disturbance.

In contrast, Moderately Suitable areas accounted for 18.1% of sightings, often with smaller group sizes, suggesting occasional or transitional habitat use. Only 10.2% of sightings were recorded in the Less Suitable and Not Suitable categories combined, predominantly as isolated or small groups (1 - 2 individuals), often near agricultural landscapes or degraded wetland margins.

Table 1. Distribution of grey crowned crane sightings across habitat suitability classes.

Habitat Suitability Class	No. of Sightings	Percentage of Total (%)	Typical Group Size Observed	Notes
Highly Suitable	41	32.3	Medium to Large (6 - 36)	Concentrated in the wetland-rich eastern areas
Suitable	50	39.4	Medium (2 - 10)	Found in the central and southeastern zones
Moderately Suitable	23	18.1	Small to Medium (1 - 6)	Transitional or buffer areas
Less Suitable	9	7.1	Mostly Small (1 - 2)	Near cultivated land, higher human activity
Not Suitable	4	3.1	Isolated (0 - 1)	Degraded, dry, or highly disturbed areas
Total	127	100		

Larger groups were significantly more likely to occur in Suitable and Highly Suitable areas χ^2 (16, N = 127) = 36.42, p = 0.003, indicating a non-random association between crane group size and habitat suitability class. Furthermore, wetland proximity appeared to be a key determinant of crane presence. Over 84% of sightings were within 1 km of mapped wetland areas, reinforcing the ecological reliance of Grey Crowned Cranes on wetland habitats for foraging and breeding.

Accordingly, these results demonstrated a statistically significant correlation between habitat suitability and crane distribution, with a clear spatial preference for wetland-rich, low-disturbance environments. These findings validate the habitat suitability model and highlight critical areas for targeted conservation interventions.

3.2. Threat Analysis

Stakeholder interviews (n = 117) revealed a diverse range of anthropogenic and environmental threats impacting the Grey Crowned Crane. The most frequently cited threats were livestock herding (15.38%), agricultural expansion (13.68%), and climate-related stressors such as flooding and drought (13.68%. These top-ranking threats reflect the increasing pressures from land-use change and climate variability on the wetland ecosystems critical to the species (Table 2).

Table 2. Threats to the grey-crowned crane in the River Rwizi wetland catchment (n = 117).

Threat	Number of Responses	Percent (%)	Explanation
Livestock Herding	18	15.38	Land conversion into grazing areas and habitat degradation due to livestock foraging reduce the available foraging and nesting sites.
Agriculture	16	13.68	Expansion of farmland leads to habitat loss and exposure to agrochemicals, threatening crane health and habitat quality.
Flooding and Drought	16	13.68	Climate variability alters wetland availability, affecting nesting and foraging opportunities for cranes.

Continued

Human Disturbance	15	12.82	Activities such as chasing, noise, and frequent human presence disrupt crane behavior and increase stress.
Tree Planting with Eucalyptus	9	7.69	Inappropriate tree planting in wetlands reduces water levels, causes pollution, and leads to habitat loss.
Earth Excavation	8	6.84	Sand mining, brick making, stone quarrying, and gold mining contribute to wetland degradation and habitat destruction.
Poisoning	8	6.84	Cranes are exposed to harmful chemicals either intentionally or through contaminated food or water sources.
Draining of Wetlands	5	4.27	Wetland drainage through channeling reduces the critical habitats needed for feeding and breeding.
Direct Harm	5	4.27	Cases of intentional injury or killing of cranes were reported, often linked to human-wildlife conflict.
Egg Destruction or Chick Predation	5	4.27	The loss of eggs and chicks due to predation or destruction hampers reproductive success and population growth.
Fires	4	3.42	Fires from agriculture or papyrus harvesting destroy nesting areas and can directly harm birds.
Electrocution and Collisions	4	3.42	Power lines and other infrastructure pose collision risks and cause fatalities.
Invasive Species	2	1.71	Invasive flora or fauna competes with native species and degrades habitats vital for crane survival.
Road Barriers	2	1.71	Roads fragment habitats, lead to vehicle collisions, and hinder crane movement.
Total	**117**	**100.00**	—

Also commonly reported was human disturbance, with activities such as chasing, noise, and proximity causing stress and displacement of Grey Crowned Cranes from preferred habitats. Other notable threats included exotic tree planting, particularly eucalyptus in wetland areas, earth excavation through sand and brick mining, and chemical poisoning, all of which contribute to habitat degradation and direct harm to the species. Though less frequently cited, wetland drainage, direct harm to cranes, and chick or egg predation were acknowledged together with fires, electrocution, and collisions with infrastructure, while invasive species and road barriers were the least frequently reported.

3.3. Community Perceptions

Community members expressed a range of positive and negative perceptions toward Grey Crowned Cranes, reflecting both cultural appreciation and conflict arising from human-crane interactions (Table 3).

Of the 36 responses on likes, the majority (30.6%) appreciated the crane's beauty, followed by its use as a biological clock (16.7%) and its symbolism on the national flag (13.9%). Other positive views included friendliness (8.3%), tourism potential (8.3%), and cultural relevance in songs (2.8%).

Table 3. Community perceptions of grey crowned cranes in the River Rwizi Wetland Catchment.

Statement on Cranes	Number of Responses	Percentage (%)
Likes		
Beautiful birds/colorful/good-looking	11	30.56
Biological clock for the community	6	16.67
It is on the Ugandan flag/national bird	5	13.89
Cranes are neither hostile nor friendly to people	3	8.33
Tourism attraction	3	8.33
The crane is on Ugandan currency	2	5.56
It is respected countrywide	2	5.56
None	1	2.78
Name used in conservation education through folk songs	1	2.78
Indicators of a healthy environment	1	2.78
They are not too destructive	1	2.78
Total responses to likes	**36**	**100.00**
Dislikes		
Crop raiding	28	59.57
Crop damage with no harm to cranes	9	19.15
None	10	21.28
Total responses on dislikes	**47**	**100.00**

Note: Percentages are based on the total responses for each category (likes and dislikes), not on the total number of respondents. Multiple responses were allowed per respondent.

Dislikes focused on crop raiding (59.6%) and minor damage (19.2%), though 21.3% reported no dislikes, indicating overall positive sentiment.

A Thematic Content Analysis of the data regarding the community's responses to Grey Crowned Cranes from likes and dislikes demonstrates overarching themes that reflect the community's attitudes, perceptions, and associations with the cranes, underscoring the crane's dual identity as both a valued cultural symbol and a source of local conflict (Table 4).

Table 4. Thematic content analysis of community responses toward Grey Crowned Cranes.

Defining Theme	Description	Illustrative Responses
Aesthetics and National Symbolism	Cranes are valued for their beauty and as symbols of national identity.	"Beautiful birds", "Beautiful colours", "Good looking". Referenced on Ugandan currency and flag: national bird.
Cultural and Functional Significance	Cranes serve symbolic and practical roles within the community.	Described as a "biological clock for the community". Emblems and songs feature cranes as cultural icons.

Continued

Environmental and Ecological Indicators	Crane presence reflects environmental health and aligns with conservation.	"Good indicators of a healthy environment". It is seen as a sign of ecological integrity.
Behavioral Perceptions	Cranes are seen as peaceful and non-destructive, supporting coexistence.	"Friendly, non-hostile". Cranes coexist well with people and are not aggressive.
Tourism and Economic Value	Cranes are appreciated for their role in promoting tourism and the local economy.	Attract visitors and contribute to tourism-based livelihoods.
Neutral or Tolerant Sentiment	Some respondents expressed indifference or tolerance toward cranes.	"No impact": tolerable crop damage by the community. Neither positive nor negative opinions.
Disruptive Negative Sentiment	Cranes are disliked for causing damage to crops, leading to conflict.	Crop damage is noted as a recurring concern.

The above observations are echoed through "narratives" mentioned during open interactions with communities (Table 5).

Table 5. Thematic content analysis of narratives on community experiences, perceptions, and the impact of human activities on crane populations around the River Rwizi wetland catchment.

Theme	*Narratives*	Inference
Decline in Crane Populations	• *We used to see flocks of cranes here, but we now see a pair or a few—like five or six.* • *Wetlands were cultivated, and cranes reduced.* • *We have destroyed wetlands and do not know from where the cranes breed.*	There is a noticeable decline in the crane population attributed to habitat destruction, particularly wetland encroachment and agricultural expansion.
Habitat Destruction	• *Grazing land for cattle has been extended even to the edge of the river, destroying habitats for cranes.* • *Wetlands have been destroyed by eucalyptus.* • *Bricklaying and sand mining have caused havoc on riverbanks and wetlands in this place.*	Habitat loss due to agricultural expansion, grazing, eucalyptus planting, brick-making, and sand mining is a significant threat to crane habitats and breeding grounds.
Environmental and Climatic Challenges	• "*When there are floods or droughts, cranes cannot find places to feed or places to go.*" • *Fires are common phenomena in wetlands, and we think they affect cranes.* • *Electric cables kill cranes. We have experienced it here.*	Environmental challenges such as extreme weather conditions (floods and droughts), fires in wetlands, and man-made hazards (electrical wires) pose risks to crane populations.
Human-Wildlife Conflicts	• *Cranes have made us suffer. They feed on and destroy gardens after cultivation.* • *We sometimes chase them from our gardens when they crop-raid.* • *They raid crops, but not too much. We can coexist.* • "*Truly, cranes are crop pests. We even replant after sowing. Maybe you can help us and take them away.*"	Although cranes cause crop damage, there is a general willingness to coexist with them, despite occasional conflicts due to crop raiding.

Continued

Perception and Cultural Beliefs	• *Can you think of killing them*? *They are beautiful and harmless*. • *To kill a crane*? *That is unheard of—maybe if you are a witch*. • *I am Omuhinda*. *Omuhinda*, *the crane*, *is our clan symbol*. *We love the crane—it's prestigious*. • *The government protects the cranes*. *They are a national bird*. • *Where would you find the eggs*? *Cranes breed in hard-to-reach*, *tall sedge vegetation surrounded by deep waters*. *They can fight you away from their nesting sites*.	Cranes are highly respected because of cultural beliefs, their beauty, and their status as Uganda's national bird. Killing them is considered taboo, or even punishable. They are naturally protected by their breeding behaviours and self-defence mechanisms.
Indirect Threats from Human Activities	• *We do not poison cranes but use agrochemicals*, *which may indirectly affect them*.	Although direct harm to cranes is rare, the use of agrochemicals in farming may have indirect negative impacts on their health and the environment.
Protection and Conservation	• *The government protects the cranes*. *They are national birds*. *They are majestic and command their esteem and respect*.	There is recognition of government efforts to protect the cranes, reinforcing the species' national significance.
Community Interaction and Coexistence	• *They raid crops but not too much*. *We can coexist*. *This has gone on for years with no harm*. • *We love cranes*, *but children may throw stones at them*.	Community members express affection for cranes and highlight a generally peaceful coexistence, though they acknowledge minor conflicts, such as children disturbing the birds.

These themes illustrate the complexity of human-crane interactions around the River Rwizi wetlands, where environmental, economic, and cultural factors shape the relationship between local communities and cranes.

4. Discussion

This study offers a multi-dimensional understanding of the ecological, environmental, and socio-cultural dynamics influencing the conservation of the Grey Crowned Crane within the River Rwizi wetland catchment. By integrating habitat suitability modeling, threat analysis, and community perceptions, it provides evidence-based insights essential for effective conservation planning in a rapidly changing, human-dominated landscape.

4.1. Habitat Suitability and Crane Distribution

The spatial distribution of cranes showed a significant association with habitat suitability, particularly the proximity to intact wetlands and areas with minimal human disturbance. These findings corroborate previous studies highlighting the importance of wetlands as core habitats for breeding and foraging [7] [8]. The concentration of crane sightings in "Highly Suitable" and "Suitable" areas, especially within 1 km

of wetland systems, underscores the ecological dependence of the species on such environments.

In contrast, the presence of Grey Crowned Cranes in "Moderately Suitable" and even "Less Suitable" areas, often representing degraded or human-converted landscapes, suggests a degree of behavioral adaptation in response to habitat loss, fragmentation, and limited access to optimal areas, a pattern similarly reported in other East African landscapes [8] [17], perhaps reflecting short-term ecological plasticity that enables the species to persist in suboptimal environments [18]. Nevertheless, such adaptation may obscure underlying population stress, as these marginal habitats typically offer reduced food availability, lower reproductive success, and increased exposure to human-induced threats [19].

Importantly, the continued use of degraded environments, such as moderately degraded wetlands or agricultural landscapes, risks creating "ecological traps", specifically areas that appear suitable but, in reality, offer poor conditions for breeding, foraging, or safety, thereby compromising crane fitness and survival [20]. As Fischer and Lindenmayer [21] caution, presence alone does not equate with habitat quality, highlighting the need for conservation efforts to focus on restoring and safeguarding core habitats rather than normalizing persistence in degraded ones.

When cranes settle in these degraded areas, they may face reduced fitness, increased vulnerability to predation and human disturbance, and lower reproductive success. This underscores the urgency of safeguarding high-quality habitats to prevent long-term population decline caused by maladaptive habitat use.

4.2. Threat Analysis

Anthropogenic and environmental threats to crane populations were diverse but primarily driven by land-use change. Livestock herding and agricultural expansion emerged as the most immediate threats to wetland integrity and crane habitats, consistent with regional findings on wetland degradation [7] [9]. Climate-related stressors such as flooding and drought compound these impacts by altering wetland hydrology and reducing habitat availability [22]. Wetland loss through farming was reported in Eastern Uganda to be the main threat, but I also documented poisoning, roost disturbance, and the collection of eggs and chicks [23].

Equally important are emerging threats such as eucalyptus planting in wetlands, sand and brick mining, agrochemical poisoning, and infrastructural hazards (e.g., electrocution). These are often overlooked in conventional assessments but have significant ecological consequences [24] [25]. Eucalyptus, for instance, alters soil and water dynamics, while poisoning, whether intentional or accidental, represents a growing source of mortality tied to human-wildlife conflict and agricultural intensification [26] and, accordingly, requires coordinated, multi-sectoral interventions that address both direct and indirect drivers of habitat degradation and species decline.

4.3. Community Perceptions

Community attitudes toward Grey Crowned Cranes revealed a duality that reflects broader socio-ecological tensions. On the one hand, the cranes are appreciated for their beauty, symbolism, and cultural importance, mirroring findings from other crane landscapes [27]. On the other hand, practical concerns, particularly crop damage, fuel local resentment, positioning the species as a pest in agricultural contexts.

From an ecological perspective, cranes were seen as Environmental and Ecological Indicators, with respondents associating their presence with ecosystem health. This aligns with ecological literature, where cranes are often cited as umbrella or indicator species due to their sensitivity to environmental change [8]. Such perceptions can be valuable entry points for community-based monitoring and habitat protection efforts.

This dichotomy reflects the challenge of conserving wildlife that is both culturally significant and economically disruptive. It reinforces the necessity of conservation strategies that are not only ecologically grounded but also socially acceptable. Incorporating community knowledge into conservation education, conflict mitigation, and incentive mechanisms such as eco-tourism or benefit-sharing can build local support and reduce antagonism [26] [28].

5. Conclusions

This study demonstrates that the conservation of the endangered Grey Crowned Crane in Uganda's River Rwizi catchment depends on integrated approaches that unify ecological data, threat mitigation, and community engagement. The species shows a strong dependence on wetland ecosystems, yet its presence in moderately suitable or suboptimal habitats indicates displacement and behavioral adaptation in response to increasing anthropogenic and climatic pressures.

The observed mismatch between habitat suitability and current crane occupancy underscores the urgency of restoring not only unoccupied yet highly suitable areas but also enhancing the quality of currently occupied, moderately suitable zones that support the remaining population. This dual-focus restoration approach is essential to prevent further decline and to create resilient habitat systems.

These results validate the habitat suitability model as a robust tool for spatial conservation planning. They also highlight the need to address both direct threats (e.g., habitat conversion) and indirect pressures (e.g., policy gaps and community attitudes) for effective, long-term conservation outcomes.

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Conflicts of Interest

The authors declare no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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