Scientific Research Publishing

Open Journal of Ecology, 2025, 15(8), 451-466
https://www.scirp.org/journal/oje
ISSN Online: 2162-1993
ISSN Print: 2162-1985

Impact of the Community-Based Conservation Approach on the Conflict Management around the Kahuzi-Biega National Park and the Itombwe Nature Reserve

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How to cite this paper: Basubi, M.M. and Bobo, K.S. (2025) Impact of the Community-Based Conservation Approach on the Conflict Management around the Kahuzi-Biega National Park and the Itombwe Nature Reserve. *Open Journal of Ecology*, **15**, 451-466.
https://doi.org/10.4236/oje.2025.158026

Received: June 4, 2025
Accepted: August 4, 2025
Published: August 7, 2025

Abstract

This research examines the effectiveness of community-based conservation in managing conflicts around the Kahuzi-Biega National Park (KBNP) and Itombwe Nature Reserve (INR) in the Democratic Republic of the Congo. Data were collected through socio-economic surveys, and the focus was done on groups in twelve villages bordering the two protected areas. The study identifies five main types of conflict and analyzes the local population's perceptions of benefits and challenges relating to conservation efforts. Proposed conflict resolution strategies are discussed, focusing on community involvement, compensation, and contractual agreements.

Keywords

Community-Based Conservation Approach, Conflict Resolution, Itombwe Nature Reserve, Kahuzi-Biega National Park, Natural Resource Management

1. Introduction

Many factors justify the persistence of conflicts and tensions around the Protected Areas (PAs) management: the scarcity of resources and useful products (food, health, cultural, religious, timber, etc.), the failure to honour commitments for the specifications of local populations, the failure of protection and conservation institutions and policies, and the population's resentment and contempt towards managers [1]-[4]. The weak capacity of local populations, the lack of transparency

and control, social stratification within communities and the neglect of local needs contribute to the largely ineffective, inefficient and inequitable resource management by the local communities [5]. In the Kahuzi-Biega National Park (KBNP) and Itombwe Nature Reserve (INR), Eastern Democratic Republic of the Congo (DRC), the PA creation has been both a source of displacement and frustration for local people due to loss of usage rights and a source of conflict by [6]-[8]. Moreover, the creation has had a negative impact on the socio-economic conditions of the riverside populations, affecting their well-being [9]. This generates conflicts and increases the demand and pressure on the PA's natural resources.

Long before, the effectiveness of conservation projects in PAs was compromised by dominant participative, colonialist and conservationist approaches centred on capitalism and capital accumulation produced by the biodiversity [10]-[13]. So, the reconsideration of participatory approaches was an alternative for the success of conservation efforts; the involvement of the local population in the conservation of forest resources depends on the effective integration of population in the PA's management [5] [12]. The shift from conservationist approach to integrated conservation has taken into account of introducing a requirement of nature protection into the everyday life (social, economic and political) of local communities, and to respond to the population's socio-economic development needs and the political participation of this population in the natural resources management [13] [14].

Despite the efforts made by participatory approaches in promoting the effective and efficient riparian population participation in the KBNP and INR management, many constraints are observed around; that is the root of the failure of the effective partnership between stakeholders: the implementation and interpretation of the participatory policy, and the sharing of the information [15] [16], the frustrations, transaction and operating costs [2] [8], the weakness in the governance caused by the feeling of territorial governance exclusion to the benefit of external players, and the lack of awareness of the difference in means and powers between players. The community-based conservation approach refers to the conservation of forest resources and/or biodiversity by local collective institutions for the benefit of local populations [17]. It aims to engage local communities in the decision-making process, so that they retain control over the uses and benefits arising from their exploitation [18]-[20]. Around the KBNP and INR, the community-based conservation approach is seen as one of the essential tools for the conflict's sustainable management by increasing the involvement of the riparian population in the PA conservation and integrated local development. It suggests alternatives for the use of natural resources inside the PA and in their influence areas, and the strategies to minimize conflicts between the riparian communities and the PAs [16].

This study aims to evaluate the effectiveness of the community-based conservation approach on the sustainable management of conflicts over natural resources in the KBNP and the INR. Conflict resolution would depend on situated and con-

textualised public policies and approaches between the KBNP and the INR, such as improving integrated and adaptive management, raising stakeholder's awareness and education, materialising customary rules and use rights, and establishing community zone [3] [8] [21].

2. Materials and Methods

2.1. Location of the Study Area

The KBNP is located in the western part of the Ridge of the Central African Graben, between 1˚36' - 2˚33' South latitude and 27˚33' - 28˚46' East longitude, 600 - 3308 m altitude. The park is covered by the dense tropical rainforests (low altitude: 600 - 1200 m) and the Afromontane forests (high altitude: 1800 - 3308 m), mixed with bamboo forest and small grasslands [22]. Rich in biodiversity (fauna and flora), it protects the large mammals by poaching [23]. One of the important and particular sites for biodiversity in Africa, the INR is located between 3˚ - 4˚ South latitude and 28˚ - 29˚ Eastern longitude. It is covered by the Mountain forests (high altitude: 1500 - 3000 m) [24].

KBNP and INR are located in one of the most densely populated regions in the DRC (an estimated population around 5,722,000 and 1,200,000 respectively in and around KBNP and INR) [25] [26], at the root of several natural resources threats and pressure. The main anthropogenic activities are the mixed farming practices on less than 0.85 ha of farmland per household, with an average household size of eight people, characterized by family and subsistence consumption. The highest cost of firewood in many villages makes people even more vulnerable, as most of them have no trees planted in their plots. Poverty is influenced by a high population density, low soil productivity, intensive deforestation, persistent armed conflicts, etc. [27].

2.2. Data Collection

Twelve villages were selected around the KBNP and INR: Bitale, Ihembe, Miti, Katana, Mbinga-Nord and Mbinga-Sud around the KBNP, and Ilibo, Ilowe, Kakozi, Kalundu, Kasalalo and Kitamba around the INR. The choice of these villages was conducted by their proximity to the PAs, the socio-economic and cultural population dependence on the PA, and the population's knowledge of the community-based conservation approach implemented within these PAs. A total of 621 people were selected for individual interviews (345 around the KBNP and 276 around the INR), and 288 people were grouped within 24 focus groups (12 around the KBNP and 12 around INR). The homogeneous non-probabilistic snowball method was used. This method offers an effective alternative by taking advantage of existing relationships and networks to obtain valuable and nuanced information. This study was carried out over a period of eight months, from February to September 2023.

A questionnaire was done and handled individually to holders of useful information at the household level, and the interview guide was submitted individually

to the PA managers. The collected information concerned the socio-demographic profile, income-generating activities, the culture and social cohesion, the contribution of the community-based conservation approach to the well-being of the riparian communities, and the conflict management approach. The information highlights the local population's perception of the community-based conservation approach advantages and constraints, the level of collaboration between the local population and the PA's managers, and the ways of conflict resolution between stakeholders [28] [29].

For the focus groups, data were collected on discussion using the interview guide. It was based on shared experience on the interaction between PA management and local populations, the constraints on community ownership of PA management, and management resolution of potential conflicts surrounding the PA's conservation [8] [30].

2.3. Data Analysis

The results were presented in tables in the form of frequencies using Xlstat 2024.3 software. The chi^2 at 5% significance level was used to highlight the variability between different parameters in the villages around the studied PAs [8] [30].

3. Results and Discussion

3.1. Population Perception of the Community-Based Approach in the Kahuzi-Biega National Park and the Itombwe Nature Reserve

Contribution of the community conservation approach to the well-being of the riparian population

The perception of the riparian population of the KBNP and the INR presented in **Table 1** shows that the implementation of the community-based conservation approach has a positive effect on the well-being of this population. This approach has contributed to improving the access of the population to Non-Timber Forest Products (NTFPs) and their availability in the community (respectively 30.14% of the 345 surveyed around the KBNP and 9.82% of the 276 surveyed around the INR), supporting local development (16.23%) and improving communication among stakeholders (13.62%), solely around the KBNP; and improving access to and availability of firewood (33.09% of the 276 surveyed), solely around the INR. However, no contribution from the approach has been recognized regarding the improvement of access to and availability of bushmeat (respectively 30.18% around the INR and 2.9% around the KBNP), the improvement of access to and availability of firewood at the KBNP (2.61%), support for local development around the INR (10.55%), the improvement of communication between stakeholders around the INR (5.45%), and job creation (0.36%). Only a very small portion mentioned the creation of job opportunities around the INR (1.16%).

A significant difference was observed in the contribution to the access and availability of Non-Timber Forest Products (NTFPs) ($p < 0.001$), firewood ($p = 0.003$),

bushmeat ($p = 0.001$), and the improvement of communication ($p = 0.033$) between the villages around the KBNP, and only in the contribution to the access and availability of NTFPs ($p < 0.001$) and firewood ($p < 0.001$) between the villages around the INR.

Table 1. Contribution of the community conservation approach to the well-being of the riparian population.

KBNP										
Variables	**Modalities**	**Bitale (N = 155)**	**Ihembe (N = 30)**	**Miti (N = 31)**	**Katana (N = 35)**	**Mbinga-Nord (N = 44)**	**Mbinga-Sud (N = 50)**	**Total (N = 345)**	**Khi²**	***p*-value**
The access and availability of NTFPs	Yes	45 (13.04%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	16 (4.64%)	43 (12.46%)	104 (30.14%)		**<0.001**
	No	68 (19.71%)	0 (0.00%)	0 (0.00%)	1 (0.29%)	10 (2.90%)	6 (1.74%)	85 (24.64%)		
Support for local development	Yes	0 (0.00%)	18 (5.22%)	9 (2.61%)	27 (7.83%)	1 (0.29%)	1 (0.29%)	56 (16.23%)		0.251
	No	0 (0.00%)	3 (0.87%)	2 (0.58%)	4 (1.16%)	2 (0.58%)	0 (0.00%)	11 (3.19%)		
The access and availability of firewood	Yes	3 (0.87%)	0 (0.00%)	0 (0.00%)	1 (0.29%)	0 (0.00%)	0 (0.00%)	4 (1.16%)		**0.003**
	No	0 (0.00%)	5 (1.45%)	4 (1.16%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	9 (2.61%)		
Employment	Yes	0 (0.00%)	0 (0.00%)	4 (1.16%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	4 (1.16%)		0.2
	No	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (0.29%)	0 (0.00%)	1 (0.29%)		
The access and availability of bushmeat	Yes	5 (1.45%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (0.29%)	0 (0.00%)	6 (1.74%)		**0.001**
	No	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	10 (2.90%)	0 (0.00%)	10 (2.90%)		
Improvement of communication	Yes	31 (8.99%)	1 (0.29%)	10 (2.90%)	2 (0.58%)	3 (0.87%)	0 (0.00%)	47 (13.62%)		**0.033**
	No	3 (0.87%)	3 (0.87%)	2 (0.58%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	8 (2.32%)		
INR										
Variables	**Modalities**	**Ilibo (N = 62)**	**Ilowe (N = 62)**	**Kakozi (N = 25)**	**Kalundu (N = 33)**	**Kasalalo (N = 20)**	**Kitamba (N = 74)**	**Total (N = 276)**	**Khi²**	***p*-value**
The access and availability of NTFPs	Yes	8 (2.91%)	4 (1.45%)	1 (0.36%)	8 (2.91%)	8 (2.18%)	0 (0.00%)	27 (9.82%)	31.48	**<0.001**
	No	0 (0.00%)	0 (0.00%)	1 (0.36%)	0 (0.00%)	0 (0.00%)	5 (1.82%)	6 (2.18%)		
Support for local development	Yes	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	-	-
	No	3 (1.09%)	11 (4.00%)	2(0.73%)	1 (0.36%)	0 (0.00%)	12 (4.36%)	29 (10.55%)		
The access and availability of firewood	Yes	26 (9.45%)	12 (4.36%)	16 (5.82%)	15 (5.45%)	7 (2.55%)	15 (5.45%)	91 (33.09%)	31.38	**<0.001**
	No	1 (0.36%)	0 (0.00%)	1 (0.36%)	0 (0.00%)	2 (0.73%)	14 (5.09%)	18 (6.55%)		
Employment	Yes	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	-	-
	No	1 (0.36%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (0.36%)		
The access and availability of bushmeat	Yes	0 (0.00%)	1 (0.36%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	0 (0.00%)	1 (0.36%)	1.73	0.885
	No	20 (7.27%)	30 (10.91%)	3 (1.09%)	3 (1.09%)	2 (0.73%)	25 (9.09%)	83 (30.18%)		
Improvement of communication	Yes	0 (0.00%)	0 (0.00%)	0 (0.00%)	3 (1.09%)	1 (0.36%)	0 (0.00%)	4 (1.45%)	7.76	0.169
	No	3 (1.09%)	4 (1.45%)	1 (0.36%)	2 (0.73%)	2 (0.73%)	3 (1.09%)	15 (5.45%)		

Collaboration between managers and the local population around Kahuzi-Biega National Park

According to the results in Table 2, the collaboration between the manager and the local population is often dependent on the benefits that this population derives

from PAs and vice versa. For the majority of respondents around the KBNP, the level of collaboration mainly depends on the provision of ecosystem services (67% of 345 respondents) and the contribution of the park to local community development (32.8%). Due to this, collaboration is considered to be "*good*", with 58.3% for service provision and 26.7% for development.

Table 2. Perception of the level of collaboration between managers and the local population around Kahuzi-Biega National Park.

Variables	Modalities	Quite Good	Good	Harmonious	Conflictual	Total	Khi²	*p*-value
Manager-community collaboration	Support for local development	2 (0.6%)	92 (26.7%)	1 (0.3%)	18 (5.2%)	113 (32.8%)	4.14	0.657
	Employment	0 (0.00%)	1 (0.3%)	0 (0.00%)	0 (0.00%)	1 (0.3%)		
	Ecosystem services	5 (1.4%)	201 (58.3%)	0 (0.00%)	25 (7.2%)	231 (67.0%)		
	Total	**7 (2%)**	**294 (85.2%)**	**1 (0.3%)**	**43 (12.5%)**	**345 (100%)**		
Constraints related to the manager-local population collaboration	Insecurity	0 (0.00%)	3 (0.9%)	0 (0.00%)	7 (2.0%)	10 (2.9%)	3.06	0.383
	Limit of enjoyment	7 (2.0%)	40 (11.6%)	1 (0.3%)	287 (83.2%)	335 (97.1%)		
	Total	**7 (2.0%)**	**43 (12.5%)**	**1 (0.3%)**	**294 (85.2%)**	**345 (100%)**		

Around the INR, Table 3 shows that collaboration mainly depends on job creation possibilities for youth (49.8% from 276 surveyed) and the contribution of PA to local development (45.8%), which are unfortunately almost non-existent. This renders the collaboration "*conflictual*" for most people, as the population feels that the PA contributes less or not to their well-being.

Table 3. Perception of the level of collaboration between managers and the local population around Itombwe Nature Reserve.

Variables	Modalities	Quite Good	Good	Harmonious	Conflictual	Total	Khi²	*p*-value
Manager-community collaboration	Support for local development	29 (10.5%)	21 (7.6%)	0 (0.00%)	76 (27.6%)	126 (45.8%)	23.288	**0.000**
	Employment	9 (3.3%)	48 (17.5%)	0 (0.00%)	80 (29.1%)	137 (49.8%)		
	Ecosystem services	0 (0.00%)	4 (1.5%)	0 (0.00%)	8 (2.9%)	12 (4.4%)		
	Total	**38 (13.8%)**	**73 (26.5%)**	0 (0.00%)	**164 (59.6%)**	**276 (100%)**		
Constraints related to the manager-local population collaboration	Insecurity	6 (2.2%)	15 (5.5%)	0 (0.00%)	40 (14.5%)	61 (22,2%)	1.476	0.78
	Limit of enjoyment	32 (11.6%)	58 (21.1%)	0 (0.00%)	124 (45.1%)	215 (77.8%)		
	Total	**38 (13.8%)**	**73 (26.5%)**	0 (0.00%)	**164 (59.6%)**	**276 (100%)**		

However, this collaboration faces several constraints, including the limited access of the local population to the resources of protected areas (97.1% of 345 surveyed around the PNKB and 77.8% of 276 surveyed around the RNI) and insecurity (2.9% around the PNKB and 14.5% around the INR). This fuels the conflicts that arise around the management of these protected areas.

3.2. Conflicts over the Management of Natural Resources in the Kahuzi-Biega National Park and the Itombwe Nature Reserve

The persistence of conflicts around the KBNP and the INR in the Democratic Republic of the Congo is often supported by the visible antagonism that exists between the PA's conservation objectives and the socio-economic local development. It is observed through the neglect of local needs and the continuation of extreme population's poverty, as well as the discomfort observed in participatory management policies, the enforcement of the law and the implementation of usage rights for local populations, which fuel resentment towards the costs of conservation (Table 4).

Table 4. Causes of conflicts around the Kahuzi-Biega National Park and the Itombwe Nature Reserve.

Variables	Causes	Protected Areas							Khi²	*p*-value
		KBNP (N = 12)	Khi²	*p*-value	INR (N = 12)	Khi²	*p*-value	Total (N = 24)		
Conflict related to the mode of PA's creation	Lack of the population involvement in the creation of the PA	5 (41.7%)	24.400	0.059	2 (16.7%)	24.400	0.059	7 (29.2%)	16.535	**0.001**
	Prohibition of access to/Illegal exploitation of the natural resources	2 (16.7%)			3 (25%)			5 (20.8%)		
	Lack of compensation for damages	3 (25%)			5 (41.7%)			8 (33.3%)		
	Loss of usage rights	2 (16.7%)			2 (16.7%)			4 (16.7%)		
Conflict related to the definition of rules and usage rights	Insufficient access to and sharing of benefits from conservation actions	3 (25%)	19	0.214	5 (41.7%)	32.800	**0.005**	8 (33.3%)	12.996	**0.005**
	Loss of livelihoods	3 (25%)			2 (16.7%)			5 (20,8%)		
	Violation of ancestral rights and abandonment of sacred sites	2 (16.7%)			3 (25%)			5 (20,8%)		
	Loss of land rights	4 (33.3%)			2 (16.7%)			6 (25%)		
Human-wildlife conflict	Destruction of crops and/or houses by wild animals	6 (50%)	19	**0.040**	4 (33.3%)	20.800	**0.023**	10 (41.7%)	15.232	**0.000**
	Physical attacks by wild animals on the local population and/or by the population on animals	4 (33.3%)			3 (25%)			7 (29.2%)		
	Zoonosis	2 (16.7%)			5 (41.7%)			7 (29,2%)		
Conflict related to the mode of governance	Contradictions in the management rules of the PA among the stakeholders	2 (16.7%)	23.143	0.081	2 (16.7%)	27	**0.029**	4 (16.7%)	43.609	**<0.0001**
	Violation of traditional rules for the use	4 (33.3%)			2 (16.7%)			6 (25%)		

Continued

	Non-compliance with specifications	2 (16.7%)			7 (58.3%)			9 (37.5%)		
	Encroachment on the boundaries of the PA	4 (33.3%)			1 (8.3%)			5 (20.8%)		
Armed conflict	Illegal and intensive exploitation of timber and minerals	6 (50%)	6	0.815	5 (41.7%)	21.600	**0.017**	11 (45.8%)	16.964	**0.000**
	Poaching	2 (16.7%)			5 (41.7%)			7 (29.2%)		
	Access to power/Impunity	4 (33.3%)			2 (16.7%)			6 (25%)		

Regarding the underlying causes, five types of conflicts have been identified by the groups in Table 4, namely conflicts related to the method of creating the Protected Area (PA), conflicts related to the definition of rules, and usage rights, human/wildlife conflicts, conflicts related to PA's governance methods, and armed conflicts.

- ***Conflicts related to the mode of PA's creation***

These types of conflicts arise from the way the KBNP and the INR were established, leading to a series of disputes, confrontations, and claims from local communities against the officials of these protected areas. Around the KBNP, the causes of these conflicts are the lack of involvement of the local population in the creation process (41.7%), followed by the lack of compensation for the damages suffered by the local population due to the creation and expansion of the park (25%), restricted access and/or illegal exploitation of vital natural resources by traditional users (16.7%), and the loss of usage rights (16.7%). Around the INR, these conflicts were caused by the lack of compensation for the local population for the damages suffered from the creation (41.7%), followed by the prohibition of access and/or illegal exploitation of vital natural resources by traditional users (25%), the absence of local population involvement in the creation process (16.7%), and the loss of usage rights (16.7%).

- ***Conflicts related to the definition of rules and usage rights***

Around the KBNP, conflicts related to the definition of rules and usage rights are mainly caused by the loss of land rights due to the displacement of the local population (33.3%), followed by the insufficient access and distribution of benefits from PA's conservation actions (25%), the loss of livelihoods (25%), and the violation of ancestral rights and abandonment of sacred places for traditional rites (16.7%). Around the RNI, they are mainly linked to the insufficient access and distribution of benefits from conservation actions (41.7%), followed by the violation of ancestral rights and abandonment of sacred places for traditional rites (25%), the loss of land rights (16.7%), and the loss of livelihoods (16.7%). A significant difference was observed in the causes of this type of conflict between the KBNP and the INR in general ($p = 0.005$) and specifically between the villages around

the INR ($p = 0.005$); however, this did not vary between the villages around the KBNP ($p = 0.214$). These generate the loss of traditional knowledge and people's practices.

- *Human-wildlife conflicts*

The creation of PA was the root of the human-wildlife conflict around the KBNP and the INR. The causes of this type of conflict vary between the KBNP and the INR ($p = 0.000$), and among the villages around the KBNP ($p = 0.040$) and around the INR ($p = 0.023$). Around the PNKB, human-wildlife conflicts are mainly caused by the destruction of crops and/or housing by wild animals (50%), followed by physical attacks of wild animals on local population and/or by the population on animals (33.3%), and zoonosis (16.7%). Around the INR, zoonosis was mainly noted (41.7%), followed by the destruction of crops and/or housing by wild animals (33.3%), and physical attacks from wild animals on local population and/or by the population on animals (25%) as the causes of human-wildlife conflicts in this area.

- *Conflicts related to PA's governance methods*

Around the KBNP, the conflicts related to PA's governance methods were mainly caused by the violation of traditional usage rules (33.3%), followed by encroachment on the PA's boundaries (33.3%), non-compliance with local population specifications (16.7%), and the contradictions in the management rules of the PA among the stakeholders (16.7%). However, around the INR, this type of conflict was fuelled mainly by the non-compliance with local population specifications (58.3%), the violation of traditional usage rules (16.7%), the contradictions in the management rules of the PA among the stakeholders (16.7%), and the encroachment on the boundaries of the PA (8.3%). This conflict varies between the KBNP and the INR ($p < 0.0001$) and between the villages around the INR ($p = 0.029$) only, but not between the villages around the KBNP ($p = 0.081$).

- *Armed conflicts*

A significant difference was observed in the causes of armed conflict between the KBNP and the INR ($p = 0.000$) and between the villages around the INR ($p = 0.017$). Nevertheless, no difference was observed in the causes of armed conflicts between villages around the KBNP ($p = 0.815$). The causes of armed conflict around the KBNP are mainly the intense, illegal, and permanent exploitation of minerals and precious woods (50%), followed by the impunity (33.3%), and the wildlife poaching (16.7%). Around the INR, this is mainly fuelled by the intense illegal exploitation of minerals and precious woods (41.7%), followed by wildlife poaching (41.7%), and the access to power and/or impunity (16.7%).

3.3. Conflict Management Strategies

Some strategies were proposed by respondents for resolving conflicts around the KBNP and the INR (Table 5). These contribute to improving the effectiveness of the community-based conservation approach implemented in these protected areas.

Table 5. Conflict management strategies in the Kahuzi-Biega National Park and Itombwe Nature Reserve.

KBNP										
Variables	**Modalities**	**Bitale (N = 155)**	**Ihembe (N = 30)**	**Miti (N = 31)**	**Katana (N = 35)**	**Mbinga-Nord (N = 44)**	**Mbinga-Sud (N = 50)**	**Total (N = 345)**	**Khi²**	***p*-value**
Compensation for households affected by the establishment of the PA	Yes	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	-	-
	No	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)		
Electrified fence on the boundary	Yes	7 (2.03%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	7 (2.03%)	-	-
	No	13 (3.77%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	13 (3.77%)		
Respect of the prior contract for harmonious collaboration	Yes	72 (20.87%)	0 (0.0%)	2 (0.58%)	0 (0.0%)	30 (8.70%)	44 (12.75%)	148 (42.90%)	-	**<0.001**
	No	63 (18.26%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	13 (3.77%)	5 (1.45%)	81 (23.48%)		
Involvement of the community/establishment of plantations within a radius of one kilometer in the periphery	Yes	0 (0.0%)	19 (5.51%)	21 (6.09%)	30 (8.70%)	0 (0.0%)	0 (0.0%)	70 (20.29%)	-	**0.033**
	No	0 (0.0%)	11 (3.19%)	8 (2.32%)	5 (1.45%)	1 (0.29%)	1 (0.29%)	26 (7.54%)		
INR										
Variables	**Modalities**	**Ilibo (N = 62)**	**Ilowe (N = 62)**	**Kakozi (N = 25)**	**Kalundu (N = 33)**	**Kasalalo (N = 20)**	**Kitamba (N = 74)**	**Total (N = 276)**	**Khi²**	***p*-value**
Electrified fence on the boundary	Yes	0 (0.0%)	2 (0.73%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (0.36%)	3 (1.09%)	-	0.718
	No	4 (1.45%)	5 (1.82%)	4 (1.45%)	5 (1.82%)	0 (0.0%)	7 (2.18%)	24 (8.73%)		
Respect of the prior contract for harmonious collaboration	Yes	36 (13.09%)	37 (13.45%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	43 (15.64%)	116 (42.18%)	-	**0.000**
	No	1 (0.36%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	13 (4.73%)	14 (5.09%)		
Involvement of the community/establishment of plantations within a radius of one kilometer in the periphery	Yes	4 (1.45%)	2 (0.73%)	4 (1.45%)	4 (1.45%)	5 (1.82%)	2 (0.73%)	21 (7.64%)	6.97	0.222
	No	4 (1.45%)	2 (0.73%)	1 (0.36%)	5 (1.82%)	0 (0.0%)	0 (0.0%)	12 (4.36%)		
Compensation for households affected by the establishment of the AP	Yes	8 (2.91%)	13 (4.73%)	15 (5.45%)	12 (4.36%)	7 (2.18%)	9 (3.27%)	63 (22.91%)	18.60	**0.002**
	No	5 (1.82%)	1 (0.36%)	1 (0.36%)	7 (2.18%)	9 (3.27%)	0 (0.0%)	22 (8.00%)		

According to Table 5, these strategies refer to the respect of the contract established beforehand between managers and the local population regarding the management modalities of the conservation area and the possibilities for harmonious collaboration (42.90% from 345 respondents around KBNP and 42.18% from 276 respondents around INR), the involvement of the riverside people in the management of the conservation area and/or the establishment of community plantations within a one-kilometre radius on the periphery (20.29% around KBNP and 7.61% around INR), and the compensation of households affected by the establishment of the conservation area (22.91% around INR). These would allow for the involvement of the local population in the conservation efforts set up as a useful partner, while benefiting from access to the resources of the protected area in view of harmonious collaboration. Nevertheless, a small proportion of surveyed people (2.03% KBNP and 8.73% INR) believe that the construction of an electrified fence separating the boundaries of the protected area from the neighbouring villages would be a solution to reduce/limit the tensions around the management of these protected areas.

The opinions on these strategies indeed vary among the villages around the KBNP regarding the adherence to the pre-established agreement between the manager ($p < 0.001$) and the local population, and the involvement of the community ($p = 0.033$), and among those around the INR regarding the adherence to the pre-established agreement between the manager ($p < 0.001$) and the compensation of households affected by the establishment of the PA ($p = 0.002$). These strategies complement and better explain the strategies proposed by Batachoka and Shalukoma in the KBNP, which suggested the establishment of functional and legal buffer zones, integrated management with ecotourism, decentralized management, and the recognition and valorisation of the level of traditional knowledge of the population in conservation.

4. Discussion

4.1. Impact of the Community-Based Conservation on the Kahuzi-Biega National Park and Itombwe Nature Reserve's Management

The results showed that the implementation of the community-based conservation approach around the KBNP and INR has a positive effect on the well-being of this population. This reality comes to resolve the problems generated by the creation of these APs as demonstrated by [9]. It depends on the benefit-sharing system installed by the PA that constitutes a powerful incentive to gain local support that increases cohesion (collaboration) between managers and the local population [1] [5].

According to [31]-[34], PAs are locally perceived as a potential supplier of economic resources by maintaining the economic balance of households. Unfortunately, the KBNP and INR are faced with several constraints, including the limits of the local population's enjoyment of the resources contained in these protected areas and the insecurity that prevails in the area, which are often the root of claims and discussion centered around access and equitable sharing of the benefits derived from conservation, leading to conflicts. The same reality has been generally observed by [27] [35] in protected areas of Sub-Saharan Africa. It is encouraged by the largely ineffective, inefficient and inequitable *resource* management.

The persistence of conflicts around the KBNP and the INR in the Democratic Republic of the Congo is often supported by the visible antagonism that exists between the PA's conservation objectives and the socio-economic local development. It is observed through the neglect of local needs and the continuation of extreme population's poverty, as well as the discomfort observed in participatory management policies, the enforcement of the law and the implementation of usage rights for local populations, which fuel resentment towards the costs of conservation. [5] highlights the weak capacity of local populations, the lack of transparency and control, the social stratification within communities and the neglect of local needs as the source of the lack of collaboration around PAs in Cameroon. According to [6]-[8], the KBNP and INR's creation has been both a source of dis-

placement and frustration for local people due to the loss of usage rights. This generates conflicts and increases the demands and pressure on the PA's natural resources.

4.2. Conflict Management around Kahuzi-Biega National Park and Itombwe Nature Reserve

Five types of conflicts have been identified around the conservation of KBNP and INR: conflicts related to the PA's creation methods, conflicts related to the definition of rules and rights of use, human/wildlife conflicts, conflicts related to governance methods, and armed conflicts. These types of conflict lead to tensions in communication, the establishment of a climate of distrust and hostility between stakeholders, and hinder collaboration between managers and the local population. This situation is due to the lack of involvement of the population in the process of creating the PA, the lack of compensation for damages caused by the creation of the PA, the loss of usage rights by the local population, and the prohibition of access to natural resources for that population. However, participatory governance should allow for the promotion of communication among the stakeholders [36].

The implementation of the community conservation approach in the KBNP and INR should be seen as a means of reducing and/or resolving tensions and claims regarding the conservation of resources through the restoration of trust among stakeholders, thanks to the restoration of communication and collaboration among them. According to [37] [38], claims and discussions inhibit communication between managers and the local population, and prevent obtaining local support. However, the effectiveness of the benefit-sharing program to stakeholders (creation of revenue generated by the activities of protected areas and a system for distributing this revenue through compensation for the loss of livelihoods) is mentioned as the means of conservation effectiveness of protected areas [39] [40]. This approach has also been demonstrated by the national strategy for community conservation in protected areas in the DRC [16], despite many flaws in its execution. [36] believes that participatory governance should promote communication among stakeholders. Hence, there is a need to improve local support around these protected areas through enhancing awareness and education levels, as well as the effectiveness of benefit-sharing from national parks.

Thus, the necessary approaches for resolving conflicts around the resources prove to be the same for both the KBNP and the INR. They should be based on: 1) the respect of the established contract in advance between the manager and the local population regarding the modalities of implementation and management, which would promote the restoration of communication and collaboration through raising awareness and educating stakeholders, empowering local communities, and sharing benefits (creating youth employment and supporting community development projects); 2) the compensation for households affected by the establishment of the functional buffer zone through the use and property rights of the dis-

placed population in and around the protected area; 3) the involvement of the surrounding community in the management of the protected area and/or the establishment of community plantations within a radius of one kilometer. 4) the construction of an electrified fence at the boundaries of the Protected Areas (PAs). These would enhance local support around these PAs. These strategies complement and better explain those proposed by [40] and [15] in the PNKB, which suggested the establishment of functional and legal buffer zones, integrated management with ecotourism, decentralized management, and the recognition and valorisation of the level of traditional knowledge of the population in conservation.

5. Conclusion

The present study was to evaluate the effectiveness of the community-based conservation approach on the sustainable management of conflicts over natural resources in the KBNP and the INR. Indeed, the resolution of conflicts concerning the studied protected areas strongly depends on the effectiveness of the community-based conservation approach implemented, in its contribution to the well-being of the local population. This contribution is shown among the provision of ecosystem services, the contribution to local community development, and the employment. Thus, efforts should be directed towards improving the level of collaboration between managers and neighbouring populations through: adherence to a contract established in advance between managers and the local population regarding management modalities, compensation for households affected by the establishment of the protected area, and involvement of the neighbouring community in the management and/or establishment of community plantations within a one-kilometer radius.

Authors' Contributions

Muke Matthieu Basubi conceived the idea and the research methodology, collected and analyzed the data, and wrote the manuscript; Kadiri Serge Bobo participated in validating the methodology and guided the writing of the manuscript.

Acknowledgements

The authors acknowledge the *Université Evangelique en Afrique* for manifold support to this work, which was graciously funded through the project A-COD-2023-0035 on improvement of research and teaching quality funded by *Pain pour le Monde*. We thank the Wildlife and Protected Areas Research Unit, Forestry and Wood Technology for the technical support.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this manuscript. In addition, ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submis-

sion, and redundancy have been completely observed by the authors.

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