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Local community perceptions towards biodiversity conservation within protected areas: Implications for policy making and management in Itombwe Nature Reserve, Eastern DR Congo

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Abstract: *Protected areas are a key strategy for protecting biological, but remain contentious due to their negative impacts on local communities and mixed evidence on their ability to conserve species and habitats. Because these protected areas limit agricultural development and exploitation of natural resources, they are frequently opposed in developing nations where reducing poverty is an important social objective.*
Towards the above ends, the present study analyses local residents' attitudes, knowledge, and concept of values concerning conservation and the management of natural resources in the Reserve. A survey was administered of 110 households in three operational sectors located within the Reserve boundaries. Survey results indicated that local residents living within the Reserve hold a variety of mixed attitudes towards the Reserve. Positive attitudes tended to increase with respondents' level of education (X^2 = 16.001, df = 2, p < 0.0001) and knowledge about conservation issues (X^2 = 22.313, df = 1, p < 0.0001). Younger residents (X^2 = 9.960, df = 2, p = 0.002), respondents perceiving benefits from the Park (X^2 = 11.292, df = 2, p = 0.001), and respondents reporting good relations with the Park staff (X^2 = 2.514, df = 1, p = 0.019), were more positive towards the Reserve. Although 86.9% of participants were favorable to the concept of biodiversity conservation within the Reserve, the decision to ban encroachments due to small-scale mining activities and to control slash and burn agriculture increased negative opinion on the Reserve management option. Factors influencing public attitudes are compared with study results in other countries. The diversity of these attitudes and perceptions suggests that conservation strategies should recognize both positive and negative perceptions and work to foster and integrate diverse values in order to more accurately reflect the reality and complexity of local people's lives. Increasing local support for and compliance with policies of the protected areas is necessary for the long-term efficacy of these areas and for protection of species. Creation of protected areas to conserve biodiversity can have both positive and negative impacts, with impacts unequally distributed within local communities. A global shift towards local community involvement in protected area governance and co-management is likely aiming at reducing costs of protected area establishment and their uneven distribution. Yet, there is mixed evidence to support whether such initiatives are succeeding. Reconciling the needs of conservation and local communities is a complex and difficult task.
For sustainable forest management and conservation to be achieved, it is vital that community's needs and aspirations, their attitudes and perceptions regarding conservation are considered and factored into strategies and management planning. In that connection, findings of the present study would be hint-worthy for the policy makers in the RNI and other country's PAs with the similar biophysical and socioeconomic contexts. Yet, there are many costs and few benefits for people living in the RNI. The need to secure long-term provisions for sustainably funding the Reserve cannot be over emphasized. This will help secure livelihoods in the RNI, thus offering viable alternatives to undertaking illegal activities which is likely to spread into the core zone in a significant way if it remains unchecked.

Keywords*: Biodiversity conservation, Itombwe Nature Reserve, Local community, Perception, Protected area,*

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I. Introduction

Protected areas (PAs) are one of the cornerstones of biodiversity conservation and are a key part of an integrated strategy for nature conservation (Dudley, 2008; CBD, 1992), but they vary considerably in their effectiveness and are frequently reported as having negative impacts on local people. There are currently 244,869 designated PAs recorded in the World Database PAs (UNEP-WCMC & IUCN, 2020*)*.They are one of the most frequently used conservation strategies, but remain contentious due to their negative impacts on local

communities (Pullin *et al*. 2013) and mixed evidence on their ability to conserve species and habitats (Eklund & Cabeza, 2017; Geldmann*et al*. 2013).

Conflicts between local people and conservation initiatives have generated one of the greatest and longest running debates in conservation science (Roe, 2008). This has contributed to a divisive and unresolved debate concerning the compatibility of environmental and socioeconomic development goals. The roots of the problem run deep and vary considerably around Africa. Here we touch on a few of the more generic problems. Elucidating the relationship between positive and negative social impacts and conservation outcomes of PAs is key for the development of more effective and socially just conservation. At one end of the spectrum is the fences-and-fines approach, which contends that to deliver successful conservation outcomes people must be excluded, even forcibly, from PAs (Brockington &Igoe, 2006).Opponents of this approach consider such exclusionist protection arrangements ethically troubling because they frequently result in PAs having disadvantageous social outcomes for local people that ultimately result in ineffective long-term conservation outcomes (Adams *et al*. 2004). An increasingly advocated strategy is that to deliver effective and long-term environmental protection PAs must accommodate the needs of local people so as to secure sustainable livelihoods and enhance their well-being (Roe, 2008). The debate between adherents to these two approaches and the importance of considering human well-being in conservation remains lively, intense, and unresolved (Marvier, 2014).

These conflicts between the authority of conservation areas and the local people are often a result of a disconnection between the conservation regulations and local conditions. McNeely (1993) echoes this point, suggesting the long-term protection of environmentally sensitive areas is threatened if people living in and around PAs are ignored. As a result, conflicts arose with the local people resenting the imposition of the national park. The long-term survival of PAs in developing nations will be jeopardized if needs, aspirations and attitudes of local people are not accounted for (Mehta & Heinen, 2001). To improve PA management, perceptions and attitudes of the participants need to be studied, which, as Sewell (1973) pointed out, will aid in identifying the problems and recognizing potential solutions for developing appropriate strategy.

Since the colonial era, efforts to preserve the biological diversity have been concentrated on PAs. However, methods used to create these PAs have been essentially top-down. PAs were created without the local communities' consent and their management has been more enforcement-oriented than inclusive of stakeholders. To start, we recognize that creating PAs has sometimes undermined local incomes and security, particularly in Africa where they are associated with exploitative colonial regimes. Urgent appeals to human rights concerns and equity have pushed a more people-centered paradigm for PA. Managing PAs in developing countries presents profound issues, given widespread conditions of poverty, rapid population growth, and political instability. In addition, policy-makers are also confronted with the vexing challenge of how to respond to the consequences of irreversible damages and violent conflicts stemming from the burden of poverty, vulnerability and natural resources scarcity aggravated by climate change. Such conditions defy credulity that these upheavals will take place without triggering new conflicts and worsening old ones between local community and PA managers while rural areas are also likely to experience increasing conflicts with regard to local stewardship over natural resources access. with regard to local stewardship over natural and associated revenues implemented via community based natural resource management.

Mutually supportive relationships between communities and nearby PAs are critical to the long-term success of conservation efforts. In sub-Saharan Africa, many PAs were first created during colonial times as hunting grounds or parks for European elites, with little or no regard for the needs or desires of local communities (Adams*et al*. 2004). Today, many of these areas harbor long-standing conflicts over land tenure and resource use (IIED, 1994). These conflicts may create tensions between local communities, PA staff, and conservation goals (Newmark *et al*. 1994). According to Wells & Brandon (1993), there is a growing recognition that successful management of PAs ultimately depends on the cooperation and support of local people. Likewise, Kothari *et al*. (1995) argued that protection strategy that alienates local communities from conservation is not only unjust and disrespectful to their fundamental right but it is also detrimental to conservation.

By the time of the 2003 IUCN World Parks Congress in Durban, South Africa, strong participation from Indigenous Peoples and community leaders consolidated these directions of change into a "new paradigm" for PAs. This paradigm, as articulated in the Durban Accord, recognizes the importance of cultural diversity and the conservation successes of local communities and Indigenous Peoples, and calls for the full incorporation of the rights, interests, and aspirations of local peoples in PAs, mechanisms for participation and benefit-sharing, and support for community conservation areas (IUCN, 2005). Such a "new paradigm" for PAs has been evolving for decades in which Indigenous Peoples and local communities are recognized as land and resource owners and managers, with positive results for both human rights and conservation. The transition to this new paradigm remains substantially incomplete, however. Understanding people's beliefs and attitudes toward PAs

within the ‘’new paradigm’’ is a key factor in developing successful management plans to conserve those areas over the long-term.

However, despite the fact that these global policy shifts have significantly increased recognition of the rights and roles of Indigenous Peoples and local communities in conservation, and global data indicate that PAs are becoming more diverse in their aims and governance, the active integration of community involvement in the global conservation agenda has been limited. At the national level, conservation PA policies and management practices remain strongly shaped by national tenure and governance regimes. Documented evidence of continued widespread conflict over human-rights infringements associated with PAs remains another indicator of this significance in terms of the persistence of large areas of spatial overlap between customary community lands interests and PAs managers especially in high-biodiversity areas, including areas under formal protection such as the forest clearings.

The attitudes of resource users living within or adjacent to PAs is a central issue for their management that will become more prevalent as demands on natural resources increase with expanding populations (Hough, 1988). As more emphasis is being placed on the effectiveness of PAs in conserving valuable forest and non-forest ecosystems and awareness of potential human impact on PAs is increasing, more research has been focused on exploring conservation management strategies involving human perceptions. The failure to include both local residents and wildlife staff in future PA management and conservation policies contributes to limited conservation benefits and further conflicts between people and PAs. Yet, most of the emphasis in understanding people’s perceptions has been on the conflicts that exist between people and PAs, such as loss of traditional extraction access or damage by wildlife to crops and livestock. This study addresses the need to explore people’s attitudes toward PAs in a way that allows them to define and describe the values they hold toward the areas and the relevant issues and concepts.

Until the 1970s, most conservation laws and designations of PAs as national parks and wildlife sanctuaries in developing countries followed the ‘preservation-oriented’ approach, which advocated centralized-regulatory control and the exclusion of local people and their subsistence forest-based activities in order to protect biodiversity (Colchester, 1996). Many PAs have followed the conventional and exclusionary approach applied at Yellowstone in 1872. The exclusionary “fortress” approach to protected-area management quickly spread across North America, to Australia, New Zealand, and South Africa, and through colonial administrations in the rest of Africa, and in parts of Asia and Latin America. It remained the dominant model of PA management for more than a century, well beyond the colonial era, and remains influential today, although new approaches have also emerged since the 1980s.

As such, many PAs have failed to fully integrate other important factors, such as social, cultural, and political issues. All this fostered widespread park–people conflicts and led local people to hold negative perceptions toward these areas (Hulme& Murphree, 2001). In some cases, this has triggered adverse social impacts on local communities, disrupting their traditional ways of living and limiting their control of and access to natural resources. Such an outcome can undermine protection policies through conflicts between park managers and local communities, all the more so since the outcome of decision-making is affected considerably by the perceptions and attitudes of participants in the process (Sewell, 1973).

Commitment of local communities to PAs is essential for conserving biodiversity. However, in many developing countries like DR Congo, former management strategies kept human from PAs using coercion. Fortunately, more recent regimes attempt to give local populations more control on the management but little is known about local residents' perceptions, beliefs and attitudes toward the management of these areas. Responding to perceptions of many conservationists — especially those working in poorer countries — that wildlife conservation and PA were doomed unless local communities become an integral part of conservation efforts (Manfredo*et al*. 2004; Hulme& Murphree, 2001), new strategies, often referred to as “community conservation” have evolved over the past two decades (Infield &Namara, 2001). Urgent appeals to human rights concerns and equity have pushed a more people-centered paradigm for PAs.

There is growing empirical evidence indicating that assessment of local responses toward PAs is a crucial step in gathering information that can be incorporated into decision-making processes and lead to people–park conflict mitigation (Rao *et al*. 2003). Indeed, local communities’ perceptions of PAs influence the kinds of interactions people have with them and thereby conservation effectiveness (Allendorf,2007). Their perceptions of PA management also play an important role in their attitudes toward them (Anthony, 2007). Therefore, understanding local residents’ perceptions about conservation is key to improving the relationship between people and PAs and will subsequently help to achieve the goals of PAs (Weladji*et al*. 2003). Meanwhile, it has been increasingly recognized that PAs are contributing on the lifestyle and livelihoods of local communities who have important and historical relationships with these areas. Rashid *et al*. (2013) pointed out that local people’s support and involvement should be incorporated in PA management; otherwise, conservation effort through PAs will be ineffective.

Many factors influence the perceptions of the PAs held by residents living within and in their periphery. These include the history of PAmanagement, the degree of awareness of PAs existence (Ormsby &Kaplin, 2005), the education level, the reference to future generation (Bauer, 2003) and the gender and ethnicity (Mehta & Heinen, 2001). A key factor limiting the resolution of this debate is the insufficient evidence base, which is currently limited to individual case studies, with few studies specifically testing causal pathways (Adam *et al*. 2010) and lack of a global analysis (Geldmann*et al*. 2013).

Existing studies have analyzed how the benefits and costs of PA establishment are distributed (Foerster *et al*. 2011; Franks *et al*.2014; Gurney et al., 2015), but few have explicitly linked this to the governance processes causing these impacts. As community involvement in PA governance becomes more widespread, we need to understand whether and how it is meeting the aim of improving PA-related equity within particular PA settings. To explore this, in this paper we focus on the RNI, which has seen a strong shift towards co-management of PA, presenting a useful case study to explore how co-management governance processes play out in reality following a long standing process which culminated in the success story relating to the participatory gazettement of the RNI through the provincial decree N °16/020/GP/SK dated on 20 June 2016.

Understanding residents' attitudes is a key to improving the PA people relationship between local residents and PAs and will improve people awareness about biodiversity conservation within these areas, thus providing the guidance for policy and management decision. People are more likely to act in accordance with what they believe their peers believe. In other words when people perceive their peers to have more positive attitude towards the park, they will exhibit more positive reaction to it. They do this in order to either gain social currency or to avoid sanction from their peers. Alternatively, people may develop their own internal belief system and value using their peer as referenced group for this development (Emerton, 1965).

The present study carried out in the RNI in the eastern DR Congo providesa good example to assess local communities' perceptions about PAs. The RNI declared a Reserve in 2006, and delineated in 2016 (Mubalama *et al*. 2018; Mubalama *et al*. 2017). The Law N°69-041 of 22 august 1969 whichwas underpinned by the idea of protecting forest reserves from human use is currently superseded by the new law 14/003 governing the conservation of nature in DR Congo. In August 2014 the community forestry decree for the DRC was signed, promulgating the modalities for local communities to obtain a forest concession. This important step towards the finalization of the forest legal framework concerning community forestry brings communities one step closer to the use of the forests for local development, thus giving local populations more control on the management of resources in the peripheral areas. As far as the RNI is concerned, it is possible to make a very rough estimate of the size of the resident population at about 418, 452 inhabitants (ICCN/RNI, 2018). Effective management of the PAs requires rigorous assessment of the perceptions and factors behind these perceptions. In this study, we sought to undertake such an assessment with a view to contributing to a scientific basis for management of the RNI forest-dominant ecosystem. In particular, we tested the following hypotheses:

Our study aimed to (i) identify background factors such as demographic and socioeconomic variables, general values toward the RNI, and past experience with damage caused by wildlife; (ii) identify residents' attitudes toward different motivations for hunting (hunting for consumption, hunting for commercial purposes, killing animals in retaliation for damage to crops, livestock or human) and deforestation;(iii) investigate residents' perception related to presence and frequency of law enforcement (perceived behavioral control; and (iv) explore correlations between background factors, attitudes, norms, perceived behavioral control, and behaviors of rural residents toward hunting and deforestation within and around the Reserve and draw the implications for effective participatory management of the RNI.

Findings of the study will provide a basis for formulating policies and guidelines that will inculcate positive attitudes and perceptions in local communities living adjacent to PAs. Although our findings should be considered within the RNI's cultural and geographical context, this study has a noteworthy relevance beyond the case we examined. Therefore, this study allows to make some broad suggestions for wider applications.

II. Materials and Methods

In recent years, attitudinal studies have increasingly been adopted as a tool for evaluating public understanding, acceptance and impact of conservation interventions, all the more so since contradiction between wildlife conservation and local people's interests are more and more serious. In addition, attitudes affecting conservation positively or negatively may vary within a community and be influenced by many factors. The need of understanding local communities' attitudes, needs and aspirations has received increasing attention, thus becoming more pressing as the goals of conservation have expanded from saving endangered species and PAs to sustaining biological diversity, ecosystem function and ecological services (Balmford*et al*. 2001). Determination of perceptions trends and the factors governing population attitudes are therefore vital to forecasting, planning and managing PAs, and in auditing the success of alternative conservation policies and practices.

The aim of this study was therefore to investigate the attitudes and perceptions of the main stakeholders towards the RNI in particular, and current wildlife policy in general. We address the following questions: (i)

What are the attitudes of local people, towards the RNI? (ii) What are the attitudes of local people, towards the wildlife policy? (iii) Are there differences in attitudes among the main stakeholders towards the RNI and the wildlife policy? (iv) what are the key factors affecting the success in conserving biodiversity in the RNI? (v) What factors (perceived benefit, wildlife depredation, etc.) influence local people's attitudes toward the Reserve? Because different communities have various needs and constraints, we hypothesized that people who developed positive perception about the RNI and its biodiversity are those who get high benefits from the RNI. We also made the assumption that people who have positive opinion about the current Reserve management methods developed positive perception about biodiversity conservation within it.

It is important to specify that until now, the RNI never took place a similar survey with this magnitude, and the results are indispensable for all institution involved in PA as management process for a successful sustainable conservation planning. This study highlights the diversity of perceptions that communities can hold toward management and demonstrates that management can play both a positive and negative role simultaneously in people's attitudes toward PAs.Understanding the attitudes and perceptions of local communities, people or the public towards wildlife is a key element of a PA manager's work as well as a means of garnering support from local people for wildlife conservation and management.

2.1 Study area

The Itombwe massif is situated north-west of Lake Tanganyika (28º02'- 29º04'E), and 02º41'-03º52'S), and covers an area of approximately 16,000 km^2 within the administrative territories of Mwenga, Fizi, and Uvira. The project site has been recognized as one of the most biologically distinctive regions in Africa. The RNI covering 5,732 km^2 (Fig. 1) within the Itombwemassif includes the complete succession of forest types from mid-altitude forests up to subalpine forest vegetation, through sub montane and montane forests (Mubalama *et al*. 2017). The RNI comprises several habitats including bamboo forest (790 km^2); sub montane forest (2,159 km^2); mid-lowland forest (409 km^2); mid-highland forest (2,202 km^2); secondary forest (149 km^2) and savannah (23 km^2). The Itombwe Mountains lie at the intersection of three main phytogeographical regions. In the west, the flora belongs to the Guineo-congolian regional center of endemism, which encompasses the extensive forest block extending from Nigeria to eastern DRCongo.

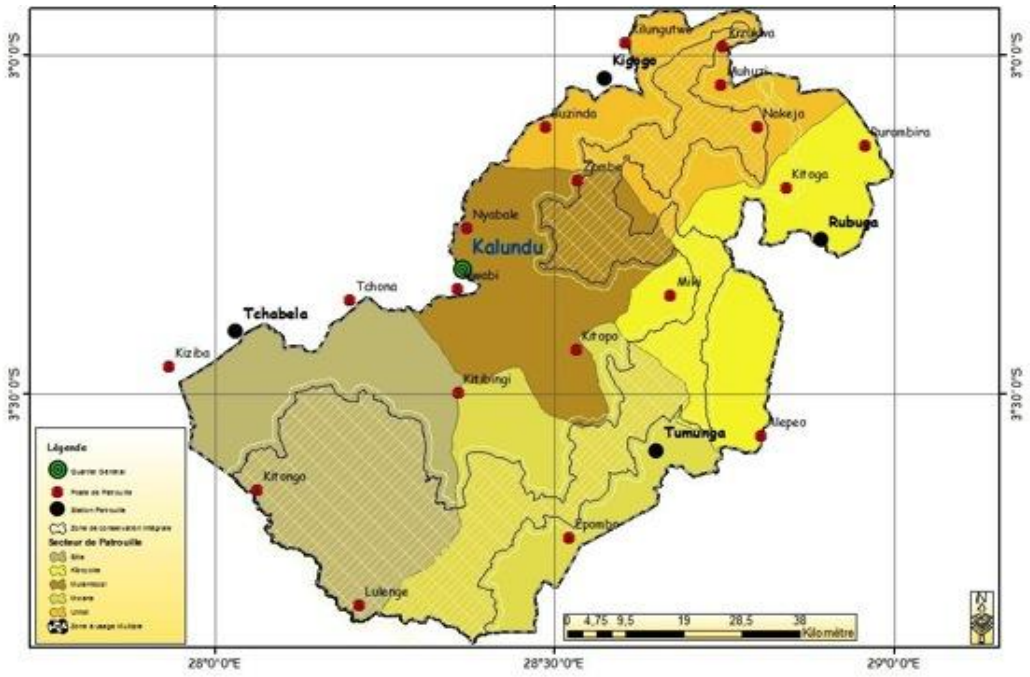

Fig 1. Itombwe Nature Reserve with location of the five operational sectors. Source: ICCN/WWF, 2017

The region avifauna is estimated to be totaling 565 species. Building upon the calculated density of 0.038 Grauer's gorilla (*Gorilla beringeigraueri*) per km^2 and 0.21 chimpanzee per km^2 following the survey carried out in 2015, the RNI holds a population of 218 grauer's gorilla and 1,204 chimpanzees (Mubalama *et al*. 2017). The zone is characterized by a mosaic of mountain and sub mountain forests interspersed with savannah woodlands, with altitudes varying between 900m and 3,475m (Mount Muhi, to the north of the Massif), providing an uninterrupted forest gradient likely to withstand, if protected, large altitudinal shifting following climate change. The INR is a key site for biodiversity in the Albertine Rift (Doumenge&Schilter, 1997). The

reserve is part of the exceptional high-altitude forests extending from 1,500 m to over 3,000 m altitude (Mubalama, 2017; Mubalama et al. 2008) and known for the discovery of the eastern lowland gorilla or Grauer's gorilla (*Gorilla beringeigraueri*) in the early 1900s (Doumenge&Schilter 1997; Plumptre*et al.* 2007). According to different biological expeditions into the massif, the site remains important for biodiversity both due to the number of endemic species (endemism) and for the number of species in general (species richness). The area is located in the eastern Democratic Republic of the Congo (DRC) as illustrated in Figure 1, and known as one of the rare high-altitude montane forests in the region. As such, it harbors a high number of species and endemics (Mubalama *et al*. 2017; Plumptre*et al*. 2007; Doumenge&Schilter 1997). However, in spite of its biological richness and habitat diversity, the biodiversity of the massif is threatened by various human activities. include hunting using traditional means or firearms, small-scale and industrial mining, lighting of bush fires to facilitate grazing by domestic animals, human settlements and the weak governance of natural resources (Plumptre*et al*. 2007). Despite the decline by some species, effective community-based conservation is central to the future of wildlife in the Reserve and beyond and is crucially dependent on the good will, effective engagement and collective action of local communities, working in partnerships with various organizations, which, in the Reserve, operate under the umbrella of the Wildlife Agency for Congolese PAs (ICCN).

2.2Methods

2.2.1 Conceptual framework

The study was guided by the Social Exchange Theory (SET), which was developed in the late 1950s and early 1960s. SET has been widely used in the field of natural resource management, more especially in understanding communities' conservation attitudes (Chibucos*et al.* 2005). SET explains the actions and/or behaviors of individuals in social relationships. In the context of this study, social relationship entails management and conservation of forest resources. The main propositions of SET are that "…human in social situations choose behaviors that maximize their likelihood of meeting self-interests in those situations". Secondly, "individuals evaluate their exchange relative to the personal benefits and costs associated with theexchange" (Chibucos*et al.* 2005). This implies that individual's action and/or behavior in social relationships are based on the perceived outcome of their action or behavior.

In most cases, individuals participate in relationships or situations that bear positive rewards or are profitable and they always strike to avoid costs or negative rewards. Napier& Napier (1991) posit that activities that generate net benefits will tend to be perceived positively, while those activities that generate net losses will tend to be perceived negatively.

In the context of the current study, SET will help in qualifying the underlying factors which influence attitudes of households towards forest management and conservation. SET shed light on understanding why households hold positive attitudes towards forestmanagement and conservation if the expected outcomes are positive and rewarding and vice versa. People's perception of PAs is influenced by the perceived costs and benefits from PAs (Ratsimbazafy*et al.* 2012). It is envisaged that local people will hold positive attitudes towards forest management and conservation if the derived benefits from forest outweigh the costs incurred (Takon*et al*. 2013; Infield &Namara, 2001; Infield, 1988).

2.2.2Household data collection and sampling strategies

Firstly, three communities involving 3 sectors of the RNI were purposively sampled. Secondly, 35% of total households from each of the three communities were selected randomly. Thus, a total of 110 households wereconsidered to form part of the study. Household heads weretargeted for interviews. In circumstances where the householdhead was absent, any member who was 18 years and abovewas considered in lieu of the household head. The participantswere selected from the communities of Mwana, Mulambozi et Elila sectors (Fig. 1) in six selected eight villages based on the dominant ethnic group in each of them (Lega and Bembe villages) including fifteen Indigenous people, in three communities. This village's selection strategy is justified by previous studies which revealed that the perception of the value of park resources is strongly influenced by socio-cultural characteristics of population (Baral& Heinen, 2007; Weladji*et al.* 2003). The participants' age ranged from 18 to 75 years.

Indeed, within each selected village, we entered in any house, established contact by introducing ourselves while presenting the objectives of the study. We used a structured questionnaire to interview one adult, the household heads, or in their absence, any adult member older than 18 years who is willing to participate in our research.

Data collection took a mixed-methods approach, comprising: (i) structured interviews, (ii) village focus groups, and (iii) household questionnaires. This research was part of a broader Basic Need Survey (BNS) study that also focused on co-management governance, participation and ecosystemservice access (Ward et al. 2017). Research design was informed by the Sustainable Livelihoods Framework and included both qualitative andquantitative methods to ensure both depth and breadth of information (Bennett et al. 2017). Interviews were

conducted in all case-study villages with key stakeholders, such as village presidents, elders and Community-based conservation members, to gain in-depth information relating to the RNI governance processes and livelihoods. Sampling followed a snowball approach, and households' interviews were completed in total (Mwana sector = 36, Mulambozi sector =39, and Elila sector =35).

Data collection was conducted in October 2016–February 2017 by the lead author with the help of trained local people and research assistants in three over the five sectors composing the Reserve (Fig 1), including Mwana (Ekombe, Kitibingi); Mulambozi (Nyabale, Zombe) and Elila (Malenge and Tshona).Ethical approval was sought from the RNI board before data collection began. The household heads were targeted as the respondents and face-to-face interviews were conducted with the sampled respondents at their homes, during their convenient times. A structured questionnaire survey was closed-ended to obtain data on perceptions of the Reserve, the roles and responsibilities of its associated groups, and extent to which expectations were met, was conducted with each household. Questionnaires were written in French but the interviews were entirely conducted in participant local language (Swahili, LegaorBembe). Teachers from the local schools were employed as enumerators. Being fluent in Lega, Bembe or Swahili was a major requirement for all enumerators because these are the common languages spoken in the Itombwe massif. All the enumerators were fully briefed on the purpose and objectives of the study and accordingly, received a day of training on how to administer the questionnaire prior to proceeding of field survey.

Two months before data collection, we conducted a pilot interview with a sample of 20 households to test the questionnaire in Kalundu one of the Reserve surrounding villages. During this test, the interviewers were trained on how to administer the questions. The purpose of the interview was to understand how local people interact with the RNI staff. We assured confidentiality of the information they provided to eliminate their worry about saying their real thoughts. At the same time, we tried to avoid leading the respondents to answer and repeated to confirm the information they provided in order to maximum the accuracy of the data collected. The majority of respondents had not completed secondary education. The interviews were supported by key informant interviews with local Community governance structure members, wildlife authority officers and local chiefdom officials.

A structured questionnaire was used to capture respondent's socio-demographics looking at: their knowledge and awareness, perceptions (how individuals viewed issues) and attitudes (actions taken as a result of how they view issues) of the RNI. The questionnaire included reliability questions that served to identify invalid or false respondents' responses.

In addition to the questionnaire three focus group discussions with the youth, women and a mixed group of women and men were held at Kipupu in Itombwe sector, Kitutu in Wakabango Chiefdom and Kiyambain Basile chiefdom (Fig 1). This allowed interviewees to construct their own accounts of experiences to counter the limited explanatory power of structured questions. Each group comprised 7-10 individuals drawn from members of community clubs (women, youth, etc.) and institutions (church, schools, rural clinics, etc.). Each discussion lasted for an hour and a half and discussions were premised on three major sections that sought to assess awareness/knowledge, perceptions and attitudes and notes were taken during the discussions.

To ensure independence of the data collected, as well as getting representative wider views as possible, only an adult family head (man or woman) was interviewed from each household. The interview and discussion with each interviewee were done separately from anyone else. To further ensure robustness of tests, reliability of inference and conclusions, an effort was made to interview as many men and women (even though most Lega and Bembe women interviewed will not agree to give interviews when their husbands are present), while also ensuring a good sample size of households interviewed in each stratum.

The local guides and interpreters were trained and used for exact translation into Lega, Bembe language from French. To ensure that the information asked was accurate, consistently phrased and presented in the same way from one interviewee to another, a discussion guided by a structured questionnaire with local interpreters was done question by question to ascertain the meaning, wording and expected responses from the interviewees. These "trained" local translators and interpreters (good in both Kiswahili and Lega, Bembe which are commonly spoken languages in the area) were retained throughout the study. Before contacting the questionnaires interview, introduction of the interviewers and the general purpose of the interview were done. Later, results of the work were presented in a joint presentation in which local community members, group ranch officials and other stakeholders were invited for discussions and further clarification of issues.

The questionnaire was structured into three sections to capture respondents 'information on demographic and socio-economic profile, forest resource utilization and household's attitudes towards forest management and conservation. The socio-demographic variables included gender, age, education level, employment, lengthy of residency, household size and forest dependency. Attitudes were assessed by items denoting protection, sustainability, management and conservation of forests. The items mainly assessed the respondent's evaluative responses and the degree of favor or disfavor on forest conservation. We asked participants about their involvement in the RNI activities, their link with local organization in charge of PA

management, the benefits they obtain fromthe PA and their opinion on Reserve management. We also collected data on participants' economic activities, their various sources of income and conservation awareness.

To investigate attitudes, respondents were asked to agree or disagree with statements about different motivations for hunting (hunting for consumption, hunting for commercial purposes, killing animals in retaliation for damage to crops, livestock or human) and deforestation (replacement of primary or secondary forests with small-scale agriculture).However, in some cases, respondents did not completely agree with the statement, citing a condition for agreement. We decided to incorporate these responses into a different classification (''partly agree'').

We decided to investigate descriptive norms because the sensitiveness of the investigated behaviors, wildlife hunting, and deforestation. We found that it was more comfortable for the respondent to talk about other people's behavior (descriptive norms) than about what people would think about their own behavior (subjective norms). Perceived behavioral control (the perceived ability to perform the behavior) was investigated in relation to the perceived presence of law enforcement officers in the area. According to Stern (2008), laws and government regulations represent contextual factors that may influence behaviors.

Data about hunting prevalence (behavior) in the study region and respondents' perceptions about the community's hunting behavior (descriptive norm) were obtained from Galindo to explore the correlation between attitudes, norms, perceived behavioral control, and behavior toward hunting. Unfortunately, data about hunting for commercial purposes (behavior) were scarce to make correlations.

2.2.3 Data analysis

All responses to the questionnaire were collated using Microsoft Excel and Statistical Package for Social Sciences (SPSS), version 25 (SPSS, 2017). Interviews and qualitative responses from questionnaires were transcribed and coded into themes and themes were organized under the various components. Demographic data were organized then analyzed by sex, marital status, age, education, ethnicity and household size. Variables that indicated a respondent's wealth and income status included monthly income, housing structure and livestock. Responses were compared using frequencies and cross-tabulations in SPSS 23. Respondents were categorized into three groups based on age, being youth (18–39 years); middle (40–57 years) and elderly (58 years and above) to facilitate in-depth analysis. Interviews and qualitative responses from questionnaires

Quantitative data were analyzed in R (R Core Team, 2014). Chi squared statistical tests were used to test for perceived changes in perceived benefits and activities since the RNI co-management had been established. In order to explore the distribution of impacts within and between communities, social groups were chosen as informed by interview and focus group data. These included village, community-based conservation membership, gender, household wealth, ethnicity and age.

Key questions relating to some of the Reserve's basic features (boundaries, institutional arrangements, knowledge of individuals punished for activities in the Reserve, legal and illegal activities) were used to assess levels of awareness and knowledge of the Reserve. Frequencies, cross tabulations and Chi-square analysis were used to compare statistical differences in responses among respondents. In order to obtain an overall result, Microsoft Excel was used to group and compare all negative responses, (responses that alluded to respondents not being aware or knowledgeable) versus positive responses that alluded to respondents being aware and knowledgeable. The purpose of the interview was to understand how local people interact with Grauer's gorilla and RNI staff. We assured confidentiality of the information they provided to eliminate their worry about saying their real thoughts. At the same time, we tried to avoid leading the respondents to answer and repeated to confirm the information they provided in order to maximum the accuracy of the data collected. With regards to perceptions towards the Reserve, responses were considered from questions relating to how respondents perceived the Reserve's purpose, benefits, wildlife numbers and reasons to protect the Reserve. Frequencies and cross tabulations including Chi-square analysis were used to compare responses. An overall result was attained by grouping all negative responses and comparing them to positive responses.

The information solicited included respondents' socio-demographic variables (e.g. gender, age, vocation, level of education, household size, residence status, family income); area of main crops; distance between settlement and Reserve core zone boundary; level of dependence on energy resources; level of awareness of wildlife protection; trends of Gorilla damages in the past five years; level of gorilla damage to local people's interests and their attitudes towards gorillas. As a measure of attitudes three questions were posed: (1) "Whether gorilla have value or not on human" (yes or no)? (2) "How you would expect the gorilla population changes" (extirpate, control or protect)? (3) "Whether you would kill gorilla when your interests were threatened by gorillas" (yes or no)?

Because most of the data were non-parametric, our analyses were conducted with non-parametric statistics. We applied a binary logistic regression analysis to analyze which factors are important in shaping local people's attitudes. Variables in the stepwise regression analysis were coded as follows (Table 1):

Table 1. Summary of all attitude statement results

Attitude statement	Agreement rate (%) *
Great apes are a threat to people	62
Great apes are a threat to crops	54
Great apes deserve protection	74
Great apes have intrinsic natural value	80
Great apes would be killed when people interests are threatened	64
I would be happier if there were no great apes at all	41
A solution to the problem of great apes deserve protection	90
crop-raiding needs to be found	90
I/we would like to receive help in solving the great ape's depredation issue	94
I benefit directly from the RNI	33
The nature/ wildlife of the RNI is a national treasure	83
The nature/ wildlife of the RNI is adequately protected	45
I am worried about the eco guard's behavior	44
I consider myself aware of conservation problems in the RNI	76
The RNI needs a national park status	17
The RNI needs more infrastructure development (road, school, clinics)	92
The existing laws are useful in protecting the RNI	37
Setting aside INR in Itombwe massif forest is relevant	79
I am concerned about overhunting in the RNI	72
I would like to get more benefits from ICCN and its partners organizations	86

We used qualitative (Silverman, 2001) and quantitative methods to examine community perceptions and attitudes towards current Reservepractices. The measurement of respondent attitudes about various conservation issues was assessed using a Likert scale (Likert, 1974). The Likert scale is a method of ascribing quantitative value to qualitative data, to make it amenable to statistical analysis. Likert scales usually have five potential choices (strongly agree, agree, neutral, disagree, strongly disagree) but sometimes go up to ten or more. A numerical value is assigned to each potential choice, and a mean figure for all the responses is computed at the end of the evaluation or survey. The final average score represents overall level of accomplishment or attitude toward the subject matter. Although this is mainly used in training course evaluations and market surveys, it has been widely used for assessing the community attitudes on natural resource management, protected and other conservation areas (Baral& Heinen, 2007; Mehta & Heinen, 2001). In our study, five choices with numerical values from 1(strongly disagree) to 5 (strongly agree) were used in the questionnaire.

Social-psychological models such as the theory of reasoned action and its extension, the Theory of Planned Behavior (TPB; Ajzen, 2012), have been used to understand and explain human behavior. According to the TPB, behavioral intentions are a result of the combination of an individual's attitudes, norms, and perceived behavioral control. To measure attitudes, subjective norms, and perceived control relating to local community membership, participants rated their agreement with each statement on a Likert scale: strongly disagree, disagree, neutral, agree, and strongly agree (Supporting Information). Statements were written to be target, action, context, and time specific (St. John *et al.* 2010). Determinants were measured directly and indirectly. For indirect measures, participants were asked about specific beliefs and outcome evaluations, motivations to comply, or perceived control. Response items were converted to numbers prior to analyses (strongly disagree, 1; disagree, 2, etc.) in order to calculate scores. For the indirect measurements, belief scores were multiplied by the relevant evaluation score and results were summed
(Francis*et al*. 2004).

We grouped villages within the three sectors to statistically compare the data between locations due to lower numbers of interviews in two villages of the areas selected (Malenge&Ekombe). This grouping was done based on the proximity of the areas and history of the Reserve creation. Data were analyzed using R software (R

Core Team,2014). Attitudes and behaviors were analyzed individually as single items. The relationships between background factors (demographic and socioeconomic variables, values held for PAs, location, and past experience related to damage to crops or livestock caused by wildlife), the components of the TPB (attitudes, descriptive norms, and perceived behavioral control), and behaviors(Table 4) were explored using Pearson _2 and Fisher tests (Contingency Tables).We did not use a multivariate analysis to explore the relative effects of the different variables due to the small sample size and the incomplete nature of the specification of the framework(based on the TPB); therefore, this study should be seen as an exploration of the relationships between elements as a guide and precursor to more detailed research.

III. Results

3.1 Respondent's profile and demographic and socioeconomic variables

The objectives of the study were to examine attitudes of local communities towards management and conservation of the RNI and to explore key factors which influenced communities to develop certain attitudes towards conservation. A total of 110 respondents from selected villages from three sectors were interviewed. Majority of the respondents were females (60.9%, n = 67). The mean age of respondents was 39.33 years (SD = 17.28), ranging from 18 to 75 years. The predominate education level of the respondents was primary (34.5%, n = 38) while tertiary constituted the least (9.01%, n = 10). However, 12.7% (n = 14) of the respondents indicated that they have not attained any form of education.

The fact that the majority of respondents (94 per cent) are small to medium scale farmers who reported farming as their sole occupation may have implications on conservation in the sense that it increases the likelihood of human wildlife conflicts (HWC), particularly due to crop raiding. Incidences of HWC are likely to increase if land clearing for agriculture and settlements remains unchecked as eco-guards do not yet have the means necessary to scare and repel marauding pest animals from farmers' fields.

Unemployment was rife in the study area as close to 54% (n = 59) of the young respondents were unemployed while only 9.01% (n = 10) were employed on a full-time basis. Furthermore, fewer respondents were self-employed while others employed on part-times basis. Household average monthly income varied between two extremes: very low average income for majority of households and very high average income for few households. Based on the foregoing, 42.7 % (n = 47) of the respondents reported an average monthly income of less than CDF80,000.00 while 4.5% (n = 5) indicated an average monthly income amounting to CDF 400,000.00 or more. The mean household size was 6.85 (SD = 2.64). Lastly, the mean length of residency in the area of settlement was 54.06 (SD = 20.73), this indicates that most of the respondents lived in their area of settlement since birth.

3.2 Establishment and Management of the Reserve

The question 'do you find the presence of the Reserve good, bad or do you have no opinion?' was answered 'good' by a large majority of respondents: 79% appreciated the Reserve's existence. The question 'do you find the work of the eco guards good, bad or do you have no opinion?' showed that 52% of the respondents appreciated the work of the eco guards. However, despite the overwhelming number that knew which institution managed the Reserve, very few (22.6 per cent) gave correct responses about the activities conducted in the RNI. Although local communities do not necessarily have an input in the day to day management of the Reserve, their contribution towards conservation is considered less significant as they are not effective co-managers of buffer zones and the multiple use zone. Some of the core zone areas situated in their areas constitute important habitats as they serve as breeding grounds for a myriad of wildlife.

The question 'do you know the boundary of the Reserve' was answered 'yes' by 73% of the respondents. This high proportion may be explained by the effectiveness of the Reserve participatory gazettement (Mubalama *et al*. 2013). The question was followed by a question to describe its location, which showed that positive answers were correct in all cases. This knowledge varied significantly with sex and age, however, men (86%) and the two older age groups (82% and 84%) answered more often that they knew the boundaries (χ^2 = 41.0, p <0.001; χ^2 = 4.3, p < 0.05, respectively). Almost all respondents (99.5%) found the Reserve too large. Answers to the question why the Reserve was created could be categorized as 'for conservation' (39%), 'for tourism' (7%), and 'don't know' (54%). Sex and age had no significant influence; the only significant variation was caused by non-use benefits accruing from the Reserve and/or the Project (χ^2 = 11.5, p <0.01); all those that answered 'for tourism' belonged to the group with non-use benefits.

Local communities are seemingly more aware of illegal activities conducted in the Reserve (89.7 per cent) as opposed to the legitimate activities. For instance, poaching and tree cutting were the most frequently cited illegal activities in the park. This is corroborated by the number of respondents that felt that the wildlife in the Reserve was decreasing due to poaching (47.7 per cent). Only 36.5 per cent felt that wildlife populations were increasing primarily due to protection from ICCN. Similarly, there were less respondents aware of people that had been punished for illegal activities in the park (15.6 per cent) as opposed to those that had no idea (44.4

per cent). This level of awareness of illegal activities may serve as an indicator of local community involvement in illegal activities in the Reserve. Nevertheless, of those that knew someone punished for illegal activities, 64.6 per cent were of the view that the meted punishments were fair; whilst 25.8 per cent thought they were too harsh, especially those who were involved in small-scale mining activities and only 9.4 per cent thought they were not stringent enough.

3.3 Local people's attitudes towards the Reserve

Although 86.9% of participants were favorable to the concept of biodiversity conservation within the Reserve, Of the 13.1% of respondents who did not appreciate the value of the RNI, none found nature intrinsically bad and only two respondents referred to ancestral claims to resources. Their motives were mostly the spatial restriction, damage to possessions and frustrations with Park management: 'space for our activities is now too restricted', 'the Reserve contains ferocious animals, the enemies of our crops' and 'game scouts don't do their duty honestly, they just want to eat out of our pockets'.(Bauer, 2003). Such finding was consistent with the results found elsewhere in Africa (Muhumuza& Balkwill, 2013). The whole concept of community participation and its application appeared to be poorly understood by the key stakeholders, including the chieftaincy and the local communities. Also, there appeared to be very little dialogue, communication or contact between the RNI managers and the local people. This situation created mistrust and suspicion between the two partners.

PAs are one of the most frequently used conservation strategies, but remain contentious due to their negative impacts on local communities (Pullin *et al*.2013) and mixed evidence on their ability to conserve species and habitats (Geldmann*et al*. 2013). Survey results indicated that local residents living within the Reserve hold a variety of mixed attitudes towards the Reserve. Positive attitudes tended to increase with respondents' level of education ($X^2 = 16.001$, df = 2, $p < 0.0001$) and knowledge about conservation issues ($X^2 = 22.313$, df = 1, $p < 0.0001$). Younger residents ($X^2 = 9.960$, df = 2, $p = 0.002$), respondents perceiving benefits from the Park ($X^2 = 11.292$, df = 2, $p = 0.001$), and respondents reporting good relations with the Park staff ($X^2 = 2.514$, df = 1, $p = 0.019$), were more positive towards the Reserve. Factors influencing public attitudes are compared with study results in other countries.

With regard to benefits, 53.4 per cent of the respondents said they did not derive benefits from the RNI while 46.5 per cent said they derived benefits. The most frequently perceived benefits were ecosystem services (60.6 per cent) that included among others the provision of water, honey, building materials and medicines. Overall, about half of the respondents felt that there should be more benefits received from the RNI. Among them, desired benefits were income generation opportunities which topped the list at 51 per cent of the respondents, followed by greater access to tourist facilities for employment (26.5 per cent) and educational opportunities (22.5 per cent).

3.4 Attitudes towards the overall Reserve Management

Sixty to 72 per cent of respondents in each sector described their relationship with the Reserve authority as friendly. However, the frequency of friendly responses showed a highly significant departure from homogeneity between the three sectors ($\chi 2=15.465$, $df=2 > p=0.05$). More respondents in Mulambozi than in the other chiefdoms perceived relations as unfriendly (Table 3). This was not surprising considering there are far more village sweeps (village to village searches carried out by ICCN) in Mulambozi as opposed to the other two sectors (ICCN/RNI, 2019). Mulambozi people themselves recognized the area of being a hotbed for poaching. The highest perceived negative impact was HWC which accounted for over 77.5 per cent of all responses. Despite being further away from the Reserve headquarters, 79.8 per cent of respondents from Mwana valley reported this as the major impact from the Reserve's existence.

There was the overwhelming evidence that communities believed that if the decision power was entrusted to local people, then the real issues of concern to them would be addressed, e.g improvement of road infrastructure, development of agriculture, permanent employment, control of ''problem animals''. People requested that they themselves be allowed to decide how the funds should be allocated and be empowered to select the projects that they felt were most needed. In this way, they felt that the community funds should be translated into real benefits for the community at large, and that people would value PA as an asset that provided them with these benefits and would hence fully protect it. They also requested improved management and accountability of the funds by donors.

Our study considers local perceptions of changes, rather than measured changes. Perceptions are an undervalued form of evidence in conservation science and alongside qualitative data can provide enhanced understanding of local equity concerns (Dawson *et al*. 2017). However, it is also important to consider that perceptions may be unreliable in terms of the objective truth and cannot determine causation. For this study perceptions were the most appropriate evidence to look at as people are less likely to cooperate when they perceive a lack of fairness, and perceived inequity may result in attempts to resist or undermine PA rules (Hirsch

et al. 2011). Perceptions of unfairness therefore lead to higher PA management costs, sometimes through active resentment, such as vengeance killing of charismatic fauna (Jones *et al*. 2008), whereas positive perceptions of governance and social outcomes are associated with improved effectiveness (Oldekop*et al*. 2016). Quantitative large-scale studies have provided useful data, and can show whether costs and benefits are shared equally, but without in-depth studies we are unable to know whether this is considered equitable by local stakeholders, and this is crucial for both moral and instrumental reasons. We need to ensure that there are studies of both types and use the data together when measuring success of PAs and conservation interventions more generally, as well as when identifying where equity concerns need to be addressed.

Opinions were significantly more positive among the respondents living further from the Reserve's boundaries (χ^2 =10.2, p<0.01). Surprisingly, the level of non-use benefits from the Reserve and/or the partners Projects had no influence on the perception of the Reserve and/or the partners Projects (χ^2 = 1.1, p = not significant). Answers to the question 'why?' showed that appreciation of currentICCNpartners' projectswas motivated by actual or expected positive effects on respondents 'livelihoods. Respondents who did not appreciate ICCNpartnersproject were mostly motivated by frustration about unfulfilled promises of development actions.

When asked for the two species of major nuisance, responses varied significantly with occupation: cattle raisers disliked leopard and hyena, farmers disliked great apes (gorilla and chimpanzee), locust and granivorous birds. (χ^2 = 277.9, p <0.001). Since occupation and ethnic group were linked, variation among ethnic groups was similarly significant (χ^2 =278.2, p <0.001). Male and female respondents had the sameopinion of species perceived to be bad (χ^2 = 6.9, p =not significant). Men were significantly more likely to report conflict (18.8%) as a cost of participation than women (3.57%; $\chi 2$ =6.83, p < 0.05, df=1). Two potential explanations for this emerged from interviews and focus groups: men are more likely to be members, attend meetings, and therefore be aware of conflicts within the local governance body (Community Conservation Committee – ''CCC'') or with theNGOandmen were morelikelytogointotheforestand therefore. morelikelytoencounterother CCCmembers or outsiders breaking rules. Women who are less likely to attend local governance body meetings or go into the forest may still encounter conflict within the village, however

Damage perception can be different from real damage averaged over time and individuals, Areas of concentrated gorilla activity were located in secondary vegetation in the vicinity of villages (eight areas), abandoned mining areas (three areas) and on steep mountain slopes where the canopy was broken by frequent clearings (six areas). In Kabelukwa, Kitibingi, Mt Kasondjo, Mt Lungye, Mt Ibenga, Kaoanga, Kianjo and Zombe areas, gorillas ranged from altitudes of 1800–2600 m and exploited a variety of habitats, including montane forest, highland prairie mosaic, monodominant stands of bamboo and regenerating fallow gardens. At all of these sites, gorillas were often located in the immediate outskirts of settlements where they foraged in gardens and recent fallow fields with the potential of coming into conflict with local population (Mubalama *et al*. 2017; Omari *et al*. 1999).

There were also costs for the local people related to the Reserve in the form of animal damage to people's assets. Predators (lion*Pantherapardus* and Common genet *Genettagenetta* killing livestock) and Grauer's Gorilla (depredating and trampling crops) were perceived as the main culprit. Hazard studies consistently show that damage is often disproportionately lamented if it is unpredictable, potentially catastrophic and beyond respondents 'control (Naughton-Treves *et al*. 2003; Naughton-Treves, 1997).

The occurrence of gorillas across a variety of vegetation types and human impact in Itombwe suggests a high degree of behavioral flexibility by Grauer's gorilla in adapting to sometimes unique local conditions. This argues strongly for efforts to protect as many of the local populations as possible to ensure the conservation of the full range of biological, and perhaps cultural, diversity within this region.

Table 2. Local people's attitudes towards the great apes in the Reserve

Reserve' value (N=107)		Population expectation (N=110)		Whether destroy or not N=107)	
No	10.2	Extirpate	19.3	No	83.6
Yes	89.8	Control	80.7	Yes	16.4
		Protect	0		

Attitudes toward the Reserve's value appeared to be different among categories of four factors (i.e. gender, vocation, education, awareness of protection). Attitudes towards great apes' population change expectation (Table 2 & 3) seemed to be different among categories of six factors (i.e. vocation, education, farmland area, awareness of protection, damage trends and damage level). With respect to people's attitudes toward great apes when their interests were threatened, it appeared to be different among categories of eight

factors (gender, education, crop income proportion, encounter, farmland area, banana- (*Musa*sp) planting area, converted farmland area) as shown in Table 3.

Table 3. Variables great apes value Population expectation Whether kill or not

Variables not	Great apes' value		Population expectation		Whether kill or
	χ 2 (U)	P	χ2 (U)	P	χ 2 (U) P
Gender	9981.500	**0.001**	10162.500	NS	9621.000 **0.001**
Age	4.589 NS		2.077	NS	0.124 NS
Vocation	2159.500	**0.000**	**2156.000**	**0.002**	2973.000 NS
Education	32.423	**0.000**	**8.830**	**0.032**	12.754 **0.005**
Household size	10595.500	NS	10483.500	NS	11034.500 NS
Crop income proportion	9956.000	NS	9626.000	NS	9271.000 **0.032**
Encounter	7713.000	NS	7534.500	NS	6944.500 **0.002**
Distance to forest	1.998	NS	1.670	NS	1.207 NS
Awareness of protection	23.943	**0.000**	11.556	**0.003**	1.709 NS
Damage trends	1.190	NS	6.203	**0.045**	5.752 NS
Damage level	3.985	NS	59.037	**0.000**	3.639 NS
Banana-planting area	2.994	NS	4.123	NS	10.132 **0.006**
Cassava-planting area	2.781	NS	4.433	NS	5.200 NS
Converted farmland area	4.923	NS	9.234	**0.026**	12.167 **0.007**

3.5 Descriptive Norms

Fifty-four percent of respondents perceived a reduction in hunting activities in the study region, and 48% said that hunting had not changed in prevalence. Fifty-six percent of respondents believed that people are not deforesting anymore and forest areas are increasing, 31% believed that people are not deforesting anymore and forest areas remain the same, and 15% believed that people continue to deforest.

Table 4. Proportion of respondents performing illegal behaviors related todifferent motivations for wildlife hunting and deforestation in the RNI

	Mwana	Mulambozi	Elila	p value X^2
Replace secondary forest Withsmall-scale agriculture (n= 25)	8 %	8.5%	6.5%	82
Retaliation (kill animals that cause damage), (n =25)	6%	9%	7%	.45
Keep small scale mining as Authorized activity outside core zone (n=56)	16.5%	17.5%	17%	.40
Hunting for consumption				

(n=67)	20%	21%	20%	.04

Note. The relationship between the reported behaviors and location is also shown. X^2 = Pearson Chi-square test.

3.6 Perceived Behavioral Control

Forty-nine percent of respondents believed that law enforcement in their villages is active and have the same frequency over the last years, 36% commented that law enforcement is nonexistent or have low frequency, and 15% related that patrols are active and have increased over the last years. Eight respondents complained about RNI employees, indicating that they were neither prepared to talk with residents nor listen to them; others complained that law enforcement agents acted inappropriately, persecuting residents. On the other hand, four respondents mentioned that recently PA staff had started to inform and guide people instead of only controlling and punishing.

3.7 Background factors versus attitudestoward different motivations for wildlife use and related descriptive norm

Three demographic factors were correlated with attitudes toward hunting; education, duration of residence, and age. Respondents with a primary education agreed more with hunting for consumption (Fisher test, p =.005) and retaliation (Fisher test, p = .01). In addition, respondents with lower duration of residence agreed more with hunting for consumption (Fisher test, p= .05). Middle-aged respondents agreed more with hunting for consumption (x^2 = 9.54, df = 4, p = .05). However, demographic and socioeconomic factors did not influence the descriptive norm related to hunting.

Positive values of PAs were related to proconservation attitudes toward hunting for consumption (Fisher test, p=.03) and proconservation attitudes toward retaliation (x^2 = 9.63, df=4, p=.05). But no association was found with attitudes toward keeping wild animals as pets (x^2= 1.28, df=2, p=.53). This suggests that people who have positive values toward PAs have positive attitudes toward wildlife conservation in general. Values related to PAs were not correlated with the descriptive norm related to wildlife hunting.

Location was not correlated with attitudes toward different motivations for hunting, neither with the descriptive norm toward hunting. We did not identify associations between people having experienced damage and their attitude toward retaliation (x^2= 4.2607, df=2, p=.12) or between having experienced damage and attitudes toward hunting for consumption (x^2= 0.19, df=2, p=.91). This variable was not correlated with the descriptive norm toward wildlife hunting

3.8 Background factors versus perceived behavioral control

Demographic and socioeconomic factors, values related to PAs, and experience with damage to crops or livestock caused by wildlife did not influence perceived behavioral control. Most people recognized that great apes should be protected, and most of respondents were inclined to choose "control" as long as great apes don't threaten their interests, and a majority choose "extirpate" considering there was benefit of existence of great apes. This was not consistent with attitude presented in other places (Naughton-Treves, 1997). Respondents of other vocations except farmers and those with higher level of education and awareness of wildlife protection tend to choose "control". Respondents with fewer farmland areas are less likely to suffer the damages of wild boars, so they are more apt to choose "control". This is in consistence with other study on costs incurred by animal damage to people's assets (Naughton-Treves, 1997).

3.8 Respondents' attitudes and wildlife use

We found negative attitudes toward restrictions on hunting, revealing respondents' desire to use wild animals, especially for consumption. On the other hand, we found a proconservation attitude related to commercial hunting. Many respondents who agreed with hunting for consumption quoted a religious justification such as ''God made wild animals for us to eat'' or ''God left wild animals to feed the poor.'' They believed the law could be more flexible and only trade-hunters should be punished by law. However, respondents who partly agreed declared that hunting should be permissible only for subsistence (Castilho *et al.* 2018). For many respondents the hunting issues raised are summed up as income poverty. Impoverished communities often turn to illegal extraction of resources from the RNI to alleviate economic pressures or to make monetary gains. Such practices can cause ecological damage and threaten wildlife population. Given that most households are poor and are dependent on subsistence agriculture the economic effect of predation may be high and prompt retaliation killings.

People who disagreed stated that if hunting for consumption was allowed, wild animals would probably disappear. Some respondents felt that it is no longer necessary to subsist on wild meat; people could raise animals and have more opportunities to earn money from employment. Almost all respondents disagreed that hunting for sale should be allowed. Respondents that partly agreed with retaliation (killing animals that caused

damage) declared that they would kill the animal only if it was considered a good wild meat for consumption. Some respondents who disagreed suggested that plantation areas could be fenced off or wild animals be scared away, but most believed that government/PA managers should either assist residents to avoid such conflicts or compensate people for wildlife damage. More than half of respondents believed that it is not right to keep wild animals in captivity, whereas the other half felt that there is no problem having a wild animal at home if you can take care of it.

Table 5. The positive and negative values expressed in response to an open-ended question about the respondents' views on the PAs (n= 110).

	% Citing
Positive views on the PAs representing naturalistic values (interest and affection for wildlife and outdoors)	
Conserve nature	17
Protect wild animals	13
Protect forest	7
Positive views on the PAs representing utilitarian values (material benefits)	
Protect springs and water bodies	17
Improve the rainfall regimes	4
Improve people's health	1
Negative views on PAs representing utilitarian values (absence of material benefits)	
People cannot work, as it is prohibited to replace forest with agriculture	28
People must relocate/government does not pay a fair value for the properties	7
Logging is forbidden, neither for use within the Property	3
It is not allowed to do anything	3
Hunting is prohibited	1
Increase in unemployment	1
Residents have neither support nor Information	1
Usage of fire is prohibited	1
Enforcement agents bother people	1
Wild animals cause damage to plantations	1
Negative views on PAs representing negativistic values (feeling of aversion or fear for nature)	
Increase of dangerous animals	4

Note. Respondents' views were classified according to the underlying values that they represented based on the Kellert's classification of values for nature (Kellert, 1993).

Table 6. The parameter estimates of variables in final Binary Logistic Regression model (variables were eliminated by Wald forward stepwise) used to examine the variables that influenced local people's attitudes towards whether they would destroy the Reserve when their interests were threatened

Variable	Categories of variables	B	S. E	Wald	df	Sig	Exp(B)
Gender	Male	1.804	.576	9.805	1	.002	7.081
	Female [a]	---	---	---	---	---	---

	No	-.902	.419	4.626	1	.031	.506
Encounters	Yes [a]	---	---	---	---	---	---
		--	13.820	3	.003	-	
	0	2.981	1.082	7.594	1	.006	18.500
Converted	0~2	1.915	1.114	2.955	1	.086	5.777
Farmland area	2~4	1.479	1.147	1.662	1	.197	4.563

a Reference variable

Compared with the probability of female respondents choosing "Yes", the probability of male respondents was 7.081 times higher than it. Males were more likely to choose to kill gorilla. Compared with the probability of respondents encountering great apes choosing "Yes", the probability of respondents not encountering was its 50.6%. Respondents encountering great apes tended to choose "Yes". Compared with the probability of respondents converting farmland area >4 choosing "Yes", the probabilities of respondents converting farmland area = 0. 0~2 and 2~4were its 18.500, 5.777 and 4.563 times, respectively (Table 6). This revealed that respondents converting fewer farmland areas tended to choose "Yes".

Results show that the communities are not satisfied with the benefits they expect the ICCN and partners institutions to deliver. Such an attitude is likely to generate mistrust and lack of confidence in the staff of the Reserve. A large majority of all respondents knew about the Reserve and appreciated its existence, and appreciation was significantly higher among respondents benefiting from the Reserve and/or Partners projects. The minority that disliked the Reserve was primarily frustrated with management practices and promises; no one objected to the Reserve *per se*. Almost all respondents found the Reserve too large. This all suggests that people perceive the Reserve positively, provided it does not limit their activities, especially in the small-scale mining sector. These results corroborate surveys around parks in Ecuador in South America and Nigeria in western Africa, where people agreed on the necessity to protect forest for future generations, but showed negative attitudes towards the daily manifestations and consequences of conservation (Ite, 1996).

IV. Discussion

4.1 Hunting

With respect to local people's attitude towards whether they would kill great apes when their interests were threatened and its influencing factors most of the respondents didn't choose "kill". This may be because it's illegal to kill great apes and it's difficult to kill because they are very smart, and many people tend to choose traditional non-lethal measures rather than lethal measures to prevent great apes' damages. Females are more afraid of wild animals than males, so males are more apt to choose "kill". People who encounter great apes frequently may know it's difficult to catch and kill great apes and have some knowledge about how to avoid conflict with them, while other people may be curious about great apes and tend to choose "kill". Further analysis by logistic regression indicated that gender, encounters, and converted farmland area (Tables 3 & 6) are factors that influence local people's attitudes toward whether they would kill great apes when their interests were threatened. However, further analysis by logistic regression showed that level of awareness of wildlife protection is the only factor that influences local people's attitudes toward great apes' value. Respondents with higher level of awareness of wildlife protection are inclined to understand the importance of wildlife protection, so they tend to choose "Yes". This is consistent with both Kidegesho (2007)and Ratsimbazafy*et al*. (2012) findings.

Our results suggested that most respondents have a strong desire to hunt for consumption. This is a big issue because it goes against the PAs' policies and the DR Congo conservation law and represents a potential threat to wildlife conservation inside PAs. In addition, illegal hunting is occurring in the study region (Mubalama*et al*. 2017) and has been considered a constant problem within the PAs.

The desire of respondents to kill animals that have caused damage is also of concern, because human–wildlife interactions have grown in frequency, intensity, range, and diversity throughout Itombwe massif forest area (Marchini&Crawshaw, 2015). Despite that an interesting and favorable finding for wildlife conservation was that respondents in both locations did not support the desire to hunt for income. Considering this, management actions should capitalize on positive values that people already perceive that PAs provide and attempt to mitigate the negative ones (Allendorf, 2007).

There were also costs for the local people related to the Reserve in the form of animal damage to people's assets. Predators (leopard and hyena killing livestock) and Gorilla and Chimpanzee (depredating and trampling crops) were perceived as the main culprits. Most of these animals were killed by hunters armed with shotguns. It was reported that at four sites gorillas had been killed within the preceding 12 months. The potential

danger, real or imagined, that gorillas living in the vicinity of villages posed to humans was the most frequently cited reason for killing them. It was not clear from the interviews if levels of gorilla hunting in the vicinity of villages had increased in recent years. Gorilla remains and one chimpanzee carcass caught in wire snares were encountered by survey teams.

Community experience of compensation, for example, indicates great dissatisfaction in two selected sectors. The lack of a compensation policy in DRC exacerbates the problem and. It is clear that there are negative and indifferent attitudes towards local partners institutions and wildlife authorities in both areas. Negative perceptions in Kitamba were attributed to suspicions of corruption and mismanagement. Although overall perceptions are negative, the slightly more positive attitude in Kitamba, in comparison to Kipupu, may indicate better communication and information flow there. Information about community institutions was mainly conveyed via meetings and hearsay in both cases. Notably, 38.3% were unable to answer due to insufficient knowledge in Kitamba in contrast to 15% in Kipupu.

An option often mentioned for mitigation of conflict without compromising conservation is a compensation system for wildlife damage, either in cash or in kind. Bruner *et al*. (2001) showed that various forms of compensation and benefit sharing contribute to park effectiveness. In the African context and particularly in the RNI, however, compensation schemes for large mammals' damage are considered inefficient and ineffective, mainly due to practical problems related to damage assessment and the distribution of compensation (Naughton-Treves*et al*. 2003). These problems also apply to many other types of wildlife damage and compensation schemes. An additional argument against compensation is the attraction of immigrants, which would exacerbate the conflict (Naughton-Treves *et al*. 2003).

4.2 Deforestation

Considering that most respondents are involved in agricultural activities, their biggest complaint was that they were restricted from replacing large patch of primary forests with small-scale agriculture, which hindered their work and livelihood. This feeling was reflected in negative attitudes toward the RNI and forest conservation, and also in negative behavior, since some of the respondents admitted to having involved in slash and burn agriculture. Moreover, according to PA managers, illegal deforestation has been registered during law enforcement events recently conducted in the RNI.

This highlights a potential mismatch between residents' perceptions, 85% of whom said that people in the region were no longer deforesting, and the perceptions of conservation managers, which requires further investigation. Deforestation by local residents represents a great challenge for the RNI management, because reconciling land use and biodiversity conservation within PAs requires precautionary measures to ensure protection of the remaining fragments, without harming residents' livelihoods.

Age was the only social factor correlated to the descriptive norm related to deforestation. The greater perception of ongoing deforestation among younger respondents may be related to different experiences and different temporal perspectives. Older respondents may have experienced the large-scale deforestation before the creation of the PAs and consequently had different perceptions of current deforestation levels. This could represent the phenomenon of environmental generational amnesia, a form of Shifting Baseline Syndrome, where individuals fail to pass their knowledge and experience to future generations, and consequently younger people are not aware of past biological conditions (Castilho*et al*. 2018).

In general, respondents who expressed positive values toward the RNI had more positive attitudes toward hunting and deforestation. General values are among multiple variables that may influence people's beliefs (Ajzen, 2012). Location had a minimal influence on attitudes; however, it affected descriptive norms and perceived behavioral control. These results suggest that differences between the PAs were not enough to change the opinions or beliefs of local people toward hunting and deforestation in the study region but may influence how people perceive management actions such as law enforcement and others' behaviors.

Our study suggests that to change behaviors of rural residents toward different motivations for hunting and deforestation in and around the RNI, management actions should consider people's attitudes and norms and the combination of background factors that influence these variables. Raising compliance with conservation policies in the Reserve is challenging, particularly if we consider that managers have scarce human and financial resources (Castilho *et al*. 2018). It is therefore essential to engage local people to a greater extent, guaranteeing that residents and their concerns will be included in the implementation of current management plan strategies (Andrade & Rhodes, 2012).Further to the investigation related to the relationship between respondents and PAemployees, some respondents stated that they felt oppressed by the laws and the control exerted by PA staff, and that information about regulations for resource utilization and how to get legal authorization were lacking. This interaction deserves further investigation in the future, considering that good relationships between PA staff and local people can influence proconservation attitudes (Anthony, 2007; Ormsby &Kaplin, 2005) and enhance the potential for achieving PA objectives (Stern, 2008). Communication programs can help to avoid

conflicts over the use of natural resources and improve awareness among residents (Ormsby &Kaplin, 2005), especially for more recent arrivals.

4.3 The Components of the TPB versus behaviorsrelated to different motivations for wildlife hunting and deforestation

Local people often considered the great apes to be the most beautiful and attractive animal in the Itombwe massif (survey respondents, *pers comm*.) but, as reflected by their attitudes, this perception is no guarantee that they will protect it. Their response to the statement 'great apes deserves protection' was often 'yes, but not on my garden'. Where farmers were sympathetic to great apes' conservation, this appeared to originate from personal, pro-conservation attitudes. Due to the higher level of damages to plantain banana-planting area, a lot of people have converted to cassava-planting to avoid great apes' damages. People converting fewer areas were inclined to choose "control". Research undertaken across the tropics suggests that wildlife-associated costs reduce tolerance and support for conservation and vice versa (De Boer &Baquete, 1998; Newmark *et al*., 1994). Other studies have shown the importance of education and other socio-economic factors. The observation suggesting that education positively influenced conservation attitudes is consistent to other studies elsewhere, Ratsimbazafy*et al*. 2012) where similar studies reported that educated respondents were more likely to hold positive attitudes towards conservation. Educated people are well informed on pertinent forest issues and the importance of conservation.

We found that positive attitudes toward hunting were positively correlated with proconservation behaviors related to hunting. Attitudes are often good predictors of behaviors when item specificity and alignment is high (Manfredo&Vaske, 2009). It is hard to know whether these correlations were a result of social desirability bias (people answering questions about illegal behaviors based on what they thought we wanted to hear). Respondents appeared to be comfortable answering direct questions honestly, however. In addition, descriptive norms, such as the perception of other people's behavior toward hunting and deforestation, were correlated with the specific behaviors, suggesting that the way respondents perceived other people's behavior in the study region may reflect their own behavior. Indirect questioning techniques can reduce social desirability bias and could be used in future studies (Castilho *et al*. 2018; St. John *et al*. 2010).

Contrary to other studies that have suggested that perceived behavioral control may represent a good predictor of behavior, we found that respondents' perception of law enforcement did not influence their behavior. The presence of law enforcement is just one element of perceived behavioral control, and considering that predictors of behaviors should be specific to each behavior investigated (St. John *et al*. 2010), it may be that other unmeasured and more specific components of behavioral control (such as time availability or skill) might be more influential. In addition, people's perception of enforcement may not be enough to prevent negative behaviors because the activities performed involved the use of resources essential to local communities' livelihoods (De Boer &Baquete, 1998).

V. Implications for conservation

Attitudinal studies are increasingly being adopted as tools for evaluating public understanding, acceptance and the impact of conservation interventions. The findings of thisstudy might be useful in guiding the policy interventions. Many factors affect conservation attitudes positively or negatively. The factors inspiring positive attitudes are likely to enhance the conservation objectives while those inducing negative attitudes may detrimentally undermine these objectives. The magnitude of the resultant effects of each particular factor is determined by the historical, political, ecological, socio-cultural and economic conditions and this may call for different management interventions (Kidegesho*et al*. 2007).

Despite the fact that there has been a significant increase in interest in the sustainable management of PAs, many still fail to fully meet conservation goals, including the RNI. Considering that the availability of adequate financial resources and the general public's interest toward biodiversity conservation both play such an important role in the successful performance of PAs, it is of great importance to investigate local residents' and wildlife staff' attitudes and perceptions regarding PAs. This will help gain knowledge of the level of financial and social support they would be willing to give to environmental protection and biodiversity conservation in PAs. From that prospect, more successful functioning and management of PAs can be achieved by understanding both wildlife staff' and local residents' attitudes and perceptions of nature conservation and by integrating them into future conservation policies.

Our study suggests that to change behaviors of rural residents toward different motivations for hunting and deforestation in and around the RNI, management actions should consider people's attitudes and norms and the combination of background factors that influence these variables. In this regard, education is one of the factors which has positive impact on people perception of biodiversity conservation This could be done especially for young people mainly in schools and in the local language with adults. Indeed, to guaranty a better

future for the biodiversity, it's important to start involving kids and young, the future managers of our environment. Young people will be trained on the importance of biodiversity conservation and they will be directly taught on how they could contribute to conserve it. They will be also charged to aware their parents. Concerning the adults, the environmental education should build on positive perceptions that people already hold and work on mitigating negative perceptions where it's possible. Education (sensitization, organized activity, etc.). could be an important way to motivate people to develop or reinforce positive perception about biodiversity conservation.

Raising compliance with conservation policies in the RNI is challenging, particularly if we consider that managers have scarce human and financial resources (Castilho *et al*. 2018)). However, to achieve long-term effectiveness of the RNI, it is widely accepted that local communities should support these areas as well as their conservation policies and actions (Allendorf, 2007; McNeely, 1994). It is therefore essential to engage local people to a greater extent, guaranteeing that residents and their concerns will be included in the management strategies (Andrade & Rhodes, 2012).

The general theme is that local people's perceptions of PAs depend on their perceived cost and benefit from PAs, their dependence on local resources and their knowledge about PA management. Because local people are not homogeneous and do not share common norms, their interests and resource use patterns vary greatly at both the individual and household level. Disregarding their diversity would cause detrimental effects to local people and hinder the achievement of conservation and management objectives (Agrawal & Gibson, 1999).

As the present study indicates, a benefits-based approach is an important motivational factor in securing local support to conservation. However, several authors have pointed out some potential flaws that may limit the effectiveness of the approach in securing the long-term goals of conservation (Barrett &Arcese, 1995). If success in conservation work is to be realized some challenges are worth addressing. First, replication of the study benefits to other villages is imperative, as it is illogical to expect success by changing the attitude of just a fraction of communities. Second, the benefits should be sufficient enough to offset the direct costs resulting from conservation and indirect costs of forgoing the ecologically destructive activities that local people perceive to be economically profitable. Third, the benefits should also be equitably distributed and their future access should be well guaranteed. However, economic, ecological and political factors may undermine the achievement of these ambitions. The most pragmatic solution to long-term success depends on improvement of local people's living standards by alleviating poverty. Provision of benefits to local people will hardly deter them from illegal activities if they cannot meet their resource demands for survival. While PAs can only minimally contribute to this goal, other sources should be secured locally and globally. In this regard, education also needs an emphasis, both as a way of creating awareness and changing attitudes and directing people to alternative income-generating activities that will relieve the pressure on conservation area resources. RNI outreach should include a wide variety of activities that managers of PA can initiate or stimulate other partner organizations to initiate. Here, however, the focus should be on resource-based outreach and mainly involving young people.

Despite the contribution realized from wildlife sector, a number of problems make wildlife a concern especially to the socio-economic status of the communities' bordering the PA. These problems include: conflicts with other land uses, poaching, habitat loss, global warming and introduction of exotic species. The failure of wildlife to compete effectively with other land uses in sustaining the livelihoods of the adjacent communities exacerbates these problems. As a result, local people look at wildlife as a liability (Newmark *et al*. 1994).

Use of force to achieve conservation objectives may increase unpopularity of conservation to local people and reduce the government credibility. Therefore, it's essential to understand local people's attitudes and make efforts to improve their awareness. Nature reserve authorities should strengthen local communities' participation in wildlife conservation and strive to strengthen the role of positive attitudes and undermine negative factors that influence people's attitudes. Measures should be taken to reduce conflicts with wildlife in order to lead local people to explore the road to prosperity with consideration of the local conditions, At the same time, financial support should be provided to local people to make use of biogas, hydroelectric power, solar energy and other green energy to reduce local people's dependence on nature resources. It is clear that the RNI so far has neither the technical nor financial resources to rely solely on a model of centralized-regulatory control to protect biodiversity from increasing human populations and concomitant resource needs of peoples living in and around PAs (Wells & Brandon, 1992). Moreover, nature reserve authorities should strengthen propaganda and education on wildlife conservation, increasing the level of local people's awareness of wildlife conservation. Current efforts at addressing social issues are essential prerequisites to gaining grass roots political support. It is clear that this support cannot be expected while attitudes of hostility remain to some extent; they must be resolved. Only when there is support for PA at the grass roots level can full political support be achieved.

Our study moves debates on the social impact of PAs and its relevance for nature conservation forwardinthreesignificant ways. First, wehaveprovided a novel, global analysis showing a positive association

between the socioeconomic and biodiversity conservation outcomes of PAs; these two objectives, thus need not be considered as conflicting. Second, we found that community participation in governance has been shown to more likely provide socioeconomic and biological benefits and reduce costs for local communities thanother governance approaches (Oldekop*et al.* 2016). Taken together these two results suggest that sustainable use PAs can perform as well for conservation as thosewithstrictermanagementregimes. Effective management plans may benefit from the inclusion of mechanisms for fostering positive relationships between PAs and the people living within or nearby. Finally,wehave provided evidence that PA initiatives aiming to deliverjointpositivesocioeconomicandconservationoutcomes should consider ensuring that all households are represented in governanceparticipation; exploring differencesimperceptions of forest protection; and targeting interventions to reach households most in need (and avoid elite capture). By designing governance structures that specifically address these challenges, PAs may be better able to provide socioeconomic and biodiversity benefits and ensure that the costs of PA establishment are not borne by the poorest, most marginalized groups.

VI. Limitations of the study

This study has some limitations that should be noted. Limited attention to the socioeconomic and related aspects of culture had previously been blamed for failure of community-based conservation approaches. The human dimension is often ignored in conflict studies (Dickman, 2010) or considered only in terms of general attitudes towards conservation, which has limited value in designing interventions (Dickman, 2010; St. John *et al*. 2010). Studies on the social dimension of biodiversity conservation and how various socio-economic and cultural factors affect PA resource use and biodiversity conservation in various contexts are recommended. This work is an important initial step for assessing the progress of this new approach to conservation in Itombwe massif. Using social science research tools, it is important to build upon this growing body of human dimensions research in Africa. Researchers need to recognize cultural variation while implementing consistent methodological and theoretical frameworks to ensure valid and reliable information is informing decision-making processes, all the more since PA governance and management is a dynamic process.

Our study did not address all the components of the TPB (in particular, excluding behavioral intention and subjective norms and exploring a nonspecific part of perceived behavioral control and a general descriptive norm related to hunting), precluding the appropriate use of the TPB framework and full analysis through structural equation modeling or multivariate regression. However, it indicates areas which conservation managers need to address in order to change residents' behavior with respect to two important conservation issues, deforestation and wildlife hunting. In addition, non-economic values, such as cultural, spiritual, and esthetic values, should be further assessed in conservation strategies while emphasizing the importance of integrating human dimensions into biodiversity conservation policies in the RNI.

The study findings provide a snapshot of current perceptions. Nevertheless, there are useful lessons that can be learned from these results, these are particularly relevant for the new network of co-managed PAs in the RNI but also globally. Careful consideration is needed as to whether these new Durban Vision PAs in the RNI can truly be defined as co-managed when there are certain rules and regulations which local communities and NGOs are not involved in designing.

VII. Conclusion

Despite the limitations of this study it is valuable in several ways. Firstly, it is the first attempt to consolidate the large body of research on this topic. Secondly, we have initiated a process of evaluating potential drivers of attitudes and how they may contribute towards building a comprehensive theory of factors that determine attitudes towards damage causing wildlife.

Our findings suggest that conservation attitudes were mainly influenced by the perceived benefits derived from the Reserve and other socio-demographic factors. The findings suggested that the youth were more likely to hold positive attitude towards conservation. This observation is associated with the relatively high literacy level among the youth as compared to the other groups. Furthermore, young people should be used as change agent on sustainable forest management. This could be achieved by empowering them with skills and the capacity to engage the elderly in activities that will assist them (elderly) to better understand and appreciate the importance of forests and the need for their conservation. In addition, the desire for devolution of the forest reserve to the community could be something which can be tapped into by the management in order to foster communities' participation in conservation. Correlation between benefits and positive attitudes has been confirmed in many cases (Abbot *et al*. 2001; Mehta & Heinen 2001).

We identified both the potential and limitations of applying TPB to conservation-related behaviors. The TPB provided useful insights into the drivers surrounding choices to participate in PA governance; however, it missed factors highlighted by the qualitative data, such as subjective norms.

People's relationships with these three sectors of the RNI are complex and multi-faceted. Although these three selected sectors differ in history, size, management objectives priority, and people's overall attitude

toward them, there are common themes in people's perceptions. These themes are negative, such as a lack of extraction and conflicts with management, and positive, such as the area provides resources necessary for survival and recreational, esthetic, and environmental benefits. The results suggest that most respondents supported the conservation of the RNI but that attitudes towards great apes were mixed and difficult to predict on the basis of socio-economic factors. Therefore, understanding which factors influence attitudes and tolerance in different situations is key to choosing and targeting the most appropriate solutions, whether mitigation to reduce losses, education to improve awareness, or benefit generation to provide incentives. Managers of the RNI need to develop approaches that will truly result in joint management with local people such as employing ecoguards from local populace.

People's positive perceptions played a particularly important role in their positive attitudes toward the areas, suggesting that recognizing, incorporating, and strengthening the non-utilitarian benefits (Table 5) that people perceive into strategies to improve the Reserve–people relationship may, in conjunction with more traditional approaches such as sustainable extraction and alternative livelihood strategies, prove valuable in improving local residents' perceptions of these PAs and strengthening their support for the areas. Conservation strategies should recognize both the positive and negative perceptions that residents have of PA and work to foster and integrate diverse values in order to more accurately reflect the reality and complexity of people's lives.

The achievements of community outreach remain fragile, and easily undone. A deeper understanding of the nature of the antagonisms between local people and PA staff, many of whom are local people themselves, is needed. This will entail a reassessment of the rights and the responsibilities of both sets of protagonists. The organizational culture of conservation agencies must begin to perceive local people as potential partners, not perpetual poachers. Equally, local communities must recognize wardens and eco guards as neighbors with a task to achieve, and not simply as harassment staff. This will encourage the development of a new conservation paradigm of 'community-based conservation' (CBC), emphasizing management of biodiversity by, for, and with local communities (Naughton-Treves, 1997).

The diverse, and possibly conflicting, perceptions that people hold toward the RNI should be recognized and understood. Management should not only work to meet people's extraction needs if possible, but also take advantage of and strengthen people's understanding of the need to eliminate or mitigate extraction from PA as well as build on their understanding of the importance of conservation of the area. Conservation strategies that foster and integrate the diverse values that people hold will more accurately reflect the reality and complexity of people's lives and, therefore, promise the best hope of sustaining the RNI and communities over the long-term. Because PAs limit agricultural development and exploitation of natural resources, they are frequently opposed in developing nations where reducing poverty is an important social objective. Conservation advocates argue that the RNI can alleviate poverty by supplying ecosystem services, promoting tourism and improving infrastructure. Thus 'win-win' scenarios may be possible in which ecosystems and their services are protected and poverty is alleviated.

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