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Original Article

Protected Areas in Burundi: Is the Lack of Clearly Defined Boundaries a Major Obstacle to their Effectiveness?

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Burundi's protected areas were created with a view to counter the degradation of the natural environment and preserve its biodiversity. Their effectiveness is often questioned, and the lack of clear demarcation, as well as shortcomings in monitoring, are put forward as the main causes of poor performance. The aim of the present study is to verify these allegations and formulate recommendations for better management and efficiency. The study involved a comparative analysis of the perceptions of three main stakeholder categories (17 Managers, 34 from local administration and 171 from the local community) on the status of protected areas and the main reason for their creation, the state boundaries and conflicts. The results of the status and attribute analysis show that most protected areas (87.57%) are centrally managed, with only a small proportion (21.43%) allowing for the participation of stakeholders other than the State in decision-making. Over 60% of all categories perceive that the boundaries are clear, and this applies to all Burundi protected area categories. Protected area categories IV and V record comparatively low proportions of positive clarity of boundaries. However, the majority (over 60%) report a lack of consensus on limits, the existence of protected areas, local population conflicts and attest to a direct relationship between the existence of conflicts and the lack of consensus on limits. These results show that what's important is not to set limits, but to have a consensus on these limits and to respect them. It is recommended that Burundi's protected areas be aligned with the logic of the new conservation paradigm, which advocates the participation of all stakeholders in decision-making.

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INTRODUCTION

Since life first appeared on Earth, species have become extinct in a normal process, with the average lifespan ranging from 2 to 10 million years (Ehrlich & Wilson, 1991 in Blondel, 2006). It is also known that the planet earth has suffered sudden species extinction crises caused by geological upheavals during which more than 50% of species have disappeared (Teyssède, 2004). Moreover, since its appearance, man has not ceased to exploit the resources of the environment, and his hold has grown as his numbers have increased and he has modernized his techniques for exploiting nature (Cury & Morand, 2004).

Some authors do not hesitate to assert that we are heading towards a sixth mass extinction crisis of species (Eldredge, 2001; Leakey & Lewin, 1996; Sodhi et al, 2009), this one being of human origin. Since the awareness of the impact of human activities on the environment, in situ, conservation approaches have been put into practice, and major events such as the Rio conference have reaffirmed that conservation is the best approach to stop the erosion of biodiversity. As a result, concerns about nature protection have led to an accelerated growth of protected areas to control and limit human action in these natural spaces (Rodary & Castellagnet, 2003).

These protected areas, often created in a process of confiscation (Héritier & Laslaz, 2008), have

deprived local populations of their rights to use resources and have not benefited from the support of local populations who question the very foundations of conservation policies (Weber, 1998). The effectiveness of this type of protected area in conserving biodiversity has thus been questioned (Mengue-Medou, 2002; Rodary, 2003). It is influenced by several factors, including taking into account the needs and aspirations of local populations (Héritier, 2008). This point of view was not shared by the conservation community, which considered that integrating the needs of local populations was tantamount to placing concerns related to environmental degradation and biodiversity conservation in competition with those related to the living conditions and social organization of local populations (Naughton-Treves et al, 2005, Naughton-Treves et al, 2007).

However, in a context where taking into account the aspirations of local populations has become essential for the success of conservation programs, it has become increasingly difficult not only to create new protected areas but also to manage existing ones adequately (Nduwimana, 2014). The need for an innovative approach to conservation that meets development imperatives has become increasingly apparent (Toillier and Serpentié, 2007). In developing countries, where a large proportion of the population depends on resources in nature to meet their needs, all protected areas should be managed according to a model that

incorporates poverty reduction strategies (Locke and Dearden, 2005). Unfortunately, the logic of creating protected areas essentially for biodiversity conservation has led to approaches that exclude populations and have not achieved the expected results despite a significant increase in the number of protected areas (Shah et al., 2021).

In Burundi as elsewhere, protected areas are a cornerstone of conservation (Chape et al., 2005). Most of the natural areas in Burundi are found in protected areas. The latter was officially created in 1980 (INECN, 2008), and the network has grown to 14 protected areas totalling 136,700 ha, i.e. nearly 5% of the total area of the national territory (Masharabu, 2011). Although it is recognized that protected areas in the tropics are better at conserving biodiversity than their surroundings (Bruner et al., 2001), all of Burundi's protected areas are under pressure and applied management approaches are less effective (UICN/PACO, 2011). This poor performance of protected areas may have several causes related to both the establishment mechanism and the management and governance approaches applied (Possingham et al., 2006). The idea behind this paper is that the mechanism for establishing a protected area is a crucial element that conditions the other processes.

The creation of a protected area is indeed a complex process, the outcome of which often depends on the attitude of the authority, but the performance depends on the local people and how well the satisfaction of their needs fits in with conservation (Andrade & Rhodes, 2012; Lin et al., 2021). This paper attempts to characterize Burundi's protected areas with a focus on the mechanism of creation and the status granted to each protected area. The data are compared with the perceptions of the different stakeholders on the boundaries of the protected areas and on the disputes over them.

The objective of the study is to have an understanding of the causes of the poor performance of Burundi's protected areas in order to propose improvements to mitigate conflicts and promote

cooperation between the various stakeholders, including local populations, around the objective of biodiversity conservation.

MATERIALS AND METHODS

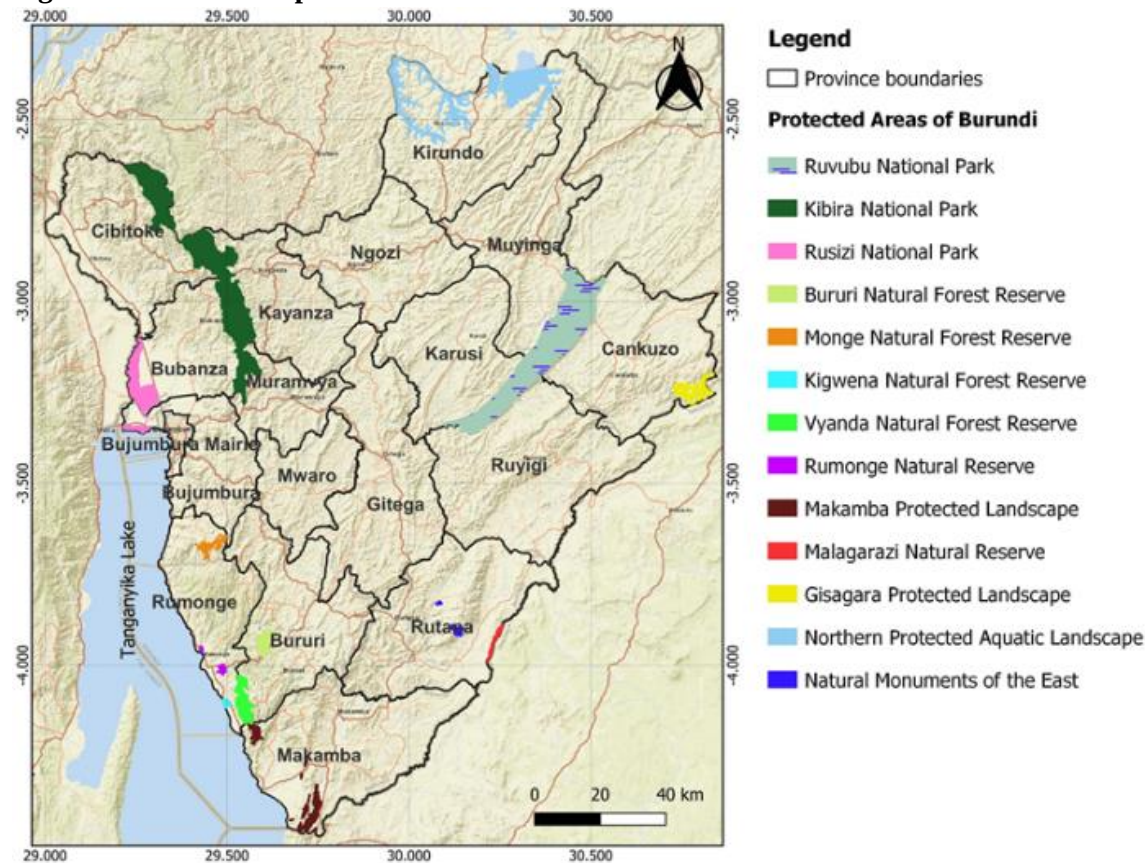
Study Area

Burundi is a small country located at the crossroads of Central and East Africa (between 2°30' and 4°28' south latitude; 28°50' and 30°54' east longitude), which, despite its small size, has a highly diversified environment. The latter is organized into geomorphological zones corresponding respectively to a plain in the western part, a western escarpment zone, a ridge zone that shares the waters of the Congo and Nile river basins, a plateau zone in the central part and depressions in the east and north-east of the country.

This geomorphological variability has allowed the development of diverse natural ecosystems, including montane rainforests, open forests, gallery forests, savannahs and grasslands (Habonimana et al., 2010). Burundi has one of the highest densities in Africa, and the pressure exerted long before the colonial era (Scott Elliot, 1896) on the natural environment is threatening the disappearance of the biodiversity already described and that not yet identified.

For an essentially agricultural country with a high population density, it is understandable that the natural environment in Burundi is being reduced essentially because of human activities (expansion of agricultural and inhabited areas, abusive extraction of resources, propagation of invasive species and homogenization of ecosystems).

In order to stop this reduction, Burundi has committed to increasing its network of protected areas, which currently comprises 14 protected areas, theoretically divided into 4 IUCN categories: 3 National Parks, 6 Nature Reserves, 2 Natural Monuments and 3 Protected Landscapes (**Figure 1**).

Figure 1: Location Map of Protected Areas in Burundi

All these protected areas have been subject to data collection

Data Collection

Data was collected on 17 protected area entities (Table 1) during a qualitative survey of the various stakeholders, including 17 protected area managers,

34 representatives of the territorial administration (communal and hill) and 171 from the population living near the protected areas. The stakeholders considered are those who are affected by the choices and actions of decision-makers and who have the power to influence these choices (Freeman, 1984).

Table 1: List of Protected Areas in Burundi and Corresponding IUCN Category

Protected Area	Entity subject of the study	IUCN PA management category	Number
Kibira National Park	Kibira National Park	II	3
Rusizi National Park	Rusizi National Park	II	
Ruvubu National Park	Ruvubu national park	II	
Bururi Natural Forest Reserve	Bururi natural forest reserve	Ib	6
Kirwena nature reserve	Kirwena nature reserve	Ib	
Malagarazi nature reserve	Malagarazi nature reserve	Ib	
Monge Nature Reserve	Monge Nature Reserve	Ib	
Rumonge Nature Reserve	Nkayamba clear forest	Ib	

Protected Area	Entity subject of the study	IUCN PA management category	Number	
	Nyamirambo clear forest	Ib		
Vyanda Nature Reserve	Vyanda Nature Reserve	Ib		
	Mpotsa Natural Forest Reserve	(Community-based management)		
Karera falls	Karera falls	III	2	
Nyakazu rifts	Nyakazu rifts	III		
Gisagara landscape	protected	Gisagara protected landscape	V	3
Makamba landscape	protected	Mukungu-Rukambasi protected landscape	V	
		Mabanda -Nyanza lac protected landscape	V	
Protected waterscape of the north	Protected waterscape of the north	V		
14	17			

Ia: Strict Nature Reserve, **Ib:** Wilderness Area, **II:** National Park, **III:** Natural Monument, **IV:** Habitat or Species Management Area, **V:** Protected Landscape or Seascape, **VI:** Protected Area with Sustainable Use of Natural Resources.

Semi-structured face-to-face interviews with representatives of the local populations of the protected areas (10 informants for each protected area, including beneficiaries of supply services and members of local environmental protection associations), interviews with representatives of the communal and hillside administration (one representative of the communal administration and one representative of the hillside administration for each protected area) and with the conservators of the protected areas (one conservator for each protected area) were carried out during January and February 2020.

The aim was to gather their views and opinions on the process of creating protected areas and on the status (categories) granted with reference to the IUCN management categories (IUCN, 1994), the size of each protected area, the status of protected area boundaries, consensus on boundaries and disputes.

There was no need to seek approval from the Ethics Committee or Statistical Visa due to the qualitative nature of the study and its size. On the other hand, those who would have to give permission at the local level were involved in data collection, which made the task easier.

A comparative analysis of the views of the different stakeholders and for the different categories of protected areas was carried out by: (i) calculating the proportions of respondents corresponding to the modalities of the different variables; (ii) using a Chi-square test to see if the differences are significant; (iii) cross-tabulation of data for the variables, analyzed to describe and highlight their relationships.

Histograms, cross-tabulations of respondents' responses and significance tests were carried out using IBM SPSS Statistics 22 software.

The values of Chi-square and critical Chi-square were calculated. The chi-square critical value is a statistical value used in the chi-square test to determine whether the differences between observed and expected data are significant (Hayes, 2024).

RESULTS

Status and Area of Protected Areas in Burundi

Burundi's protected areas have been created for the most part, 11 out of 14 (78.57%), under the status of national park (II), nature reserve (Ib) and natural monument (III), while protected landscapes (V) represent only 21.43%.

The table below (**Table 2**) provides a summary of the status of protected areas in Burundi and their evidence as perceived through local practices.

Table 2: Status of Burundi's Protected Areas and Characteristics as Perceived Through Local Practices

The main design element identified	Percentage (%) of respondents by protected area (PA) categories			
	II. National Park	III. Natural Monument	IV. Habitat/ Species Management Area	V. Protected Landscape/Seascape
Naturalness	100	100	100	100
Biodiversity richness	100	100	87,5	60
Source water protection	33,3	0	12,5	40
Erosion control	0	0	37,5	20
Tourism	100	100	25	20
Cultural dimension	33,3	100	12,5	0
Wetland area	67,5	0	25	20

The precise areas at creation are not known for most PAs, and the values given are estimates. Respondents perceive that the area of PAs has varied (53.3% of PAs have experienced a reduction in their area at creation) over time without prior

« Naturalness » is seen as the main attribute that would have led to the design of Burundi's natural environments as protected areas. « Biodiversity richness » and « tourism » would be the other main elements considered. « Biodiversity richness » would not be an important element for categories IV and V, whereas « tourism » is very important for categories II and III.

reclassification. The ANOVA on the variation in area (**Table 3**) shows that it is not influenced by the status of the protected area (P-value greater than 0.05%).

Table 3: Analysis of Variance between Size and Category of Burundi Protected Areas

	Sum of squares	degrees of freedom (df)	Mean square	F	Sig.
Between groups	30,141	3	10,047	0,256	0,856
Within groups	511,037	13	39,311		
Total	541,178	16			

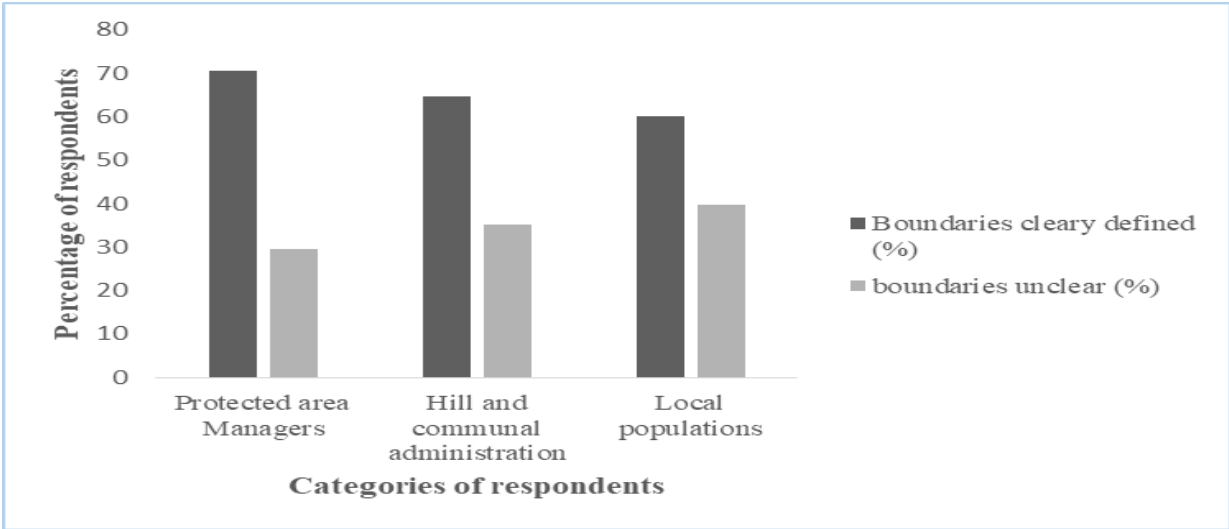
Stakeholders' Perception of the State of Protected Area Boundaries in Burundi

Perception of the Demarcation of Boundaries

A large proportion of respondents in all stakeholder categories interviewed perceive that Burundi's protected areas have clear boundaries (**Figure 2**).

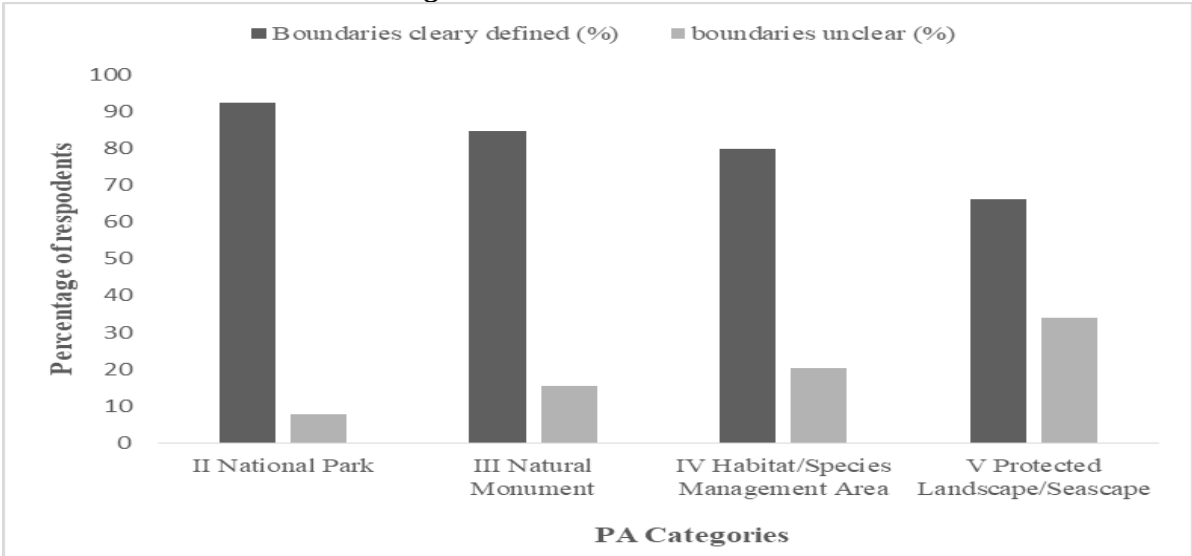
Although the differences are not significant (P-value = 0, 75126776; Chi-square = 0, 57198631; Critical value of Chi-square = 5, 99146455), the proportions of perceptions of the local population category appear comparatively low.

Figure 2: Proportions Corresponding to the Perceptions of Different Stakeholders on the Clarity of the Boundaries of Burundi's Protected Areas

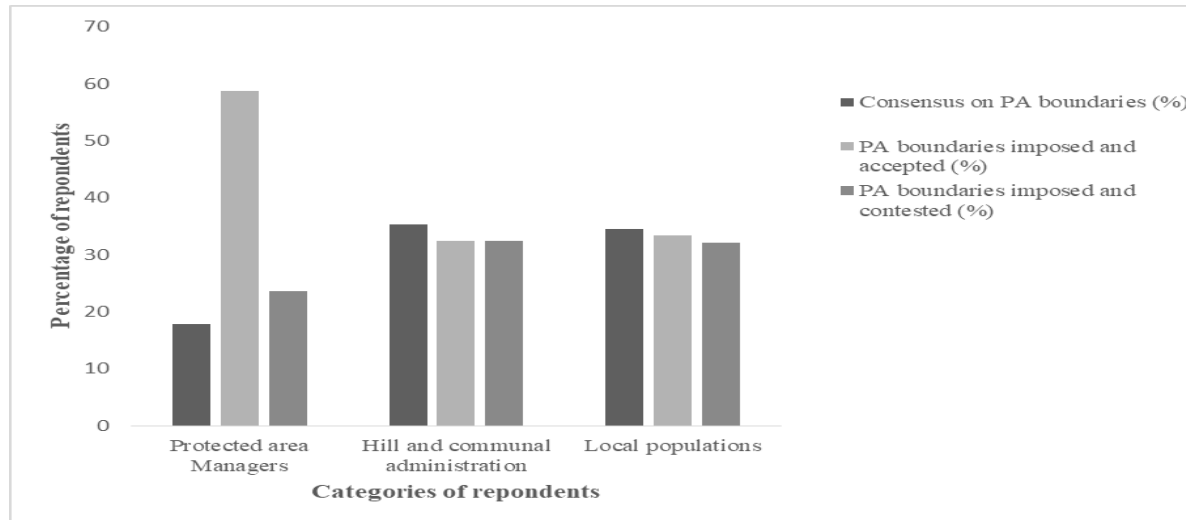


Perceptions of the clarity of Burundi's protected area boundaries vary significantly (P-value = 0, 0011033; Chi-square = 16, 0580952; critical value of Chi-square at 0, 5% = 12, 8381565) across protected area categories (Figure 3). Categories IV and V have low scores for clarity of boundaries.

Figure 3: Proportions Corresponding to the Perceptions of Different Stakeholders on the Clarity of the Boundaries for Different Categories of Burundi Protected Areas



Acceptability of Burundi Protected Area (PA) Boundaries The boundaries of the Burundi protected areas are not consensual overall (Figure 4).

Figure 4: Proportions Corresponding to the Declarations of the Different Stakeholders on the Status of the Limits of the Protected Areas of Burundi

For managers, 17.65% of respondents stated that the boundaries are consensual, 58.82% that they are imposed and accepted and 23.53% that the boundaries are imposed and disputed. For the representatives of the administration, 35.29% of the respondents stated that the boundaries are consensual, 32.35% that the boundaries are imposed and 32.35% that the boundaries are contested.

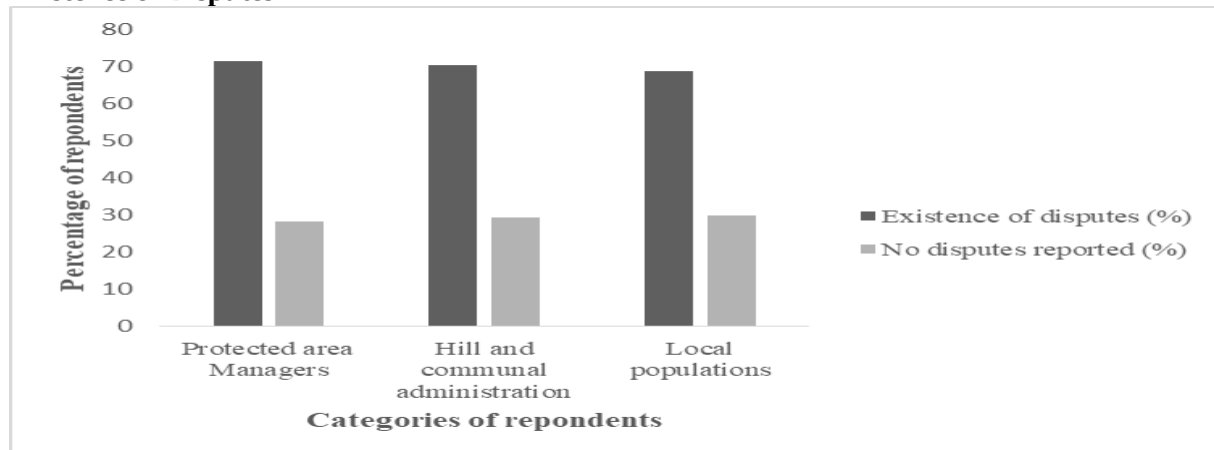
For the local population, 34.50% of the respondents stated that the boundaries are consensual, 33.33% that the boundaries are imposed and 28.65% that they are contested. The difference in the proportions corresponding to the different stakeholders is not

significant (P -value = 0, 32887346; Chi-square = 4, 61722141; the critical value of Chi-square at 5% = 9, 48772904).

Conflicts and Disputes in and Around Burundian Protected Areas

Existence of Conflicts and Disputes

The data collected on Burundi's protected areas show that disputes exist. This is affirmed by more than 70.59% of respondents in the manager category, more than 70% in the administration category and more than 68% in the local population category (Figure 5).

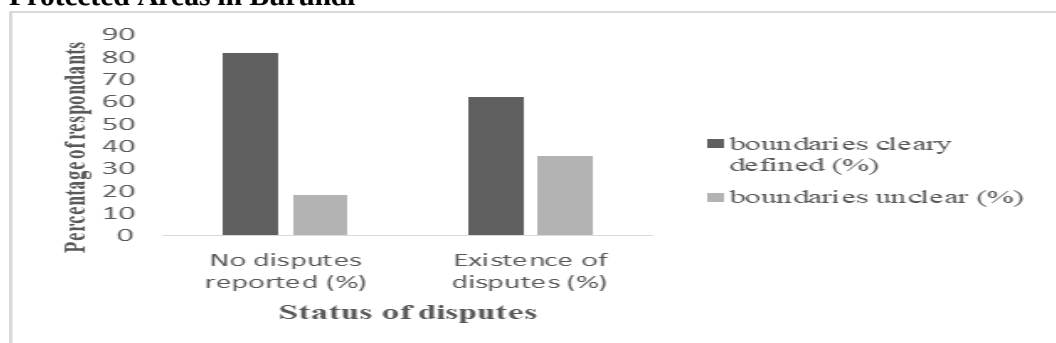
Figure 5: Proportions Corresponding to the Declarations of the Different Stakeholders on the Existence of Disputes

There is no significant difference between the responses provided by the different categories of respondents (P-value = 0, 99173072; Chi-square = 0, 01660731; the critical value of Chi-square at 5% = 5, 99146455).

Relationship between Weak Demarcation of Burundi Protected Area and the Occurrence of Disputes

The results show that for statements corresponding to clearly demarcated protected area boundaries, the proportions corresponding to disputes are relatively low and that for statements corresponding to unclearly defined boundaries, the proportions for disputes are relatively high (**Figure 6**).

Figure 6: Relationship between the Demarcation of Boundaries and the Occurrence of Disputes for Protected Areas in Burundi

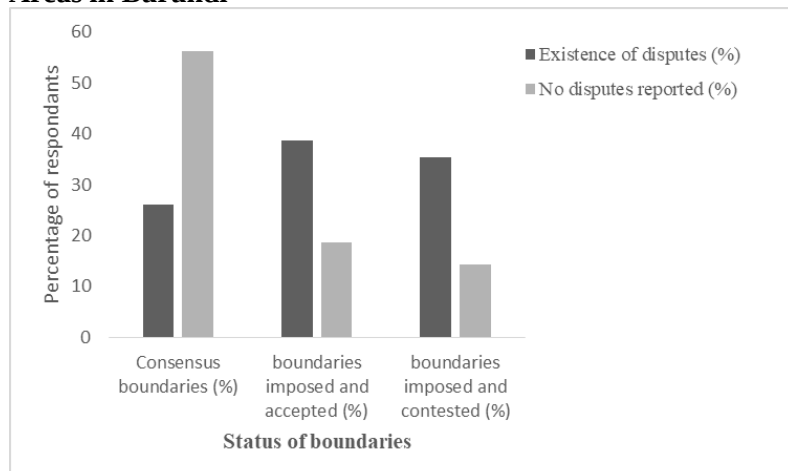


The Chi-square test confirms that there is a link between the demarcation of boundaries and the occurrence of disputes for protected areas in Burundi (P-value = 0, 01045804; Chi-square = 6, 55516001; the critical value of Chi-square at 5% = 3, 84145882). There are indeed fewer disputes when the boundaries are clear.

Relationship between the Consensus on the Boundaries of Burundi Protected Areas and the Occurrence of Disputes

The results of the comparison of perceptions on the existence of disputes and consensus regarding the boundaries of protected areas show that there are fewer disputes where there is consensus on the boundaries of protected areas (**Figure 7**).

Figure 7: Relationship between the Status of Boundaries and Occurrence of Disputes for Protected Areas in Burundi

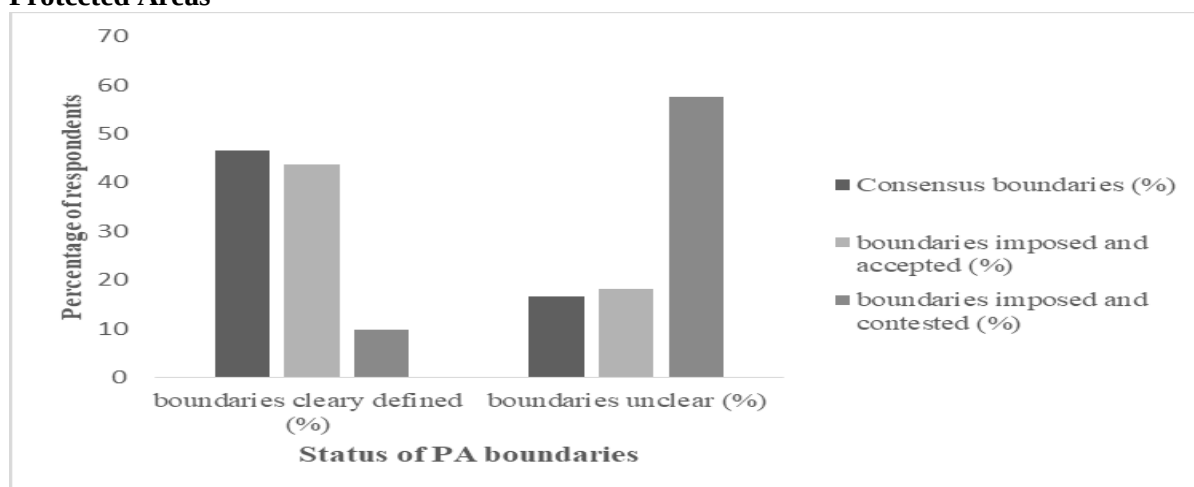


The results of the chi-square test (P -value = 5, 25804E-05; Chi-square = 19, 7063341; the critical value of Chi-square at 1% = 9, 21034037) show a strong relationship between the consensus on the boundaries of Burundi protected areas and the occurrence of disputes.

Relationship between Clarity of PA Boundaries and Acceptability of Boundaries

The comparison of the perceptions on the clarity of the boundaries of the protected areas and on the consensus during their establishment shows that the boundaries are deemed clear when they are accepted and they are deemed unclear if they are imposed and disputed. (Figure 8).

Figure 8: Relationship between Clarity (Status) of Boundaries and Their Acceptability for Burundi Protected Areas



The results of the chi-square test (P -value = 7, 44495E-12; Chi-square = 51, 2469706; the critical value of Chi-square at 1% = 9, 21034037) show a very strong relationship between the acceptability and perceptions on the status of Burundi protected area boundaries.

DISCUSSIONS

Status and Area of Protected Areas in Burundi

The dominant status of protected areas in Burundi is that of strict conservation. The design of these protected areas was dictated by the State, for the most part with the expulsion of the populations living there (Sournia, 1998). This state of dominant status reflects weakness in the adaptation of Burundi's protected areas to the imperatives of taking into account the needs of the local populations as advocated by the fifth World Parks Congress held in Durban in 2003 (Triplet, 2009). Naturalness is the main reason for the design of

Burundian protected areas. Now that there is evidence that the biodiversity to be protected exists even outside of wilderness areas, conservation will need to integrate anthropised areas (Western, 2001; Langhammer et al., 2011), which requires an open approach to establishment.

The surface areas of Burundi's protected areas are not well known because the values given are approximations given by the managers at the time of design, and the real situation varies because protected areas are subject to anthropic pressures (UICN/PACO, 2011).

Stakeholder Perception on the State of Protected Area Boundaries in Burundi

A large proportion of respondents in different categories of respondents say that the Burundian protected area's boundaries are clear. This demonstrates that the various stakeholders were informed of the establishment of each protected area

in Burundi. The creation of a protected area is normally accompanied by a physical demarcation, by law enforcement guards or by drawing the boundary only on the map (Junker et al., 2020). Positive perceptions of the local population category appear comparatively low. This may be the result of significant restrictions for the local population when establishing a protected area (Maksanova et al., 2021).

The proportion of those who say there was no consensus on the boundaries is high. Burundi protected areas were created under « fortress conservation mode », a mode which did not care about the interests of the local populations and provoked their discontent (Colchester, 2004; Dowie, 2009). The boundaries are contested but imposed by the authority's regulations.

Conflicts and Disputes in and Around Burundian Protected Areas

The proportions of those who recognize the existence of conflicts and disputes for the protected areas of Burundi are high for all categories of respondents (managers, administration, and local populations). This can be explained by the fact that despite the existence of different models of protected areas, the classic form of national park predominates, even though it does not take into account the interests of local populations (Elvestad et al., 2011) and in many cases exclude local populations (Htun et al. 2012).

Analysis of the results reveals that the clearer the boundaries of the PAs are declared, the fewer conflicts there are. More conflict declarations appear when the boundaries are less clear. There are indeed fewer disputes when the boundaries are clear. There is a strong relationship between the consensus on the boundaries of Burundi protected areas and the occurrence of disputes. According to Recheński et al. (2019), conflicts over protected area boundaries are a manifestation of the mismatch between social, natural and administrative systems

at the time of creation and management of protected areas.

The results show that the boundaries are deemed clear when they are accepted, and they are deemed unclear if they are imposed and disputed. It is therefore not the boundaries themselves that are the source of conflicts but the restrictions on access to resources that are imposed by the context of the expansion of protected areas driven by global policies (Redpath & Sutherland, 2015).

CONCLUSION

The study showed that the boundaries of Burundi's protected areas, even if they are not physically marked, are known to the main conservation stakeholders. They should not, therefore, be the primary concern because their existence does not prevent disputes, pressure and conflicts. What is lacking is a consensus on the limits, which will be difficult to achieve if there is no real openness to participation and negotiation of interests.

Recommendations

For the effectiveness of Burundi's protected areas, we would recommend that decision-makers include protected areas in the new paradigm, where they must also contribute to the well-being of local populations.

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