Policy analysis

Conservation conflict following a management shift in Pendjari National Park (Benin)

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ABSTRACT

A common strategy to counteract global biodiversity loss is sustainable management of protected areas. However, as protection of nature sometimes conflicts with human livelihoods and involves stakeholders with different interests, conservation conflict is globally on the rise. These conflicts can hamper sustainable development, social equity and effective biodiversity conservation. Understanding perceptions of different stakeholders and mapping discourses is key in this respect. In this study, we investigated conservation conflict in the Pendjari National Park in Benin, West Africa. The conservation conflict was fueled in part by a shift from state-led collaborative management to a public-private partnership. Pendjari is the largest remaining savannah ecosystem in West Africa and home to several threatened megafauna species. Using Q methodology, we identified two distinct discourses among stakeholders. The first discourse, supported mainly by formally educated people with non-agricultural jobs, focuses on the limitation of anthropogenic activities in favor of biodiversity conservation. The second discourse is mostly supported by people with a lower education level and a direct dependency on the land. They agree there is a need for conservation but even more so for viable alternatives to ensure people's livelihoods. The identification of these discourses and their underlying drivers can be included into future decision-making processes and management of the Pendjari National Park.

1. Introduction

Global biodiversity is rapidly declining, also driven by anthropogenic pressures (Butchart et al., 2010). Loss of biodiversity directly threatens the delivery of ecosystem services and hence human well-being (Cardinale et al., 2012). One pathway to counteract this trend is the sustainable management of existing protected areas (PAs), which can be approached in different ways (Geldmann et al., 2013).

One approach is collaborative or participatory governance, where multiple stakeholder groups contribute to the management of protected areas, with varying degrees of involvement or decision power (Bodin, 2017). In their global survey, IPBES (2019) found that when local communities are engaged in the PA management, those are on average less degraded. Another approach are public-private partnerships, where the government determines the policy but mandates a non-governmental organization to execute the day-to-day management (Baghai et al., 2018). This can provide long-term financial help, something African PAs with the current underfunding and lack of capacity can use dearly (Baghai et al., 2018). However, critics raise questions on the ethics of delegation of law enforcement and the loss of sovereignty of the state, as well as the potential loss of community inclusion (Baghai et al., 2018).

The growing urgency to conserve natural resources and the multitude of stakeholders involved with their respective interests is causing a global increase of conservation conflict (Redpath et al., 2013; Young et al., 2016; Ramos et al., 2021). Conservation conflict is a social conflict

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occurring in environmental conservation context, which can occur when there are clashing opinions on conservation objectives, uneven power relationships (Redpath et al., 2013), or an economic or ecological distribution conflict such as struggles over salaries or access to fertile land (Scheidel et al., 2020). Conservation conflicts can limit conservation effectiveness and inhibit sustainable development and social equity (Redpath et al., 2013). To resolve such conflict, we must first understand the stakeholder perceptions regarding conservation and PA management (Vodouhê et al., 2010; Redpath et al., 2013). By mapping discourses, we can understand the attitude of different stakeholders towards conservation goals. Reporting these discourses in a participatory way to local stakeholders can improve management decisions and facilitate dialogue (Omoding et al., 2020).

We chose to apply Q methodology (Q) to a conservation conflict in Pendjari National Park (PNP) in Benin, West Africa. Q is a semi-quantitative method used to map first-person perceptions by asking participants to sort statements by degree of agreement. Afterwards statistical analysis groups participants together into shared discourses (Watts and Stenner, 2012). Q has increasingly been applied in conservation since 2015, however, it has been mostly used in Europe and North America (Zabala et al., 2018; but see Langston et al., 2019).

West Africa is under-researched and underrepresented in comparison to southern and southeastern Africa, due to political and societal instability, persistent poverty and inaccessibility for international tourism or development organizations (Bauer et al., 2021). West African ecosystems have suffered huge wildlife population declines (IPBES, 2018). However, PNP in Benin is one of the protected areas displaying successful conservation due to inter alia better funding by various public and private donors (Bauer et al., 2021). PNP is the largest remaining protected savannah ecosystem of West Africa, hosting many threatened megafauna species (APN, 2017). It has known different management strategies over the years (Fig. 1) which overall have led to a satisfactory conservation of wildlife populations, however distrust and conflict among stakeholders has been prevalent since the emergence of PNP (Pochet, 2014). PNP was first created as a game reserve by French colonial administration, who expelled local people and installed them in surrounding villages (Fig. 1a, b). After Benin's independence, the governmental Forest Department ruled with repression and violence to keep locals out of the park (Fig. 1c, d) (Idrissou et al., 2013). In 1993, participatory management was installed where independent governmental body "CENAGREF" managed the park in collaboration with a board of local village representatives "AVIGREF". To gain trust, CENAGREF increased local employment and shared profits from trophy hunting with AVIGREF. In 2017, PNPs' management shifted from state-led collaborative management towards a public-private partnership, fueling more conservation conflict. In this study, we map discourses on PNPs' current management and we evaluate the applicability of Q in the context of African protected areas.

2. Methods

2.1. Description of the study site

This study was conducted in the Pendjari National Park (PNP) in northern Benin (Fig. 2). In 2017, Benin was the 23rd poorest country worldwide with a GDP of 827 USD per capita, of which 23% was generated by agriculture, forestry and fishing (World Bank, 2017). PNP is part of transboundary W-Arly-Pendjari (WAP) protected area complex across Benin, Burkina Faso and Niger. Several transhumance routes run through WAP during dry season, when cattle herders from the Sahel zone migrate to the south of Benin in search of water (Amahowé et al., 2013).
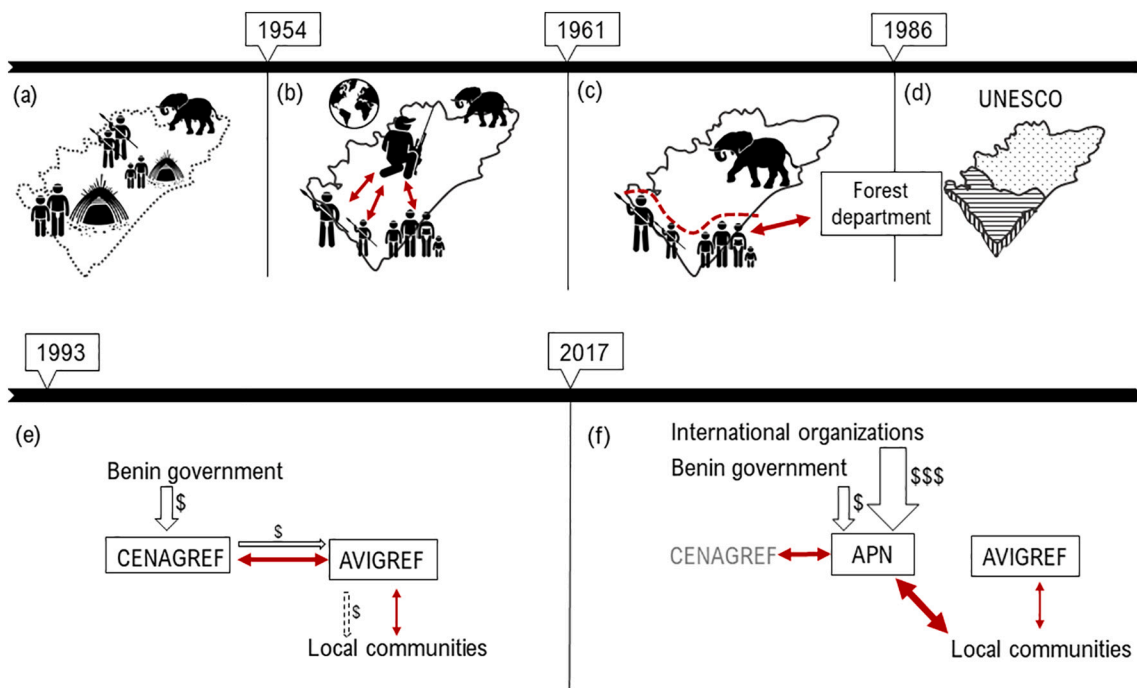

Fig. 1. Overview of the management history in Pendjari National Park. (a) Before 1954, local people lived, hunted and cultivated crops in the area of Pendjari. (b, c) In 1954, French colonists expelled the locals to a restricted zone (red dotted line) and made Pendjari a Game Reserve. In 1961, Benin gained independence and Pendjari upgraded to a National Park. (d) In 1986, Pendjari joined the Man and Biosphere Reserve network and was divided in three zones: Zone of Restricted Occupation (vertical lines), a Hunting Zone (horizontal lines) and a core zone (dots). (e) In 1993, a collaborative management scheme was installed, where a government body 'CENAGREF' works together with a board of representatives of the local village communities associated in 'AVIGREF'. (f) In 2017, a public-private partnership starts and NGO African Parks Network (APN) takes over the management. Red arrows indicate conflict, white arrows indicate financial flows (size of arrows are in proportion). A box indicates stakeholders with an active management function. (For interpretation of the references to color in this figure legend, the reader is referred to the web version of this article.)
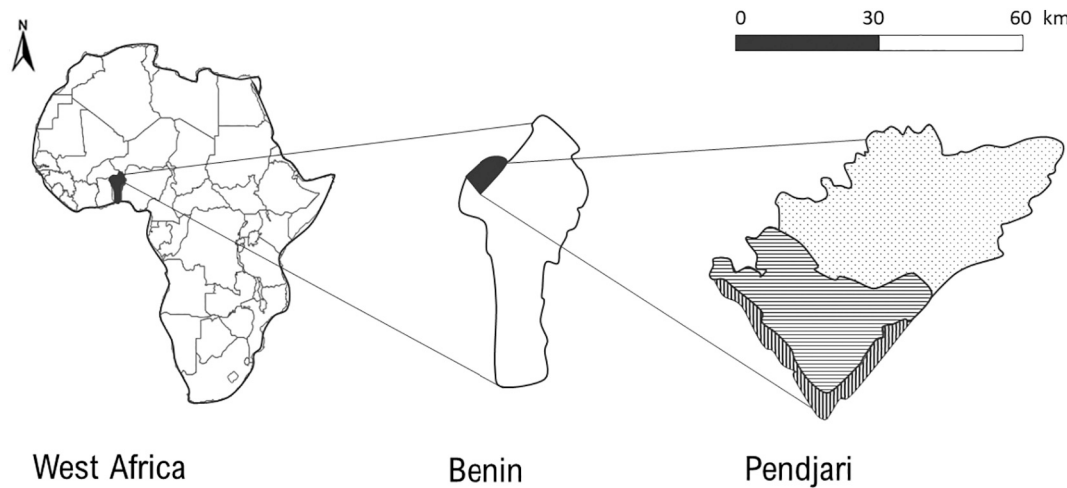
Fig. 2. Map of the Pendjari National Park in Benin (West Africa). It is 2755 km² and is divided in three functional zones, typical for Man and The Biosphere Reserves: 1) the Zone of Controlled Occupation where settlements and all agricultural activities are allowed (vertical stripes), 2) the Hunting Zone where medium-impact activities are allowed such as regulated harvesting of non-timber forest products and trophy hunting by tourists (horizontal stripes, 3) the Strict Natural Protection Zone where no other activities but research and low-impact tourism such as safaris are allowed (dots).

PNP features a savannah ecosystem with gallery forests along the Pendjari river and hosts West Africa's biggest populations of large herbivores such as Roan Antelopes (*Hippotragus equinus*, É. Geoffroy Saint-Hilaire, 1803) and Elephants (*Loxodonta africana*, Blumenbach 1797) (Vodouhê et al., 2010), as well as the critically endangered West African Lion (*Panthera leo leo*, Linnaeus, 1758) (Henschel et al., 2015). Over 28,000 people live around PNP spread across 24 settlements. The population's main source of livelihood is agriculture, small-scale animal husbandry and tourism. Literacy rates are low with only 45% and 33% of men and women being able to read and write (OECD, 2014). The main religions are Christianity and Islam, mixed with traditional religion Voodoo where spirits are represented by natural elements which are strictly protected and should receive regular offerings. Currently, PNP consists of three zones with different functions, typical for a UNESCO Man and Biosphere reserve (Fig. 1c): in the Zone of controlled occupation (ZOC), settlements and all agricultural activities are allowed. In the Hunting Zone, regulated harvesting of non-timber forest products and religious activities are allowed as well as trophy hunting by tourists. In the core zone of the park, no other activities but research and low-impact tourism are allowed.

2.2. Q methodology

Q methodology (Q) is a semi-quantitative method which is used to explore subjective viewpoints and identify patterns among them (Watts and Stenner, 2012). Participants are presented with a set of statements to sort from least to most agree. These Q-sorts are statistically analyzed to elicit 'clusters of subjectivity' or Q-factors. Q is conceptually akin to inverse factor analysis, where participants (P-set) are the explanatory variables, statements (Q-set) are the tests and Q-sorts are the dependent variables (Watts and Stenner, 2012).

Q has been used for decades in disciplines such as psychology, health care and political science, but only recently gained attention in conservation research (Zabala et al., 2018). Here, it has mostly been used for policy appraisal, conflict resolution and to test acceptability of management alternatives (Zabala et al., 2018). As Q is a one-on-one process, it is suitable for situations with high conflict to avoid group-think bias or dominance effect (Mukherjee et al., 2018). There is no need for large sample sizes and it is easier to reach people higher up in the societal hierarchy than with a group-based technique such as focus groups. The systematic and structured way provides semi-quantitative evidence but keeps the in-depth quality of an interview (Mukherjee et al., 2018).

A typical Q study consists of four main stages: 1) research design, 2) data collection, 3) analysis, 4) interpretation.

2.2.1. Research design

We gathered scientific and grey literature on PNP using the search term "Pendjari AND Benin" via Web of Science and Google Scholar in French and English (last accessed: 10th August 2018). We selected 45 documents relevant to conservation and management. From these, we isolated 129 fragments expressing a value, opinion or untested hypothesis. Fragments were structured per keyword and similar fragments were combined into overarching statements. This resulted in 44 statements (Table 1), containing a balanced mix of different drivers, pressures, state, impact and response (DPSIR framework by EEA, 1999) and of negative and positive statements.

2.2.2. Data collection

The fieldwork took place from August to October 2018, 15 months after the non-governmental private organization African Parks Network (APN) took over PNPs' management. 53 face-to-face Q-sessions, of which one pilot run to test the relevance of the selected statements, were conducted with participants who were purposefully selected to represent all stakeholder groups. Stakeholder groups were research, AVIGREF [Village Association for the Management of Wildlife Reserves], CENA-GREF [previous management "National Center of Wildlife Reserves Management"], APN, non-governmental organizations, agriculture, transhumance, tourism and politics. We made use of snowballing, where participants recommend other potential participants. Participants were asked to place the statements in seven categories from "+3" to "-3" in a forced normal distribution. They were instructed to sort respectively from most agree to least agree, with neutral statements in the middle 'zero' category.

Demographic information (age, education, place of birth, etc.) was collected, as well as notes on the quality of the Q-session (see Appendix A). After the Q-sorting process, we asked to clarify the placement of particular statements in a post-sorting interview (as in Hugé et al., 2016 and as recommended by e.g. Zabala et al., 2018). We also added the following three questions: 1) Is conservation of biodiversity necessary according to you?, 2) why or why not?, 3) what would you change if you were in charge of PNP?

2.2.3. Analysis

Before beginning the analysis, we eliminated the pilot run and 12

Table 1

The statements with z-scores and rank per Q-factor. Z-scores are a weighted average score showing the relationship between each statement and the Q-factor. The rank is a rounded z-score to match the original Q-board distribution. When z-scores do not differ significantly between Q-factors (P > 0.05), they are marked as consensus statements in bold. When the z-scores differed highly significantly between Q-factors (P < 0.000001), they are marked as distinguishing statements in cursive.

Statement	Q-factor 1		Q-factor 2	
	Z-score	Rank	Z-score	Rank
1. The participation of local communities is not essential to the effective conservation of wildlife and ecosystems in PNP.	**−1.91**	**−3**	**−1.76**	**−3**
2. All stakeholders of the PNP trust AVIGREF.	−1.03	−2	−0.47	−1
3. There is no conflict between the stakeholders of the PNP.	**−1.74**	**−3**	**−1.78**	**−3**
4. The collaboration between APN and the local people should be improved.	**1.46**	**3**	**1.53**	**3**
5. All stakeholders of the PNP trust African Parks Network.	−1.19	−2	−1.69	−3
6. Local communities should get monetary rewards for protecting nature in PNP.	−1.14	−2	−0.66	−1
7. The distribution of revenues generated by trophy hunting is not sufficient to compensate the loss of access to PNP.	0.20	0	0.66	2
8. Benefit-sharing from tourism activities does provide huge benefits for the local communities around PNP.	*0.56*	*1*	*−0.97*	*−2*
9. Tourism should be promoted to increase the profit for PNP.	**1.48**	**3**	**1.63**	**3**
10. Local communities support the existence of the park because of the school trips organized by APN.	*−0.42*	*−1*	*1.09*	*2*
11. APN staff members have a good job with a high salary.	−0.34	−1	−0.77	−2
12. People working in PNP should be motivated by more than financial gain only.	0.95	2	0.15	0
13. The Park should create more jobs to ensure support from local communities for biodiversity conservation.	**1.36**	**3**	**1.63**	**3**
14. People who are directly dependent on agriculture benefit less from the park than people with non-agricultural jobs.	**0.22**	**0**	**0.51**	**1**
15. Tradition should be emphasized in order to ensure local support for conservation in and around PNP.	0.75	1	0.31	1
16. Agroforestry needs to be supported by seedling production in protected plant nurseries by the park staff of Pendjari.	0.09	0	−0.61	−1
17. Agroforestry is a key solution to reduce pressure on the PNP.	*0.54*	*1*	*−0.93*	*−2*
18. Planting rapidly growing fuelwood species is essential to reduce the pressure on PNP.	0.82	2	0.26	0
19. Education is a key factor in ensuring support for biodiversity conservation in and around PNP.	*1.83*	*3*	*0.76*	*2*
20. Education and awareness-raising regarding the multiple benefits provided by PNP should be organized by APN.	**1.16**	**2**	**1.34**	**2**
21. It is important to involve kids and young people in the conservation of wildlife.	**1.89**	**3**	**1.96**	**3**
22. Restricting access to the PNP is not a good way to protect wildlife in the long run.	*−0.61*	*−1*	*0.47*	*1*
23. Strict enforcement of the rules regarding access to the park and its resources is essential for successful management.	0.41	1	0.95	2
24. All agricultural activities should be banned from the PNP and its periphery to ensure wildlife conservation.	−1.58	−3	−2.12	−3
25. Access to the park may not be completely prohibited for cattle.	*−1.34*	*−3*	*0.85*	*2*
26. Fencing the PNP is necessary to safeguard the wildlife and reduce human-wildlife conflict.	−1.26	−2	−0.27	0
27. Providing financial support for fencing in cattle is an effective strategy to protect them from predators around PNP.	**−0.59**	**−1**	**−0.28**	**−1**
28. Wild prey density should be increased to reduce predation pressure on livestock.	**−0.90**	**−2**	**−1.22**	**−3**
29. International financial aid is needed to improve wildlife conservation in PNP.	*0.13*	*0*	*1.50*	*3*
30. Pesticides used in agriculture have a negative effect on wildlife.	0.94	2	0.34	1
31. Poaching is a serious threat to the Lion and Elephant population in PNP and needs to be addressed.	1.14	2	0.49	1
32. Poaching is a serious threat to non-iconic species, such as smaller herbivores and birds, in PNP and needs to be addressed.	**0.54**	**1**	**0.47**	**1**
33. Illegal poisoning of carcasses is a threat to the Lion population.	−0.30	−1	−0.79	−2
34. Lion trophy hunting is badly managed around PNP.	0.05	0	−0.71	−1
35. Conflict between humans and predators is increasing due to better protection of predators.	−0.14	0	0.30	0
36. Conflict between humans and wildlife is decreasing.	**−0.28**	**0**	**−0.27**	**0**
37. It is more important to focus on the socio-economic dimension of conservation than on the ecological dimension.	*−0.82*	*−1*	*0.28*	*0*
38. Gallery forests should receive extra scientific attention as they are of high economic and ecological value.	0.77	2	0.12	0
39. At PNP, adaptations to climate change are well taken into account in the management strategy.	−0.39	−1	−1.17	−2
40. Scientific research is needed to solve human-wildlife conflicts in and around PNP.	0.44	1	−0.19	0
41. Secure land tenure will be beneficial for PNP's ecosystems and the local people.	−0.02	0	−0.35	−1
42. Transboundary cooperation in the WAP-area is fully functioning and effective.	−1.03	−2	−0.30	−1
43. The management of PNP should focus on iconic species such as Lions, Elephants and Cheetahs.	−1.31	−3	−0.76	−2
44. Zonation into protected and buffer areas with different rules of access and use is the best way to conserve biodiversity at PNP.	**0.59**	**1**	**0.46**	**1**

other participants based on their performance during the Q-session. The eliminated participants i) did not reread or replace their statements according to the rules of prioritization, or ii) did not match the category on the Q-board with how they verbally expressed their opinion on that specific statement, for at least three statements. This resulted in a selection of 40 candidates, with whom we continued all further analyses.

All analyses were performed in R version 3.6.0 (R Foundation for Statistical Computing, 2019). Additional packages used were MVN version 5.7 (multivariate normality; Korkmaz et al., 2014), psych version 1.7.2 (unrotated PCA; Revelle, 2018), nFactors version 2.3.3 (parallel analysis, optimal coordinates; Raiche, 2010), qmethod version 1.5.4 (rotated PCA; Zabala, 2014), stats version 3.6.0 (logistic regression models; R Foundation for Statistical Computing, 2019) and qpcR version 1.4.1 (AICc; Spiess, 2018).

We explored demographic data using Welch's two-sample *t*-test and Pearson's product-moment correlation (Appendix A). Before performing an unrotated principal component analysis (PCA) with 20 factors, we tested assumptions of multivariate normality and homogeneity of variances. To determine how many factors to retain, we ran a parallel analysis with 1000 random runs, calculated optimal coordinates and a scree plot. We then ran a PCA with two factors, varimax rotation and Pearson correlation coefficient. What is usually called a "principal component" is here called "Q-factor". We opted for automatic flagging of participants onto a Q-factor. Automatic flagging is based on a significantly high factor loading of the Q-sorts ($P < 0.05$) and on the square loading of a factor not being higher than the sum of square loadings for all other factors (Zabala, 2014). The factor loading is equivalent to correlation coefficient, which shows the link between participants and Q-factors.

To examine what demographic variables explained membership of participants into Q-factor 1 and Q-factor 2, we used logistic regression. Based on prior literature, we formulated several hypotheses about how different demographic factors could affect membership into Q-factor 1 or Q-factor 2. Based on these hypotheses, we built nine logistic regression models. We then compared the explanatory power of these models using corrected Akaike's information criterion (AICc) for small sample sizes. AICc estimates how parsimoniously a model fits data while taking into account different numbers of explanatory variables. We used the AICc values to calculate Akaike weights: the probability of a model being the correct model in the set tested. We performed likelihood ratio tests to compare the models to the null model with no explanatory variables. We used the Nagelkerke's pseudo R^2 to examine model fit. Model assumptions of collinearity, homoscedasticity and residual normality were examined graphically as per Zuur et al. (2010).

2.2.4. Interpretation

Based on z-scores (i.e. weighted average score showing the relationship between each statement and Q-factor), ranks, qualitative data from post-sorting interviews (Watts and Stenner, 2012) and quantitative data retrieved from demographic variables, we formulated the discourses of the Q-factors. Discourse 1 is the interpretation of Q-factor 1, discourse 2 is the interpretation of Q-factor 2.

3. Results

3.1. Q methodology

The scree plot, parallel analysis and optimal coordinates, based on eigenvalues of an unrotated PCA with 20 factors, all indicate that most of the variance is explained by the two first factors.

The rotated PCA with two factors showed 26 flagged and loading participants on Q-factor 1 and 14 on Q-factor 2. While all 40 of our participants got automatically flagged on one or the other Q-factor, there are 15 flagged participants who loaded significantly ($P < 0.01$) on both factors. To avoid a loss of information, we decided to keep these confounding participants in our analysis. Together Q-factor 1 and 2 explained 51% of variance in the Q-sorts (respectively 30% and 21%), which surpasses the threshold of 35–40% (Watts and Stenner, 2012). The two Q-factors are correlated for 70%.

3.2. Description of discourses

The Q-factors provided by rotated PCA represent two main discourses. We also used quotes from post-sorting interviews to clarify the discourses.

3.2.1. Consensus statements

The two discourses overlap for 70% on statement ranking: they agree on many issues. During the interviews almost all participants express that they think conservation of biodiversity is necessary for the following reasons (in order of frequency of use): for the next generations, for sustainable development, for exploitation of natural resources, against climate change and for spirituality. This might show effects of previous environmental education and/or a traditional positive attitude towards their environment.

All participants (p) rated statements (s) (Table 1) concerning conflict after the management shift in 2017 as very important and agreed there is conflict between the different stakeholders (Table 1, s3), there is a need for more collaboration (s4) and that participation of local communities is essential in an effective conservation strategy (s1). Moreover, everyone agrees that economic activities should be highly prioritized. Specifically, all participants agree tourism should be developed (s9), APN should create more jobs (s13) and agriculture should be allowed within the ZOC (s24). Emphasis was also placed on education: everyone deems it very important to involve younger generations in conservation (s21) and thinks APN should provide more education on ecosystem services (s20).

Although the following statements are not ranked as highly important by participants, everyone agrees that tradition could be used to stimulate biodiversity conservation (s15), that poaching is a threat to "non-iconic" species (s32) especially medium to large herbivores, that people directly depending on the land for agriculture benefit less from the park than others (s14) and that the current three-way zonation of PNP serves best to protect nature (s44). In terms of human-wildlife conflict, they do not think that increasing wild prey density would alleviate pressure of predators on livestock (s28) or that fencing in livestock is a good solution (s27). Neither do they estimate that human-wildlife conflict has decreased recently (s36).

3.2.2. Discourse 1: conservation for nature's sake

Discourse 1 is in favor of conservation centered around natures' interest and its intrinsic value. They support a strict ban of livestock from PNP, emphasize the protection and plantation of trees and see environmental education as the key to success.

Discourse 1 (D1) supporters strongly believe education is the key solution to effective conservation (s19). They do not think one should work in conservation with money as motivation (s12) or that locals should receive cash to protect natural resources (s6). D1 strongly believes livestock should be completely banned from PNP (s25). "*Domestic animals do not belong with wildlife. They destroy habitat and spread diseases.*" (p11). However, D1 is milder on restricting people's access to PNP. "*Restricting access is not a battle you can win. The locals still have a strong tradition linked to the park and are dependent for food and medicinal plants. Only by using the park's resources, one can understand its value.*" (p6) and also: "*You need flexible rules, otherwise you create aversion.*" (p45).

D1 emphasizes protection of trees by prioritizing scientific research on gallery forests (s38). They think that planting fast-growing fuelwood would be an effective solution to provide for local needs (s18) and that science could help alleviate human-wildlife conflict (s10).

D1 does not think management should be entirely focused on iconic species (s43), but they do think that poaching on Elephants is a serious threat (s31): "*Poaching on lions rarely happens, however, poaching on elephants is a major threat which should be addressed.*" (p21). On pesticides in agriculture (s30), they state: "*The biggest threat to PNP at the moment is pesticides.*" (p6). In terms of the management conflict, D1 finds APN (s5) and AVIGREF (s2) to be equally distrusted by other stakeholders. "*There is a lot of intoxication going on with rumors circulating about APN which is sabotaging them.*" (p25). They emphasize that the management coordination across the WAP-complex is not effective (s42): "*The WAP cooperation does not work. From Burkina Faso, poachers enter Pendjari and escape easily again over the border where we cannot follow them. Burkina can fish, Benin cannot. We need to coordinate better.*" (p22). While D1 does not prioritize the bad salary by APN as much as D2, they say: "*There are many complaints about the APN salary and tough work circumstances of the rangers. They do not have shelter from the rain, nor medicine, nor good food.*

A lot of rangers get sick." (p40). D1 rates the ecological dimension of conservation to be more important than the socio-economic side (s37).

3.2.3. Discourse 2: conservation for human's use

Discourse 2 supports conservation n function of human benefit. They want access to the park for water for livestock, food, medicinal plants and religious purposes. They disagree with agroforestry since they fear decreased harvests, and rather than environmental education, they want concrete, economically viable solutions.

Discourse 2 (D2) prioritizes financial issues, by saying there is a lack of international aid (s29): "*International aid money has been disappearing higher up before it even reaches us.*" (p7) and that locals are not equally sharing in benefits of tourism or trophy hunting (s8, s7): "*Why can white people have trophy hunts, but we locals cannot enter for food?*" (p13). They do not think passion for nature is more important than money as a motivation (s12) and they emphasize that the park staff are badly paid (s11). D2 strongly expresses how other stakeholders distrust APN: "*The moment APN took our grounds and access away, they also took our trust in them.*" (p32), while they say AVIGREF is better trusted (s5, s2). "*The worst AVIGREF can do is take money away from us. But APN is dangerous, they do not listen and can kill us.*" (p31).

D2 strongly disagrees to ban all livestock from the park (s25), making this the subject where both discourses differ the most: "*We have not yet seen any alternatives for watering our cattle, despite all the promises. But we have been thrown out of the park already.*" (p44). They also are not agreeing to limit access for locals (s22): "*We need medicinal plants and we need to feed the fetish [traditional Voodoo spirit represented by a natural element], otherwise the park will die.*" (p13). D2 says that the school trips into the park with children are one of the reasons they support the existence of PNP (s10). Poaching is not seen as a major problem (s31, s32, s33) and D2 does not agree with the security measures APN has taken to protect wildlife.

Education is deemed important but not in touch with reality as it does not provide viable solutions (s19): "*Education only speaks of human impact on the environment, but it does not bring concrete solutions for the locals.*" (p38). D2 strongly disagrees that agroforestry is a viable solution (s17, s16): "*Agroforestry would not work here due to our nutrient-poor soil. Shade means no harvest.*" (p32). However, they think climate change is not integrated into the current management (s39) and voice their concerns about desertification: "*The desert is knocking on our door. We need to protect the trees even before we protect the animals.*" (p38). At the same time, D2 explains the use of pesticides: "*It is true that pesticides are bad for the environment, but we cannot go without. There are no viable alternatives.*" (p16).

3.3. Explanatory factors of discourses

Participants differ in several demographic and socio-economic factors (Fig. 3). These factors are a means of further describing the discourses, rather than an attempt of extrapolation to the wider population. The importance of formal Western-style education and agricultural activities in differentiating the two discourses is supported by our logistic regression analysis. Membership to discourses was best described by a model that only included education (AICc weight: 0.50, Table 2). In this model, decreased education significantly increased the chance of belonging to discourse 2 (GLZ education effect: Est. = −0.81 ± 0.39,

Table 2
Summary of the logistic regression models. (a) The best model (in bold) is significantly better than the null model where the variable is 1. The pseudo R^2 indicates the percentage of variance explained by the model. The AICc weights indicate the probability that a model is the correct model out of all tested models. Significant models are shown in bold (P < 0.05*) or with a dot (P < 0.1•).

| Logistic regression model	pse. R^2	X^2	df	P	AICc	AICcWt
Education level	**0.16**	**4.85**	**1**	**0.03***	**51.3**	**0.50**
Agriculture	0.10	2.95	1	0.09•	53.2	0.19
Amount of time worked in PNP	0.03	0.86	1	0.36	55.3	0.07
APN + NGO + research	0.03	0.80	1	0.37	55.3	0.07
Member of AVIGREF	0.02	0.44	1	0.50	55.7	0.05
APN + top function AVIGREF + politician	0.01	0.15	1	0.70	56.0	0.05
Member of CENAGREF	0.01	0.14	1	0.70	56.0	0.05
Tourism + teacher	0.02	0.73	2	0.69	57.7	0.02
Age + gender + birthplace	0.07	2.13	3	0.55	58.8	0.01
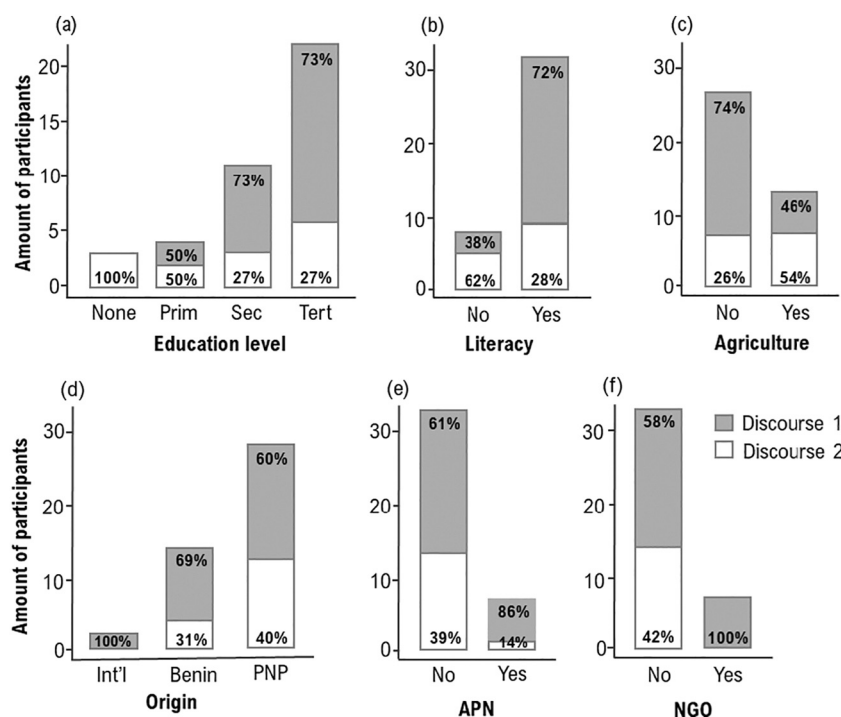
Fig. 3. Distribution of our participants along demographic variables. (a) Highest completed education level being no education (None), primary education (Prim), secondary education (Sec) or tertiary level which includes bachelor, master of PhD level (Tert), (b) literacy records whether our participants were able to read the statements, (c) agriculture indicates whether people were active in cultivating crops or livestock, (d) origin shows whether participants were born and grew up outside of Benin (Int'l), in Benin (Benin), or in the villages around the park (PNP), (e) APN shows whether participants worked for African Parks Network, (f) NGO indicates participants working for other NGO's than APN. Discourse 1 in grey and Discourse 2 in white.

Wald's t = −2.06, P = 0.04). Moreover, the second-best model was based on whether participants were active in agriculture (AICc weight: 0.19). However, this model was not significantly better than the null model at P < 0.05.

4. Discussion

We found two distinct discourses (D), with the largest disagreements around access to natural and financial resources. Supporters of D1 "Conservation for nature's sake" agree with restricting access, planting and protecting more trees, while D2 "Conservation for human's use" wants more access to natural and monetary resources and does not support agroforestry. At the base of this divide, we found western-style education level as statistically significant explanatory factor. The consensus among the Q participants is that conservation conflict is present in PNP and –more- collaborative management and strengthening trust is a high priority. Most participants want income-generating activities such as tourism to be further developed. Environmental education is deemed a solution to promote and integrate conservation within the local communities, as well as involving younger generations.

Eviction of local people out of protected areas has been used as a means to better protect nature, when human activities are deemed unnatural and thus detrimental to the ecosystem (West et al., 2006). However, this has not always resulted in positive conservation results (Brockington and Igoe, 2006). Mutanga et al. (2015) found attitudes towards conservation to be determined by the creation history of parks, with negative connotations linked to forced relocation, fences and fines. With PNPS' non-consensual past (Idrissou et al., 2013), the feeling of historical injustice plays a role in the current attitude of local communities towards APNs management. "*My parents still lived in the center of the park. APN has no right to restrict access to our ancestral lands.*" (p44, D2).

Three of the major threats to PNP are poaching, encroachment and unsustainable agricultural practices (APN, 2019), resulting in lower wildlife populations than the carrying capacity (Sinsin et al., 2002). To counteract these threats, APN has installed law enforcement cells with 100 rangers who received military training and weapons (APN, 2019). This falls under what Duffy et al. (2019) define as "militarization of conservation". Rangers have complained of low salaries, a phenomenon which has been widely reported by Belecky et al. (2019). However, root causes of poaching should be addressed through e.g. poverty alleviation and environmental education, as militarization risks to alienate local communities (Duffy et al., 2019). "*Over 16 local poachers have been severely wounded by APN rangers. Before APN, we imprisoned and re-educated poachers. Now, they are hunted down like wildlife.*" (p31, D2).

In conservation conflict situations with illegal resource use, researchers often make enforcement-based recommendations, however, in a context of agricultural expansion or active protest against conservation, stakeholder-based interventions are recommended (Baynham-Herd et al., 2018). To generate attitudinal change and make stakeholder engagement successful, it is important to apply the International Human Rights principle of Free Prior and Informed consent (Barelli, 2012), to include stakeholders' values into decision-making, to increase different forms of trust (Stern and Coleman, 2015) and to make decision-making transparent (Sterling et al., 2017). "*APN comes and explains their decisions to us after they are taken. But they should first consult the Wise Men and Village Chiefs and listen to them.*" (p32, D2). Trust, a critical slow variable in social-ecological systems (Ostrom, 2009), can increase by fair participation and makes conflict resolution more likely (Young et al., 2016). PAs with a management focusing on participation with locals and maintains cultural and livelihood benefits are more likely to have both positive socio-economic and conservation outcomes (Oldekop et al., 2016). "*First, we need trust between APN and locals, only then environmental education and the current management will be accepted. We don't need empty reports and pretty pictures.*" (p22, D1).

To reduce human encroachment, poaching and human-wildlife conflict, APN has reduced the size of the Zone of Controlled Occupancy, built a fence and reduced the harvest of natural resources such as non-timber forest products. This has been effective as more wildlife has been spotted in the newly protected southern area of the PNP (APN, 2019). However, locals have ranked agriculture and water as the most important ecosystem services (own team's research, 2018) and do perceive the loss of extractive access as an important limitation to their livelihood opportunities (Goad, 2019). "*APN took our land. We do not have enough for agriculture anymore.*" (p18, D1).

Poor people have so far been hit the hardest by the consequences of biodiversity loss and climate change (Roe et al., 2019). As a means of poverty alleviation and revenue generation, APN focuses since 2017 on the development of international tourism. This is a successful strategy in southern and southeastern Africa (Bauer et al., 2021). However, growing regional insecurity (e.g. two French tourists kidnapped in PNP by jihadi extremists, Euronews, 2019; growing influence of Boko Haram and retrieving of western military forces, Trémolières et al., 2021) and the reduced international travel opportunities because of the COVID-19 pandemic hurt the opportunities of APN to draw international crowds.

Vodouhê et al. (2010) investigated perceptions of PNPs' previous collaborative management and found management assessment, education level and birth place of participants to be the main underlying drivers. The higher the education level, the more positive the perception towards the PNP, which is consistent with our results. However, birth place was not significant for us. We did not measure income, household size or religion which are brought up by Mutanga et al. (2015) as drivers determining attitudes towards PAs.

Q methodology has several beneficial features for understanding perceptions in conservation and can be used for conflict mitigation or stakeholder analysis (Mukherjee et al., 2018). However, it is a cognitively challenging and lengthy process which requires much patience from both interviewer and interviewee. Interviewer bias due to linguistic, cultural and gender differences between interviewer and respondent is important to consider (MacKenzie, 2016). In the context of African Biosphere Reserves, we suggest Q would be better combined with a survey or nominal group technique (Hugé and Mukherjee, 2018) to reach a wider public of lesser educated stakeholders and to consume less time. This way, new information which might have been overlooked while making the Q-set can still be uncovered. We also want to emphasize that these results merely represent one moment in time. Much might have changed in the APN management strategy and/or how it is perceived, which is why we suggest further research to repeat a Q every 1–2 years to record the shifting discourses.

5. Conclusion

In this study, we used Q methodology to map discourses after the management shift in 2017 from state-led collaborative management to a public-private partnership in the Pendjari National Park (PNP), Benin. We identified two distinct discourses, however with consensus on some issues. All participants agree that there is conservation conflict in PNP and that more trust is needed between the stakeholders. Discourses disagree strongest about the restriction of access to natural and financial resources. The level of education of the participants is the most probable explanatory factor for this division. Although Q methodology can be a lengthy and cognitively challenging process, it can be a useful tool in the context of conservation research to map discourses and understand stakeholder perceptions. By addressing current conservation conflicts in PNP, future management can be more effective and sustainable.

CRediT authorship contribution statement

Iliana Janssens: Conceptualization; Data curation; Formal analysis; Methodology; Visualization; Writing- original draft; Writing – Review & editing

Luc Janssens de Bisthoven: Project administration; Writing – review & editing

Anne-Julie Rochette: Project administration; Writing – review & editing

Romain Glèlè Kakaï: Methodology; Writing – review & editing

Farid Dahdouh-Guebas: Funding acquisition; Project administration; Writing – review & editing

Jean Hugé: Conceptualization; Methodology; Supervision; Validation; Writing – Review & editing.

Declaration of competing interest

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

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Appendix A. Exploration of the Q-sessions and P-set

A.1. The Q-sessions

Before the selection, we explored all 53 conducted Q-sessions. The Q-sessions lasted between 20 to 180 min with an average of 65 min. The average time of the Q-session seems to go down the higher the education level is (mean time ± standard deviation (sd) in minutes for i) no education: 72 (±16), ii) primary education: 74 (±18), iii) secondary education: 63 (±22), iv) tertiary education: 64 (±36)). However, when tested with a Pearson's correlation, this is not significant ($r = -0.59$, df $= 50$, P $= 0.55$).

We looked at the understanding of the participants of i) the rules of the game (how to sort and prioritize the statements with only a limited amount of spaces per category) and ii) the content of the statements. When we had to explain the rules or statements more than twice, the participant was ranked as bad. 30% (n $= 16$) of the participants understood both the rules and the content badly. Their mean interview time ±sd in minutes was 73 (±18). 53% (n $= 28$) of the participants understood both the rules and the content good. Their mean interview time (±sd) in minutes was 64 (±33). However, with Welch's two-sample t-test this was not significant (t $= 1.1$, df $= 42$, P $= 0.26$).

We explored the link between the understanding and literacy. Literacy changes the Q-session experience for the participant, as the statements have to be read-aloud to them. We saw that of those who understood both the rules and content well, the majority can read (literate: n $= 27$, illiterate: n $= 1$), while the majority of those who did not understand rules and content, was not able to read (literate: n $= 6$, illiterate: n $= 10$). This indicates that the Q methodology is quite a difficult process for people who cannot read.

During the Q-sessions, we took note of the level of impatience of the participants, based on whether they negatively commented on the time the Q-session took and their unwillingness to reread and change their initial Q-sort. Those who were not impatient at all (n $= 31$) have a mean interview time ±sd in minutes of 70 (±32), while those with a lot of impatience (n $= 8$) have a mean of 43 (±13) min. Welch's two-sample t-test shows impatience and amount of minutes are significantly negatively correlated (t $= 2.4$, df $= 33$, P $= **0.023**$).

A.2. The P-set (participants)

We selected 40 well-performing participants for our analysis. The participants are between 21 and 58 years old, with a mean age ±sd of 42 (±10). 93% is male (n $= 37$) and 7% is female (n $= 3$). 20% (n $= 8$) is illiterate, their interviews were conducted with a translator.

Education level varied among the participants: 8% (n $= 3$) did not have any education, 10% (n $= 4$) finished primary education, 27% (n $= 11$) finished secondary education and 55% (n $= 22$) finished tertiary education which includes a bachelor, master or doctoral study. There is a significant, negative Pearson correlation between education level and age ($r = -3.3$, df $= 50$, P $= **0.0018**$). Those with tertiary education are on average 10 years younger (mean age ±sd: 36 ±9) than those who are do not have tertiary education (mean age ±sd: 46 ±9).

Participants with tertiary education seem to be born further away from the park (median distance ±sd in km: 171 ±1832) than the ones without an education (mean age ±sd: 47 ±8, median distance ±sd in km: 21 ±120). 62% (n $= 25$). However, this is only marginally significantly correlated with Welch's t-test (t $= 2.0$, df $= 25$, P $= **0.055**$). With the Pearson correlation test, we found a significant correlation between education level, agricultural livelihood and conservation livelihood (participants active in APN, other NGO's or research). Education level and conservation are positively correlated ($r = 4.9$, df $= 50$, P $= **9.5 e^{-6}**$), while education level and agriculture are negatively correlated ($r = -6.3$, df $= 50$, P $= **6.7 e^{-8}**$). This indicates those active in conservation have a higher education level, while those active in agriculture have a lower education level.

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