Understanding the conservation challenges of armed conflicts in protected areas: insights from the W–Arly–Pendjari Complex in Benin, Burkina Faso and Niger

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Abstract Armed conflicts in biodiversity hotspots across Africa significantly threaten conservation efforts. The incursion of armed groups since 2017 in the W–Arly–Pendjari Complex in Benin, Niger and Burkina Faso poses a severe threat to conservation efforts in one of West Africa's largest transboundary natural World Heritage sites. Local conservation managers often have no clear strategies to address such threats. A better understanding of the key drivers of the armed conflict would help them to respond quickly and effectively using adaptive management approaches. We used the participative Delphi technique to identify the factors driving the conflict, the key players contributing to security threats in the region and the stakeholders who could contribute to solving the conservation issues linked to the security crisis. A panel of 20 experts identified the main drivers of the insecurity to be political, economic and social, especially the vulnerability and marginalization of local communities as a consequence of weak government control and limited resources. Violent extremist groups, particularly Jama'at Nusrat al-Islam wal-Muslimin, pose significant threats to conservation efforts in the region, which our results suggest would be best addressed through military action and regional cooperation to combat terrorism. We recommend that conservation managers adopt a community-focused strategy to reduce the vulnerability of forest-dependent communities and counter local alliances with Jama'at Nusrat al-Islam wal-Muslimin. Our findings contribute to a wider understanding of how the growing threat of violent extremist groups can negatively affect protected areas and what steps should be taken to counter this.

Keywords Armed conflict, biodiversity, communities, Delphi technique, insecurity, transboundary cooperation, W–Arly–Pendjari Complex, West Africa

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Introduction

Over the past 50 years, the average size of wildlife populations monitored worldwide has declined by 73% (WWF, 2024). In response to this alarming trend, the establishment of protected areas is a key strategy to reverse the ongoing loss of biodiversity (Mora & Sale, 2011). Transboundary cooperation is crucial for managing shared resources between countries, including in protected areas (Amahowé et al., 2013). Hammill & Besancon (2003) noted that transboundary protected areas hold different meanings for different groups: for conservationists, they serve as an effective measure to protect biodiversity; for oil and mining companies, they represent an untapped source of revenue; for armed groups, they can be a refuge or strategic target during times of conflict; and for local communities, they are sources of ecosystem services but may also impose restrictions on access to livelihood resources, relocation opportunities, or potential income generated from tourism revenues and other nature-based solutions. These differing perceptions position transboundary protected areas in policy and academic literature as a potential tool or approach for promoting peace and resolving conflict (Conca & Dabelko, 2002; King, 2010). Transboundary protected areas are typically vast landscapes with ecological, social and economic complexities and are perceived as strategically important for security in regions where there is armed conflict. Given these circumstances, designing and implementing sustainable

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conservation strategies in such landscapes is an important challenge for conservationists.

Over 90% of major armed conflicts between 1950 and 2000 occurred within countries with biodiversity hotspots, with > 80% occurring directly in these hotspot areas (Hanson et al., 2009). In Africa, this resulted in significant declines in large mammal populations from 1946 to 2010 (Daskin et al., 2018). Armed groups often exploit natural resources as a primary source of revenue (Dudley et al., 2002) and may encourage local communities to participate in illegal activities such as poaching (de Merode et al., 2007). Furthermore, during periods of conflict funding for conservation is often reduced, leading to the suspension of projects (McNeely, 2003). In 2024, armed conflicts continued to be the primary reason that World Heritage sites listed for their natural value appeared on the List of World Heritage in Danger (UNESCO, 2026), and these conflicts also threaten new transboundary protected areas such as the W–Arly–Pendjari Complex in Benin, Burkina Faso and Niger, West Africa (Lhoest et al., 2022; Houehounha et al., 2024).

Since 2022 some components of the W–Arly–Pendjari Complex ecosystem have been considered military zones because of constant security incidents and the lack of conservation management. Furthermore, in 2023 Niger, Burkina Faso and Mali formed the Alliance of Sahel States after leaving the Economic Community of West African States (ECOWAS). This departure from ECOWAS led to socio-political conflicts between these countries and their neighbours as well as security challenges that have disrupted conservation efforts in the Niger and Burkina Faso components of the W–Arly–Pendjari Complex.

The effects of armed conflict on protected areas in West Africa include the mining of diamonds, commonly referred to as blood diamonds because they are mined in war zones and then sold to finance war efforts (Richards, 2001; van Solinge, 2008; Grant, 2010), timber extraction (van Solinge, 2008) and a rise in poaching activities (Daskin & Pringle, 2018; Abatan & Assanvo, 2023). Violent extremist groups, often called non-state actors or rebel organizations, have diverse motivations for their actions, such as land rights, religious beliefs, ethnicity or politics. They use various methods to further their aims, including kidnapping for ransom, terrorism and bombings (Lhoest et al., 2022). Few studies have addressed the impacts of these activities on the conservation of protected areas (Lhoest et al., 2022; Eizenga & Gnanguênon, 2024). In this context, the W–Arly–Pendjari Complex offers an opportunity to examine the ongoing security issues associated with violent extremist groups and their impacts on conservation efforts.

Here we explore how conservation managers can address these challenges at a practical level. We used the participative Delphi technique to engage with experts, with the aim of, firstly, improving our understanding of the continuing armed conflict affecting the W–Arly–Pendjari Complex and, secondly, to propose potential solutions for redressing the negative impacts. This research highlights the importance of understanding the factors contributing to armed conflicts that affect biodiversity conservation, particularly where violent extremist groups are involved, to support development of tailored and realistic solutions.

Study area

The transboundary W–Arly–Pendjari Complex is the largest protected area in the West African savannah and woodland biogeographical province. It consists of the most significant continuum of terrestrial, semi-aquatic and aquatic ecosystems in the West African savannah belt. The Niger component of the protected area, known as W National Park, was added to the World Heritage List in 1996 for its ecological processes (World Heritage List criterion ix) and for its exceptional biodiversity (World Heritage List criterion x; UNESCO, 2025b,c) UNESCO (2022). A transnational extension involving Benin and Burkina Faso was approved in 2017, establishing the W–Arly–Pendjari Complex. It became a UNESCO Biosphere Reserve in 2020.

This transboundary protected area is a connected mosaic of nine protected areas covering 1,714,831 ha. It includes the W Regional Park Tri-National Complex, which comprises the W National Parks of Benin, Burkina Faso and Niger, and the Arly National Park in Burkina Faso, Pendjari National Park in Benin, and hunting areas in Koakrana and Kourtiagou (Burkina Faso) and Konkombri and Mékrou (Benin). In addition, the W–Arly–Pendjari buffer zone encompasses a further 1,332,147 ha (UNESCO, 2025b), including regions with different levels of protection such as hunting reserves, wildlife reserves and legally designated special buffer zones, all established by national laws (Fig. 1).

UNESCO (2022) has reported an increase in violent incidents involving armed groups within the W–Arly–Pendjari Complex since 2017, and the area faces significant ongoing threats from terrorist groups (Lhoest et al., 2022; Eizenga & Gnanguênon, 2024). Armed groups pose severe challenges to conservation efforts and local communities (Brottem, 2022; Pellerin, 2022; Abatan & Assanvo, 2023), jeopardizing the site's Outstanding Universal Value, which is defined by its importance as a refuge for threatened wildlife (UNESCO, 2025b). Paragraph 49 of the Operational Guidelines for the Implementation of the World Heritage Convention defines Outstanding Universal Value as a cultural and/or natural significance that is so exceptional that it transcends national boundaries, making it of importance now and in the future (UNESCO, 2025a).

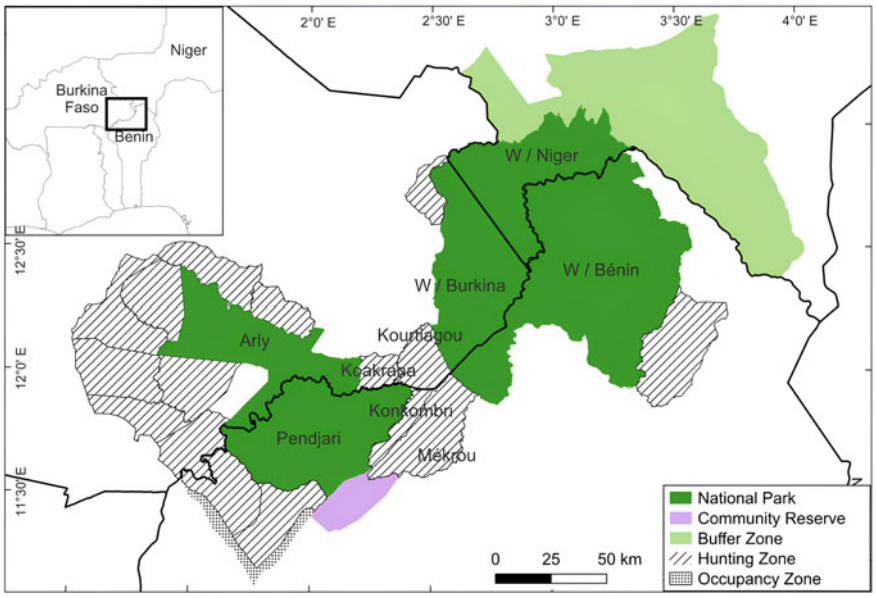

FIG. 1 The W–Arly–Pendjari Complex and its buffer zones in Benin, Burkina Faso and Niger. The transboundary protected area is a connected mosaic of nine protected areas, covering a total area of 1,714,831 ha across the three countries.

In 2020, UNESCO recommended adding the W–Arly–Pendjari Complex site to the List of World Heritage in Danger because of growing security issues and a complete lack of formal management of the Arly and W Regional components in Burkina Faso. The three concerned States Parties (countries that adhere to the World Heritage Convention; Benin, Burkina Faso, Niger) have requested additional time to re-establish effective control over the entire area of the Complex. A new State of Conservation report was provided to UNESCO on 1 February 2025 for examination by the World Heritage Committee at its 47th session in July 2025. This report addresses the urgent conservation needs of the site, which required a broad mobilization of resources to preserve its Outstanding Universal Value, including the potential for inclusion on the List of World Heritage in Danger. In July 2025, the World Heritage Committee adopted Decision 47 COM 7B.42, deploring the continuing insecurity, marked by the presence of armed groups and further loss of life among the Benin Defence and Security Forces and African Parks rangers following attacks in 2024 and January 2025. The Decision further noted that the 2024 aerial inventory, based on 2019 methodology and carried out exclusively in Benin, shows increases in the populations of African savannah elephant *Loxodonta africana*, African buffalo *Syncerus caffer* and hartebeest *Alcelaphus buselaphus*, but decreases in topi *Damaliscus lunatus korrigum* and roan antelope *Hippotragus equinus*, as well as a significant presence of domestic livestock. The Decision requested that the State Parties submit to the World Heritage Centre, by 1 February 2026, an updated report on the state of conservation for examination by the World Heritage Committee at its 48th session in June/July 2026.

Methods

The Delphi Technique

The Delphi technique is a method of gathering and assessing expert knowledge (Mukherjee et al., 2015). It can be used to structure group communication processes effectively, enabling a number of individuals to address complex problems collectively (Hugé et al., 2010). It involves multiple rounds of questions, allowing experts to provide their insights anonymously. The technique is commonly used in research, including in conservation management, and is suitable for assessing the threats posed by emerging terrorist groups to the conservation of protected areas in West Africa (Mukherjee et al., 2015; Ratsimbazafy et al., 2019). It entails a structured and iterative survey of participants designed to generate unbiased opinions and convert expert perspectives into one or more collective notions through feedback (Benitez-Capistros et al., 2014). Upon completing the first round of the survey, each participant receives anonymized feedback on the group's responses. They then re-evaluate and resubmit their survey forms, allowing them to potentially adjust their opinions based on the insights shared by others. This process may be repeated over several rounds, to reach a consensus.

We chose the Delphi technique because we were able to identify knowledgeable experts and they were not required to meet physically. Nevertheless, Delphi still enables intersubjectivity because all respondents are exposed to the anonymized responses of their peers during the inter-round feedback (Mukherjee et al., 2015). The aim was to gather information on all three components (Benin, Burkina Faso and Niger) of the W–Arly–Pendjari Complex while minimizing negative group biases, as highlighted by

TABLE 1 Selection and contribution of the 20 participants in the Delphi study. Experts were drawn from amongst contributors to the UNESCO 2025 State of Conservation report on the W–Arly–Pendjari Complex (Fig. 1) with at least 10 years' involvement in conservation and representing a range of organizations and knowledge.

Category	Invited	Round 1	Round 2
Government (protected area management authorities)	6	6	5
Scientists/academics	4	4	4
NGOs	4	4	4
Technical & financial partners	6	6	6
Total	20	20	19

Ratsimbazafy et al. (2019). We used the online *KoboCollect* application (KoboToolbox, 2024), to overcome the limitations of paper-based surveys.

Data collection

Selection and identification of respondents

Delphi is an expertise-based technique yet defining expertise is challenging because it is context-dependent (Burgman et al., 2011). For this research, we considered an expert a person who has been involved for at least the pervious 10 years in the conservation activities of the W–Arly–Pendjari Complex nationally or regionally and who was known to have information or access to information concerning the conservation impact of armed conflict in the relevant protected areas. We assessed expertise by reviewing the list of people who contributed to the State of Conservation reports of the W–Arly–Pendjari Complex submitted to UNESCO since the security crisis arose in 2017. Twenty experts from governmental bodies (mainly protected area management authorities), non-governmental organizations, universities, research institutions and technical and financial institutions were identified and invited to participate in the Delphi study and all agreed to take part.

Preparation and distribution of the questionnaires

In this study, the Delphi method consisted of two rounds of consultation using an online questionnaire. We used the same structure in both rounds for the same group of respondents. The questionnaire was based on four UNESCO World Heritage Committee decisions adopted during 2017–2024 following the first armed incursions in the W–Arly–Pendjari Complex, and field data collected in the Benin components of the W–Arly–Pendjari Complex (Pendjari and W National Parks) during December 2023–January 2024. The study examined the impact of the security threats on the conservation of species that exemplify the Outstanding Universal Value of the Pendjari and W National Parks in Benin.

The Round 1 questionnaire included 15 multiple-choice questions (Supplementary Material 1). The questionnaire for the second round (Supplementary Material 2) contained 14 multiple-choice questions, based on the responses provided in the first round (a complete answer was obtained to question 6 in Round 1). Questions 1, 7 and 11 required a single-choice answer in Round 2, to complement the answers obtained in Round 1.

Each of the two rounds contained two sections. Section I (questions 1–9) focused on our first objective, which was to understand the ongoing armed conflict affecting the W–Arly–Pendjari Complex. It examined the actors believed to play either a positive or negative role in the conservation of the Complex, the drivers of the conflict and the reasons behind the ongoing insecurity in the area. Section II (questions 10–15) focused on our second objective, which was to provide possible solutions for resolving the challenges of the armed conflict affecting the W–Arly–Pendjari Complex.

We distributed the Round 1 questionnaire to the 20 experts in January 2024 (Table 1) and summarized the results in a report in July 2024 (Supplementary Material 2). We removed questions where there was consensus amongst at least 75% of respondents in the first round and sent a revised questionnaire to participants by email in July 2024 for the second round, accompanied by the report detailing the results of the first round. We sent three reminders to encourage participation during August–September 2024, resulting in 19 responses out of 20 by late September 2024. It took c. 9 months from distributing the first questionnaire in Round 1 to completion of Round 2, together with preparation of the reports.

Data analysis

The data collected in Round 1 were primarily used to refine the questions for Round 2. We calculated descriptive statistics to assess response frequencies and indicate how often each response occurred, with results presented in per cent. We measured consensus using mean ratings and a threshold of at least 75% of the respondents in agreement. We took each Round 1 question in turn and calculated whether the 75% agreement threshold was reached, removing it from the Round 2 questionnaire if there was consensus. Following von der Gracht's (2012) criteria, stability of response

TABLE 2 Per cent of respondents selecting the top three actors believed to play a positive role in conservation efforts in the W–Arly–Pendjari Complex in Rounds 1 (20 respondents) and 2 (19 respondents) of the Delphi study.

Actor	Round 1 (%)	Round 2 (%)	Round 2–Round 1 (%)
International organizations & donors	70	95	+25
Government institutions & authorities	50	84	+34
Civil society organizations & conservation NGOs	35	84	+49

was assessed by examining the per cent change between rounds, with a change of $\leq 15\%$ considered stable. It was not possible to measure stability for those questions that achieved 75% consensus in Round 1.

Results

All 20 participants submitted responses in the first round, and 19 participants responded in the second round (Table 1). Summaries of the Round 1 and Round 2 responses are provided in Supplementary Material 2 and 3, respectively.

Key aspects and drivers of the security issues

In their responses to the first question in Round 1, the 20 participants identified their two main contributions to the conservation of the W–Arly–Pendjari Complex as the protection and management of protected areas and the promotion of community development around these areas (n = 16, 80% consensus). For question 2 in Round 1, the respondents initially identified the top three actors playing a positive role in the conservation efforts of the W–Arly–Pendjari Complex as government institutions and authorities (14, 70%), followed by civil society organizations and conservation NGOs (10, 50%) and local communities (7, 35%). International organizations and donors were ranked fourth (5, 25%). During Round 2, when the 19 respondents reconsidered the question in the context of the views of other participants, the contribution made by international organizations and donors was ranked highest by 18 respondents (95%), followed by government institutions and authorities together with civil society organizations and conservation NGOs ranked equally (16, 84%).This represents a significant increase from Round 1 to Round 2 in the number of experts ranking international organizations and donors as the most important actors having a positive impact (Table 2) and a reduction in the perceived contribution of local communities (4, 21%).

In response to question 3 asking participants to identify the three main actors having a negative impact on conservation efforts, by Round 2 there was unanimous agreement amongst all respondents that violent extremist groups and illegal users of natural resources were undermining conservation efforts to the greatest extent (100% consensus). Illegal users of natural resources are individuals who exploit natural resources for commercial or subsistence purposes in violation of regulations (Gavin et al., 2010).

Thirteen negative actions affecting the conservation of biodiversity in the W–Arly–Pendjari Complex were highlighted in Round 1 in response to question 4, with poaching identified most frequently (6, 30%). This reduced to 10 actions in Round 2 with only extreme violence (17, 89%) reaching the consensus threshold of 75%, followed by poaching (13, 68%).

In response to question 5, most participants in our study perceived that the primary reason for the ongoing armed conflict in the W–Arly–Pendjari Complex was weakness at the level of the State and the lack of resources to maintain territorial integrity. Consensus amongst participants increased from Round 1 (8, 40%) to Round 2 (16, 84%).

Question 6 focused on identifying the main armed groups threatening security in the W–Arly–Pendjari Complex. This was accomplished in Round 1 with participants identifying the two main terrorist group coalitions operating in West Africa, and Jama'at Nusrat al-Islam wal-Muslimin specifically in the W–Arly–Pendjari Complex (Table 3). When participants first considered the leading causes of the security issues threatening the protected areas (question 7) in Round 1, they identified political and economic drivers (15, 75%); however, in Round 2, most respondents identified social issues (15, 79%) as the most influential factor.

Question 8 suggested a range of wider problems that are currently neglected in the W–Arly–Pendjari Complex and asked respondents to nominate their top three. Views varied but the exploitation of natural resources (food and materials) by terrorists was identified as important by the majority of respondents (63%). This was explored further in question 9, with more specific issues included in Round 2. Both the fraudulent exploitation of resources and the use of parks by terrorists as a refuge approached the 75% consensus threshold (14, 74%).

Potential ways of resolving the armed conflict

Section II of the questionnaire focused on ways in which the armed conflicts could be resolved. The responses to this general issue (question 10) differed between Rounds 1 and 2, with a majority of respondents (16, 84%) agreeing in

TABLE 3 The per cent of respondents selecting the top two armed groups active in the W–Arly–Pendjari Complex in Round 1 of the Delphi study.

Main armed groups	Pendjari National Park, Benin (%)	W National Park, Benin (%)	Arly National Park, Burkina Faso (%)	W National Park, Burkina Faso (%)	W National Park, Niger (%)	Buffer and transition zones (%)
Jama'at Nusrat al-Islam wal-Muslimin	85	90	80	85	85	85
Daesh	20	25	15	25	25	20
Others	10	15	15	10	10	10

Round 2 that large-scale military action was needed to impose security. With respect to ongoing conservation efforts (question 11), more respondents felt that these should continue despite the armed conflict, a view that was strengthened in Round 2 but did not exceed the consensus threshold.

Questions 12, 13 and 14 focused on the recommended timing of actions to mitigate the impact of the armed conflict on the W–Arly–Pendjari Complex. Priorities changed in the context of the views of other participants, with most respondents (16, 84%) in Round 2 identifying the need to prioritize the securing of border areas in the short term by strengthening and increasing the number of security personnel and coordinating their efforts. There was > 75% consensus (15, 79%) that it was also a priority to reach agreement amongst the various neighbouring countries (Benin, Togo, Burkina Faso and Niger) to work together to eradicate attacks by violent extremist groups within protected areas and their surroundings. The same two actions were selected as medium-term priority interventions (15, 79%).

We did not find > 75% consensus amongst the responses to questions 11, 14 and 15 in Section II, although there was broad agreement. In terms of when to take action, 13 respondents (68%) believed it was not necessary to wait for the resolution of the armed conflict before increasing conservation efforts in the W–Arly–Pendjari Complex. There was consensus amongst 14 respondents (74%) that the long-term priority actions (> 10 years; question 14) necessary to mitigate the impacts of armed conflict on the W–Arly–Pendjari Complex were the promotion of the socio-economic development of local communities and adequate resourcing of conservation activities. Finally, in response to question 15 there was agreement amongst 13 respondents (68%) that they (or their organizations) should make their expertise available to the countries involved as part of the process of addressing the armed conflict affecting the W–Arly–Pendjari Complex.

Table 4 summarizes the key responses in Rounds 1 and 2, indicating whether there was consensus amongst the respondents at the 75% threshold. Table 4 also shows the change in responses between the two rounds, and the stability from Round 1 to Round 2.

Discussion

The high response rates to the two Delphi rounds (100% in Round 1, 95% in Round 2) are consistent with the participation rates documented by Veugelers et al. (2020) and higher than the average response rate in some Delphi studies (Mukherjee et al., 2015). Furthermore, consensus at the 75% threshold was achieved for 10 of the questions (67%), reflecting agreement amongst participants on key issues.

Participants identified extremist violence as the primary threat to the conservation of the transboundary landscape, with Jama'at Nusrat al-Islam wal-Muslimin being recognized as the leading violent extremist group operating within the W–Arly–Pendjari Complex. Similarly, Lhoest et al. (2022) indicated that 62% of the W–Arly–Pendjari Complex is controlled by violent extremist groups, and Afriyie (2024) identified Jama'at Nusrat al-Islam wal-Muslimin as responsible for > 64% of all violent incidents in the Sahel region since 2017. Additionally, Sampaio et al. (2023) noted that Islamic State Sahel Province (Daesh) operates in the W–Arly–Pendjari Complex, although to a lesser extent. Jama'at Nusrat al-Islam wal-Muslimin and Daesh initially collaborated by capitalizing on the history of community tensions and conflicts surrounding the W–Arly–Pendjari Complex, but by late 2019 and throughout 2020, frequent armed clashes for power were taking place between the two groups, which further complicated the situation (Sampaio et al., 2023).

Our study also reveals that although the security crisis has shattered the coordinated management of the W–Arly–Pendjari ecosystem, the primary objective of the three countries (Benin, Burkina Faso and Niger), supported by international organizations and donors, remains the same: to preserve the biodiversity of the W–Arly–Pendjari Complex while strengthening the resilience of local communities. Our questionnaire respondents stated that countries should prioritize an agreement to secure borders through coordinated efforts. Eizenga & Gnanguênon (2024) also advocated the improvement of access to social services, promotion of income-generating activities and fostering trust among security forces and with the local communities, and noted that although the persistent and

TABLE 4 Summary of the key responses in the two rounds of the Delphi study, indicating the per cent of respondents who selected the top option(s) for each question in Rounds 1 (20 respondents) and 2 (19 respondents) and whether this value was > 75%, the threshold for consensus. Questions that achieved > 75% consensus in Round 1 were not included in Round 2 of the questionnaire. Variation is the change in the per cent of respondents selecting the option between Rounds 1 and 2, having reviewed the report summarizing the results of the first round. Stability is a measure of the per cent change in responses between the two rounds. Variation and stability are not indicated where consensus was not achieved after Round 2, as this was not analysed further. See Supplementary Material 1 for the full questionnaire.

	Round 1		Round 2			
Question	%	Consensus	%	Consensus	Variation (Round 2–Round 1) (%)	Stability < 15%
Q1 What are the main efforts deployed for the W–Arly–Pendjari Complex conservation?						
R1.1 Protection and management of protected areas	80	Yes				
R1.2 Promotion of community development around protected areas	80	Yes				
Q2 Who are the key actors playing a positive role in the conservation of the W–Arly–Pendjari Complex?						
R2.1 International organizations and donors	70	No	95	Yes	+25	No
R2.2 Government institutions and authorities	50	No	84	Yes	+34	No
R2.3 Civil society organizations and conservation NGOs	35	No	84	Yes	+49	No
Q3 Who are the key actors playing a negative role for the conservation of the W–Arly–Pendjari Complex?						
R3.1 Armed groups	50	No	100	Yes	+50	No
R3.2 Natural resource exploiters	50	No	100	Yes	+50	No
Q4 What are the main threats to the W–Arly–Pendjari Complex conservation?						
R4.1 Extreme violence	5	No	90	Yes	+85	No
Q5 What are the reasons for the persistence of armed conflicts in the W–Arly–Pendjari Complex?						
R5.1 Weakness of States and the lack of resources for territorial control	40	No	84	Yes	+44	No
Q6 What are the main armed groups active in the W–Arly–Pendjari Complex?						
R6.1 Jama'at Nusrat al-Islam wal-Muslimin (JNIM)	85	Yes				
Q7 What are the main drivers of the insecurity threatening the W–Arly–Pendjari Complex?						
R7.1 Political	75	Yes				
R7.2 Economic	75	Yes				
R7.3 Social	60	No	79	Yes	+19	No
Q8 What are the major problems for the conservation of the W–Arly–Pendjari Complex that no one is addressing?						
R8.1 Social injustice	15	No	37	No		
R8.2 Lack of decent jobs for the local communities and young people	15	No	53	No		
R8.3 Sources of food and war material for terrorists	10	No	63	No		
Q9 What are the primary uses of the W–Arly–Pendjari Complex in the armed conflict?						
R9.1 Use of parks by terrorists as a refuge	20	No	74	No		
R9.2 Illicit trafficking of natural resources	10	No	74	No		
Q10 What does the resolution of armed conflicts in the W–Arly–Pendjari Complex mean to the experts?						
R10.1 Resumption of conservation activities in the W–Arly–Pendjari Complex	50	No	26	No		
R10.2 Large-scale military actions to ensure security	10	No	84	Yes	+74	No
R10.3 Promotion of local communities' socio-economic development	5	No	63	No		
Q11 Should we wait for the conflicts affecting the W–Arly–Pendjari Complex be resolved before improving conservation efforts?						
R11.1 Yes	40	No	32	No		
R11.2 No	55	No	68	No		
R.11.3 No response	5	No		No		

(*Continued*)

Table 4 (*Continued*)

Question	Round 1 %	Round 1 Consensus	Round 2 %	Round 2 Consensus	Variation (Round 2–Round 1) (%)	Stability < 15%
Q12 What are the priority actions to be implemented in the short term (less than 5 years) to mitigate the impact of the armed conflict on the W–Arly–Pendjari Complex?						
R.12.1 Awareness raising and strengthening community livelihoods	50	No	21	No		
R.12.2 Security of the border areas by coordinating efforts and strengthening the security system	35	No	84	Yes	+49	No
R.12.3 Establishment of agreement among neighbouring countries (Benin, Togo, Burkina Faso and Niger) to work together to eradicate extreme violence	20	No	79	Yes	+59	No
Q13 What are the priority actions to be implemented in the medium term (6 to 9 years) to mitigate the impact of the armed conflict on the W–Arly–Pendjari Complex?						
R.13.1 Awareness raising and strengthening community livelihoods	40	No	68	No		
R.13.2 Security of the border areas by coordinating efforts and strengthening the security system	15	No	79	Yes	+64	No
R.13.3 Establishment of agreement among neighboring countries (Benin, Togo, Burkina Faso and Niger) to work together to eradicate extreme violence	10	No	79	Yes	+69	No
Q14 What are the priority actions to be implemented in the long term (more than 10 years) to mitigate the impact of the armed conflict on the W–Arly–Pendjari Complex?						
R14.1 Promotion of local communities' socio-economic development	5	No	74	No		
R14.2 Funding for conservation and availability of skilled human resources	5	No	74	No		
R14.3 Stronger internal security organization	5	No	63	No		
Q15 What role do you or your organization think you can play in resolving the armed conflict affecting the W–Arly–Pendjari Complex?						
R15.1 Support for the development of income-generating activities for communities and young people	30	No	63	No		
R15.2 Funding projects for sustainable and resilient ecosystems	10	No	63	No		
R15.3 Providing expertise to governments	5	No	68	No		

complex attacks by violent extremist groups hinder the implementation of these strategies, regional security cooperation is vital. The Multinational Joint Task Force is designed to combat violent extremism and stabilize the region, and strengthen security forces and increase the number of security personnel, to eliminate attacks from violent extremist groups (Eizenga & Gnanguênon, 2024). This approach aligns with the African Parks strategy regarding the Benin components of the W–Arly–Pendjari Complex, in which long-term partnerships with the Benin government facilitate synergistic coordination between defence and security forces (for territorial integrity and control) and African Parks (in its conservation role) as a viable solution to managing protected areas and achieving long-term conservation goals at the national level.

This strategy is yielding positive results in Pendjari and W National Parks in Benin, as demonstrated by the latest Integrated Management Effectiveness Tool (IMET) index (Fig. 2) following the assessment of the protected areas of the W–Arly–Pendjari Complex (Houehounha et al., 2024). The IMET Index is the average efficiency across the six elements of the management cycle (management context, planning, inputs, process, outputs and outcomes). This assessment could be extended to the other countries in the Complex to alleviate the effects of the security crisis. However, the strict enforcement of boundaries could disrupt local communities and cause unrest (Lewis, 1996). This

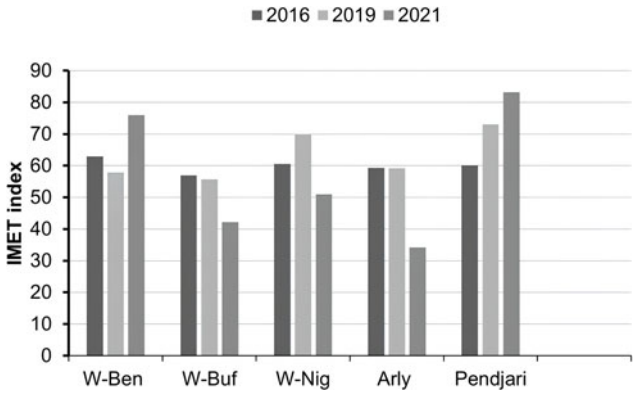

FIG. 2 The IMET (Integrated Management Effectiveness Tool) Index in 2016, 2019 and 2021 for the W–Arly–Pendjari Complex in Benin, Burkina Faso and Niger: W National Parks of Benin (W-Ben), Burkina Faso (W-Buf) and Niger (W-Nig), Arly National Park in Burkina Faso, and Pendjari National Park in Benin.

is evident in the eastern part of the Democratic Republic of the Congo where the local population perceives the Park's management as a form of personalized governance, or state-within-a-state, in an armed conflict zone (Marijnen, 2018). The security crisis can only be addressed effectively through genuine engagement with local communities, which is essential for conserving and managing protected areas (Lhoest et al., 2022). Excluding local communities from environmental protection programmes leads to conflict, rather than fostering opportunities to build peace (Hubert, 2021). In this context, the established W–Arly–Pendjari Complex Executive Secretariat in 2025, as the principal authority, as determined by the council of ministers of the involved countries, and headquartered in Niamey, Niger, will promote the effectiveness of regional efforts and strengthen community engagement in the management of protected areas.

There was no clear consensus amongst our respondents regarding some aspects of the ongoing armed conflict, including the best way to address the long-term challenges posed by security threats. There was also no consensus on whether the armed conflicts should be resolved before redoubling conservation efforts. This contrasts with the views of Lhoest et al. (2022) who emphasized that international support for protected areas must continue during times of conflict and Outstanding Universal Value must be conserved even during conflict. When conservation actions have been suspended whilst conflicts are ongoing, this has resulted in the extinction of species, for example the northern white rhino subspecies *Ceratotherium simum cottoni* in Garamba National Park in the Democratic Republic of the Congo (UNESCO & UICN, 2016). Likewise, during 2002–2007 Côte d'Ivoire experienced a political and military crisis that significantly affected the lion *Panthera leo* population, a key species of Outstanding Universal Value in Comoé National Park. Despite restoring protected area management during 2008–2015, there were no reported sightings of lions when the Park was removed from the List of World Heritage in Danger in 2017 (Houehounha et al., 2024), nor since.

There were also differences in opinion amongst our respondents about other major problems that affect conservation in the W–Arly–Pendjari Complex. Social injustice, a lack of employment for members of the local communities and for young people, and the role of protected areas as sources of food for violent extremist groups were all identified as problems that are currently overlooked, but a consensus was not reached regarding which were of highest priority. As well as a source of food, the W–Arly–Pendjari Complex provides a safe area away from conflict, acts as a logistical base, offers storage space for contraband goods (Eleanor, 2022) and a place of detention for hostages, and allows armed groups to participate in various illicit economic activities.

Finally, we note that although online research methodologies offer significant practical advantages compared to fieldwork in conflict zones (Cole et al., 2013), web-based questionnaires tend to exclude input from local stakeholders and community representatives who lack internet access. In particular, former members of violent extremist groups could contribute valuable insights. Future research could involve these key stakeholders, to clarify the role of armed groups in developing illicit economies and governance strategies. We acknowledge this would pose significant risks to research teams as well as requiring additional financial resources and more time and effort to build a local presence and establish trust. The benefits of sustainable financing of protected areas impacted by security threats also warrants further investigation.

Conclusion

The security situation in the W–Arly–Pendjari Complex remains precarious because of the presence of violent extremist groups. Violent incidents continue to occur within and around the protected areas despite various local, sub-regional and national efforts to restore control. The experts canvassed in our study indicated that the primary drivers of security threats are political, economic and social factors. Politically, the issues stem from repressive and unstable political systems and governance approaches that often marginalize stakeholders, such as the Peulh community in West and Central Africa. Economically, the problem arises from inequalities and opportunities that facilitate illegal trafficking and the illicit exploitation of natural resources. Socially, the marginalization and precarious conditions of local communities contribute to their sense of insecurity, making them vulnerable to the influence of armed groups.

The armed conflict in the W–Arly–Pendjari Complex is undermining conservation efforts and jeopardizing its UNESCO World Heritage status as a site of Outstanding Universal Value. Urgent action and mobilization of resources across Benin, Burkina Faso and Niger are needed to regain control and protect the biodiversity of the region. We recommend that conservation managers adopt an adaptive management strategy and a community-focused approach to reduce the vulnerability of forest-dependent communities and counter local alliances with Jama'at Nusrat al-Islam wal-Muslimin.

Achieving lasting peace will require broad initiatives to enhance community resilience, alongside coordinated military strategies in the short, medium and long term, supported by international and civil society organizations, donors, government institutions, authorities and conservation NGOs. However, the transboundary nature of the W–Arly–Pendjari Complex presents a unique opportunity for different governance systems to coexist within the same landscape such as the State governance in Burkina Faso and Niger and shared governance in Benin. We recommend that future research investigates how the governance structures of the different protected areas can contribute to managing the ongoing security crisis.

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Conflicts of interest None.

Ethical standards This research abided by the *Oryx* guidelines on ethical standards and follows the ethical guidelines of the University of Liège. All participants were informed about the purpose of the study and how the data would be utilized, anonymized and used solely for academic research. All agreed that their responses could be included and each participant received a summary of our findings.

Data availability The data supporting the findings of this study are available within the article and its Supplementary Material. Additional information about the W–Arly–Pendjari Complex in Benin, Burkina Faso and Niger is available from the UNESCO World Heritage Centre.

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