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RESEARCH ARTICLE

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Lessons learned while protecting wild chimpanzees in West Africa

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Abstract

Though human activities are postulated to be the main drivers of the worldwide biodiversity crisis, humans are also suggested by some to be an important part of the solution to the crisis. How can such a paradox be best solved? This paradox requires an adaptive, context-specific, dynamic solution, at a fine-grained scale that varies by location. The Wild Chimpanzee Foundation (WCF) works on the ground in three West African countries: In Côte d'Ivoire, where bushmeat consumption is a recurrent and generalized threat to wildlife, WCF used live theater performances in the villages to address this issue. Post-activity evaluations revealed that the more often individuals have been part of such awareness activities, the less they will consume bushmeat. In nearby Liberia, where illegal miners have invaded many protected areas and intact forests, the WCF supports Community Watch Teams (CWT) to patrol the Sapo National Park with Forestry Development Authority staff. Within 11 months of its creation, the CWT patrols around and in the Sapo National Park resulted in thousands of illegal miners progressively leaving the national park. In Guinea, where coexistence between humans and primates has prevailed based on religious traditions, the WCF developed a strategic approach, as the Moyen-Bafing National Park contains about 5000 chimpanzees as well as some 255 villages. Therefore, we adopted an "integrated landscape approach" whereby the community activities are planned in combination with initiatives increasing forest regeneration and connectivity in high conservation value areas. Communities in northern Guinea confronted with dramatic fluctuations due to climatic changes welcomed such activities that help them become more resilient and adaptable to those alterations. In conclusion, evidence-based information at the local level helps to resolve the conservation paradox by adapting with the local communities' context-specific dynamic approaches to enhance the conservation of great apes.

KEYWORDS

chimpanzee, conservation, evidence-based approach, local communities, West Africa

1 | INTRODUCTION

The current biodiversity crisis is considered to be mainly the result of different human activities that are detrimental to the environment and its fauna. Many studies have documented how some human activities negatively impacted the distribution of species (review in Kablan et al., 2019; Redford & Sanderson, 2000; Robinson & Bennett, 2000), the population size of those species (Heinicke et al., 2019; Wilkie et al., 2011) and the presence of behavioral diversity (Kühl et al., 2019). On the other side, some are claiming that for conservation to be effective it needs to include the local human populations (Schwartzman et al., 2000, 2010). This paradox of including in conservation projects the same people that led to the negative impacts presents a very special challenge and has led to conflicting results (C. Howe et al., 2014; McShane et al., 2011; Suich et al., 2015).

Great apes are very sensitive to human presence (G. Campbell et al., 2008, 2011; Köndgen et al., 2008; Heinicke et al., 2019; Tranquilli et al., 2011); thus, the proposition that conservation works best when we involve humans seem at first more difficult to implement with great apes than it is with other species that are less sensitive to human presence. A recent analysis showed that chimpanzee densities drop dramatically when the forest has been degraded by as little as 8% (Heinicke et al., 2019). However, the success of conservation is not only dependent on the species we want to protect, but also on the socioeconomic context and the density of humans in the area where the populations live.

The worldwide human population expansion has made it impossible for conservation projects to work in areas pristine, and often valuable biodiversity remains despite the presence of human populations. In addition, the consequences of climate change are felt more heavily in areas of the planet where biodiversity is highest, the tropics. Both factors have radically altered the context of conservation projects in recent years. We must not only think about species valued for conservation but need to integrate the larger concept that involves both, social and the even larger climatic changes. This begs for dynamic solutions as those contexts vary extensively with the specific situations, the susceptibility to climate change of the area, and the rainfall alterations.

The Wild Chimpanzee Foundation (WCF) was created in 2000 in the face of the rapid progress of deforestation in West Africa, especially visible to us in the South-West of Côte d'Ivoire during the last 40 years of the Taï chimpanzee project. The WCF started its activities in Côte d'Ivoire by supporting the local authorities to protect the Taï National Park and the nearby chimpanzee populations. However, the chimpanzees faced a rapid decline in the whole region (Kormos & Boesch, 2003), and so the WCF expanded its activities in Liberia, in 2006, where much more forest blocks were remaining than in Côte d'Ivoire, and in 2009 in Guinea, due to the presence of the largest West African chimpanzee populations subject to important pressure from a booming mining sector. In 2016, the West African chimpanzee (*Pan troglodytes verus*) was declared by the IUCN as critically endangered, due to a decrease of over 80% in the last 20 years (Kühl et al., 2017), and this reinforced the motivation of the WCF to work towards protecting remaining chimpanzee populations within national parks.

The WCF, in its effort to improve the survival of chimpanzee populations in West Africa, has been addressing this conservation paradox in different ways. Conservation efforts in West Africa have to be done on the ground where the context varies extensively in terms of the environment, from the rainforest to open woodlands and to dry savanna, or in terms of human population size, density, levels of education, and religious practices that affects their hunting habits (Boesch et al., 2008, Junker et al., 2015), as well as in terms of economic development (Junker et al., 2015). Because of this, the WCF decided to adopt context-specific activities to address some of the most important threats to the chimpanzee populations and their forested environment. This means that depending on the specific context we face, the solutions adopted included different levels of involvement of the local communities and different types of activities.

This will be illustrated in turn for the three West African countries in which the WCF is active; Côte d'Ivoire, when addressing the threat of bushmeat consumption, Liberia, when addressing the threats of illegal mining, and Guinea, when addressing the pressure of desertification to maintain the traditional coexistence of chimpanzees and humans.

2 | ENVIRONMENTAL AWARENESS AND BUSHMEAT CONSUMPTION IN CÔTE D'IVOIRE

In Côte d'Ivoire, forest degradation and hunting pressure were the two main threats faced by wildlife in this economically successful West African country, which is the largest worldwide cocoa producer and the third for coffee. In early 2000, the pristine rainforest was to be found only in Taï National Park (NP) and some neighboring classified forests. The chimpanzee population within the park was estimated to be around 3000 individuals in the early 1980s, it declined to about 300 individuals in late 2010 (N'Goran et al., 2012). As a response to the hunting pressure, the WCF developed an interactive theater play to address the issue of coexistence with chimpanzees with all local communities around the park, as well as a school education program, the Club Pan. At the same time, WCF actively supported the local authorities in implementing a yearly biomonitoring program of Taï NP, supporting the development of two ecotourism projects and implementing activities with the local communities (see www.wildchimps.org).

The Taï National Park, Côte d'Ivoire, is one of the largest protected areas of the Upper Guinean rainforest in West Africa, and as such is famous for its high diversity and large populations of 11 different primate species, including chimpanzees. However, the local populations have a long tradition of consuming bushmeat, as well as selling meat to big cities (Figure 1) (Borchers et al., 2014; Caspary et al., 2001; Refisch & Kone, 2005), resulting in an estimated

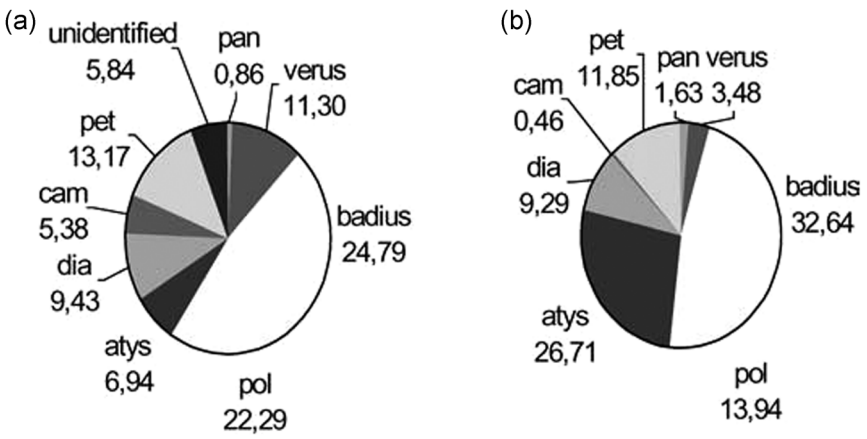

FIGURE 1 Proportion of primates consumed (a) west and (b) east of Taï National Park (from Caspary et al., 2001). Species abbreviations: atys, *Cercocebus torquatus atys*; pol, *Colobus polykomos*; badius, *Procolobus badius*; cam, *Cercopithecus campbelli*; dia, *Cercopithecus diana*; pan, *Pan troglodytes*; pet, *Cercopithecus petaurista*; pol, *Colobus polykomos*; verus, *Colobus verus*

total amount of 974,171 kg of bushmeat consumed per year of which 247,683 kg is primate meat (Table 1 in Refisch & Kone, 2005). Taking into account the proportion of primate meat, that is, chimpanzee (on average 1.24% see Figure 1), it provides an estimate of about 120 chimpanzees eaten per year (taking an average of 25 kg per chimpanzee of all ages killed). We also know that not each chimpanzee shot by a hunter is found, as wounded individuals run away silently, that is, this number is a strong underestimation (possibly up to three to four times more individual chimpanzees are actually shot).

When taking into account the existing wild animal population sizes, many of these species are hunted unsustainably, leading to strongly reduced population sizes and to local extinctions (Table 1).

To tackle the specific issue of bushmeat hunting, the WCF developed a large year-long environmental awareness program. This program included regular live performances of theater plays in the villages (Figure 2), followed by discussion, as well as the implementation of an environmental education program in schools called "Club Pan" (see 2011 to 2015 WCF annual reports at www.wildchimps.org). The theater play "The chimpanzees are our cousins" was started in 2005 by a local professional company "Ymako Teatri," and was later complemented by amateur school teams being trained to play in their local languages. The WCF implemented this program for many years around Taï NP and we added new theater plots over the years to address urgent local issues.

In addition to the theater play, the Club Pan was launched in 2007/2008 with 10 specific lessons in nine schools around the Taï NP, including 1244 participants with 616 pupils from the first year and 667 from the second year of primary school (Borchers et al., 2014). The Club Pan is an extra-scholarly course about the environment and biodiversity taught by teachers having undergone training by the WCF. It was implemented in schools of villages where previously the theater performances had taken place (Boesch et al., 2008, Borchers et al., 2014).

We maintained the Club Pan for several years, and, in 2011, it was active in 12 schools with 754 pupils following the 10 lessons, and a parent day with the participation of about 2800 adults whose knowledge, transmitted by their children, was evaluated.

To evaluate the impact of our environmental education program, we performed a bushmeat study in the villages around Taï NP that have been visited by our program for a varying number of times. We selected people who had seen the program once to up to seven times (Kouassi et al., 2019). Foremost, bushmeat consumption in the rather isolated region on the western side of the Taï NP was strongly influenced by the socioeconomic situation of the households (Figure 3). Poorer and larger families were the most likely to consume bushmeat, that was in the majority of the cases acquired directly from the forest by family members (Kouassi et al., 2019).

Directly relevant to our conservation program, we could show that the more frequently participants took part in such environmental awareness activities, the more they reduced their bushmeat consumption: After participating in the program four times, we saw a 65% reduction in their consumption of bushmeat (Figure 4).

TABLE 1 Impact of hunting on five species of primates in the Taï National Park (adapted from Refisch & Kone, 2005)

Species	Maximal sustainable harvest (Nb/km^2)	Current harvest (Nb/km^2)	Overexploitation (%)
Red colobus	2.6	2.1	88
Black and white colobus	0.9	1.4	156
Sooty mangabey	0.7	1.4	206
Diana monkey	1.4	1.5	106
Mona monkey	0.2	0.8	364

Note: As can be seen, for all species, except the red colobus, hunting pressure is too high on the wild populations, leading to overexploitation and local extinctions.

FIGURE 2 A scene of the play "The chimpanzees are our cousins" in the center of a village; the actors play the scene of a chimpanzee fatally injured by a poacher when the chimpanzee group members gather around the wounded one. As seen in this picture, the theater play could attract big crowds of spectators ranging between 400 to over 2000. The play is performed in the afternoon, and after sunset a film on the chimpanzees is shown to the audience, followed by a question session that could last well into the night

This strong signal shows the potential impact that environmental education can have, leading to important behavioral changes in the participants. However, this effect appears only through repeated exposure to such education campaigns, and it stresses the importance to plan environmental education programs on a long-term basis. Indeed, positive impacts should not be expected after only one exposure.

The final critical question is if these environmental education activities had a positive impact on the forests and the chimpanzees? Many factors, like forest cutting for agriculture, commercial and artisanal logging, artisanal mineral mining, as well as hunting of wildlife for commercial purposes or local consumptions, and disease outbreaks can affect animal population size and forest cover. Furthermore, these factors have an effect on different spatial scales; artisanal mineral mining or forest cutting can lead to total destruction on a small scale, whereas hunting can affect populations over many dozens of kilometers (Köndgen et al., 2008). This makes it very hard to quantify the specific effect of one single factor on animal populations. In the case of the Taï forest, all these negative factors are at work at the same time. The general trend in the last 20 years has been for the forest cover to remain stable within the limits of the Taï NP, though the wildlife has decreased tremendously from 2008 to 2014 leading to local extinction for some species, like the chimpanzees and elephants (Kablan et al., 2019; Tiédoué et al., 2019; WCF, 2016). However, a clear increase of chimpanzees and other fauna densities was observed closer to the chimpanzee research area

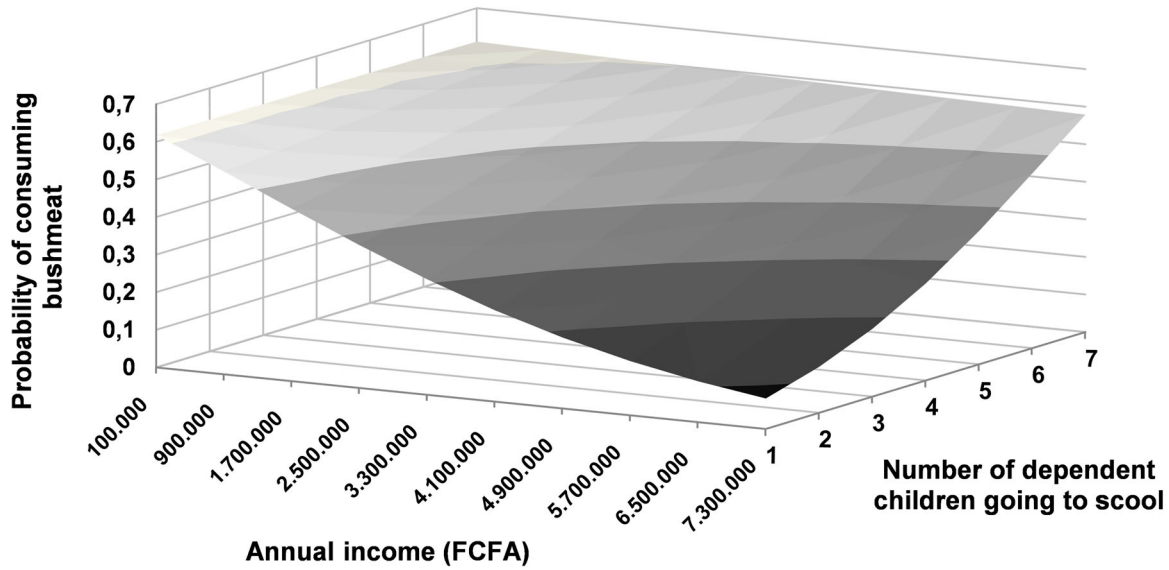

FIGURE 3 Rural households with more children (on the right) and with less income (in the front) were more likely to consume bushmeat (on the left) on the western side of the Taï National Park (after Kouassi et al., 2019)

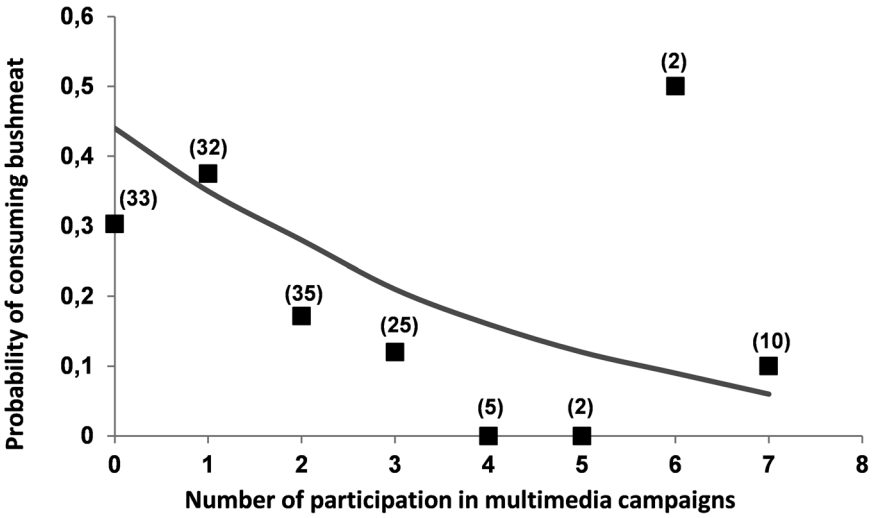

FIGURE 4 Decrease in bushmeat consumption as a function of the number of awareness campaigns individuals have been following (Kouassi et al., 2019). In brackets are provided the number of individuals

as well as to the ecotourist project both located on the western side of the Taï NP (Köndgen et al., 2008). Still, the Office Ivoirien des Parcs et Reserves (OIPR) and partners have remained very active in protecting the Taï NP and in the past 3 years, the situation seemed to have stabilized for some species but time will show if a recovery is taking place (Kablan et al., 2019; Tiédoué et al., 2019). A recent study has confirmed that a need for more frequent active law enforcement would be necessary to lead to an increase in the chimpanzee population (Kablan et al., 2019).

Our work in Taï NP demonstrates that though our human engagement activities were successful at reducing bushmeat consumption, there were other threats in the region also impacting the wild chimpanzee emphasizing the importance of a comprehensive program that can monitor all of the threats in a region.

3 | COMMUNITY WATCH TEAMS TO PROTECT THE SAPO NATIONAL PARK, LIBERIA

Liberia is one of the poorest countries in Africa and its agriculture is less developed than in neighboring Côte d'Ivoire, making it one of the most forested countries in West Africa, with still two-thirds of Liberia's land surface being forested. At the same time, hunting is ubiquitous in the country and the national chimpanzee population was estimated to be of only about 7000 individuals in 2012 (Tweh et al. 2014). WCF worked with the Forest Development Authority (FDA) of Liberia to create the new Grebo-Krahn National Park in 2018. Sadly, illegal mining activities have become widespread in many forests of the country directly threatening the chimpanzees and other fauna. As a response to the illegal mining activities, the WCF developed an ecoguard program with the local communities to document and prevent incursions into protected areas.

Liberia presents vast differences to Côte d'Ivoire affecting the way conservation work can become effective: Liberia has a 50% smaller human density but has a 50% higher forest cover with a three-times lower deforestation rate (www.mongabay.com). Importantly, a number of artisanal miners have been seen entering the forests to search for gold or other minerals (Figure 5). Sapo National Park, the oldest park in the region, has not been spared from this threat (see the summary in Table 2). In 2009, the WCF and FDA did a systematic survey of the chimpanzee and elephant population in the Sapo NP, except for the areas where illegal miners were present. A chimpanzee population of about 1079 individuals was estimated (95% confidence interval = 713–1633 individuals, WCF report to USFWS, 2010). However, no recent data on the chimpanzee population have been published to monitor the situation within the park.

The situation was complicated by the violent political situation prevailing in the country with two civil wars in 1989 and the 2000s, periods during which numerous community members took refuge from the violence within the park, whereas others used the reduced protection of the park to invade it for mining and poaching. The success of the repeated attempts to clear the park of encroachments were all short-lived, partly due to the lack of permanent presence of protective actions in the area and the lack of involvement of the local communities. As can be seen in Table 2, the situation repeated itself over the years until, during the Greenville Conference in 2017, all stakeholders were able to reach a unanimous agreement in favor of enhanced protection.

During the Greenville Conference in 2017, it appeared that communities living around Sapo NP actually wanted the same outcomes as FDA and partners: They want to protect the Sapo NP. They were angry because they felt that their ancestors had been able to preserve the forest for hundreds/thousands of years, but the protection was weak and the forest was being destroyed since the government/FDA had taken over. Therefore, during the Greenville Conference, they requested to actively participate in the protection of the park.

Following the conference, in October 2017, FDA and partners developed the terms of reference for the Community Watch Teams (CWT), and within weeks, panels comprising town chiefs, women

FIGURE 5 Illegal settlement of gold miners called "Camp Beirut" within Sapo National Park, Liberia, in 2016

TABLE 2 Summary of the history of Sapo National Park, Liberia, showing the illegal encroachment over the years that led to the creation of the Community Watch Team (CWT) in 2017, a solution proposed by the communities to protect the forest of their ancestors, financed and trained by the WCF (Figure 6)

Date	Event	Illegal encroachment	Comments
1983 May	Park creation (1308 km^2)		Communities relocated and compensated
1985	First management plan		FDA starts conservation operations and construction of the research center
1989–1990	First civil war starts Management restarts	– Some community members take refuge in the park – First intermittent gold miners (Camp Iraq)	FDA evacuated the gold miners
2000–2002	Second civil war starts in 1999	New gold mining in different parts (Camp Congo)	FFI[a] starts support to management effort interrupted by the civil war
2003	Park extension (1804 km^2)		– No relocation needed – No demarcation done
Until 2005		Illegal mining increases with about 5000 people in the park	FDA evacuates and compensates illegal miners
2006–2010		– Illegal mining restarts – 18,000 evacuated from the park	
2015–2017		– Illegal mining restarts in the park with up to 2000 people – Incident in a law enforcement attempt by the FDA	– WCF[b] supports FDA to understand the situation in the park – Ebola crisis decrease park management activities
2017–present	Greenville Conference for Sapo National Park (SNP)	– Local community starts the Community Watch Team (CWT) supported by the WCF and FDA – Illegal miners left the park due to CWT patrols	Sapo Task Force with all partners to support SNP

[a]Fauna and Flora International (FFI) has been supporting the Forest Development Authority (FDA) to manage the Sapo National Park since about the year 2000 and remained active there throughout all those troubled years until today. However, no recent biomonitoring data are available to evaluate the impacts of these illegal mining activities on the fauna in the park.

[b]Wild Chimpanzee Foundation (WCF) was asked in December 2014 by the FDA to provide support to understand the situation within Sapo NP and help to have the illegal miners evicted with the participation of the local communities (Ape-Tag report, WCF, 2017). WCF, at the demand of FDA, remained committed to support the park and implement an ecoguard program.

heads, and youth representatives had provided a list of 100 names for 10 teams. The CWT included youth from different villages around Sapo NP that initially patrolled the limits of the park to control entry and inform persons entering of the new restrictions prevailing inside the park. In November 2017, the WCF financially supported the CWT activities. In May 2018, after basic supervision of the 10 teams by FDA, WCF trained them on data collection using GPS, compasses, and cameras (see Figure 6).

FIGURE 6 Training session of the members of the Community Watch Teams and Forest Development Authority (FDA) staff implemented by Wild Chimpanzee Foundation team members at the FDA Headquarters of Sapo National Park in Jallay Town, Sinoe County, in May 2018

Finally, in June 2018, joint patrols of the CWT and FDA started with the full support of the community authorities, and they arrested illegal miners and destroyed mining and hunting camps within the park. Figure 7 shows the location of the 10 different villages around the Sapo NP where CWT gathered and entered deep into the park to patrol around most illegal mining camps and the surrounding areas. Their regular presence in the park, combined with the support of the local communities and their traditional authorities, produced some impressive positive effects: By August/September 2018, these patrols led to a complete halt of the mining activities within Sapo NP.

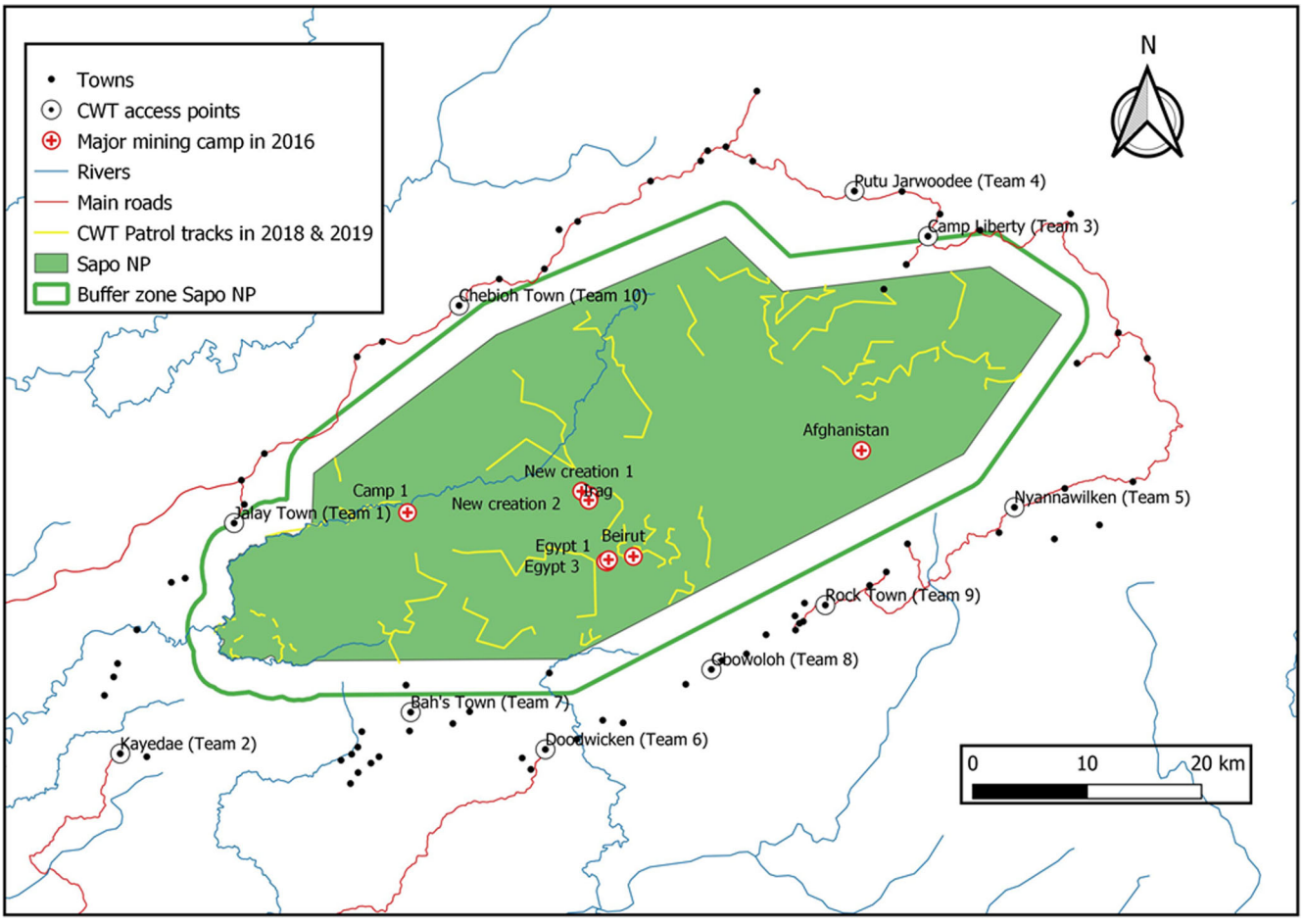

FIGURE 7 Sapo National Park (NP) with the tracklogs of the Community Watch Team (CWT) in 2018 and 2019. The locations of the illegal mining camps within the Sapo NP in 2016 are indicated, along with the villages where each of the 10 CWT gathered before entering into the park. The tracklogs of the patrols in yellow indicate the areas they covered. Thanks to the patrols of the CWT, all miners have left the park in the summer of 2018

Since September 2018, no mining activities have been observed inside of Sapo NP, and with the cessation of mining, forest regeneration was able to begin.

At the time of the Greenville Conference, the WCF had since 2014 a tradition of working with local community ecoguards in Liberia when, in agreement with the FDA, we trained and supported community ecoguard teams in the proposed Grebo-Krahn National Park, near the border to Côte d'Ivoire. First, we had two teams, each with two community members and one FDA team leader, but once the park was officially created in 2017, the WCF increased the number of teams to seven including 10 women (see WCF biomonitoring in the proposed Grebo-Krahn National Park, 2014). These teams are trained to collect data using SMART (Spatial Monitoring and Reporting Tool) technology thus enabling them to make formatted reports with precise geo-referenced maps. The patrols of the Community Ecoguard Teams are now continuously inside of the Grebo-Krahn NP. Therefore, the CWT was something natural for the WCF to support, and we are continuing to work with FDA to ensure that the CWT members are trained to patrol Sapo NP using a more systematic methodology. It is now planned to train them in using the SMART tool to document what is happening within the park boundaries.

The ultimate question on the impact our work has on chimpanzee populations remains to be answered. First, as said the clear decrease in illegal mining activities and the interruption of permanent camps within the park can only have positive effects on the fauna. Second, a quantification of the actual chimpanzee population is still pending. The classic line-transect method has been widely used to survey chimpanzee populations in the forest, as direct observations by human observers are not possible with wild chimpanzees (Kühl et al., 2008). However, this method requires making key assumptions that are hard to verify (Buckland et al., 2001; Cappelle et al., 2019; E. Howe et al., 2017; Kühl et al., 2008; Thomas et al., 2010). Essentially, the method requires estimating night-nest production and decay-rate that has proved hard to generalize (Kouakou et al., 2009). Therefore, we have been developing a more precise method based on direct observation of chimpanzees and other species with the use of motion-triggered camera traps (Cappelle et al., 2019; Després-Einspenner et al., 2017; E. Howe et al., 2017). This method is now being implemented by the WCF in the whole of the Taï and Moyen-Bafing NP and is being tested currently in the Grebo-Krahn NP. This should allow us to monitor over time more precisely the trends in chimpanzee populations and be able to respond more quickly in case of negative trends.

As was seen in Côte d'Ivoire, our work continued to engage the local population, however, we used a very different approach that was specific to the location and needs of the conservation work.

4 | PRESERVING THE LONG-LASTING HUMAN AND CHIMPANZEE COEXISTENCE IN GUINEA

Guinea is home to the largest remaining populations of the West African chimpanzees, with about 53,000 individuals mainly in scattered populations (Heinicke et al., 2019). Due to the high prevalence of the Muslim religion in vast areas of the country, chimpanzees are quite well protected by a food taboo (Boesch et al., 2017). However, the need for rapid development in the country has led to a boom in new mining projects threatening directly the survival of the fauna and its environment. As a response, the WCF is working with the private sector to implement a chimpanzee offset project aimed at compensating for the loss of chimpanzees resulting from the mining operations.

The distribution of chimpanzees is nation-wide in Guinea with the largest concentrations of them in the northeastern part of the Fouta Djallon (Heinicke et al., 2019; WCF, 2016). To achieve its national objective to protect 15% of the terrestrial national territory, the Ministry of Environment has mandated the WCF with the Office Guinéen des Parcs et Réserves (OGPR) to create the Moyen-Bafing National Park in an area inhabited by over 4600 chimpanzees and about 36,000 people (Figure 8). The people living in the area of the park are mainly traditional farmers with a strong Muslim tradition. As such they respect a taboo of not killing or eating primates, including chimpanzees, and the different wild pigs present in the park (Boesch et al., 2017; Heinicke et al., 2019). The main threats in the area, thus, is not bushmeat consumption, as we faced in Côte d'Ivoire, nor illegal mining as we saw in Liberia, but the growing negative impacts of uncontrolled bushfires that sweep through the whole area during each dry season, entering each year deeper and deeper into the forest and burning forest tree species that are less resilient to fire than their savanna counterparts. The result is that large sections of the proposed park have been degraded by repeated fire (on average over the past 10 years, we detected about 1.23 fire per km^2/year for the whole park; WCF, 2018b).

The peculiarity of this project is that the WCF, to ensure sustainable finance, works with two private mining companies, the Compagnie des Bauxites de Guinée and Guinea Alumina Corporation. Both, following an International Finance Cooperation (IFC) scheme, receive important loans from the IFC under the conditions they follow the IFC Performance Standards (PS) that requires, among other conditions, to finance sustainably a chimpanzee-offset project to compensate for the residual negative human impacts their mining activities have on the wild chimpanzees in their concession (PS 6, IFC, 2012). This financial contribution from the mining companies was central to initiate the project of creating a national park.

Therefore, the objectives of the project do not totally overlap with a traditional conservation project, where the main objective is to protect an area from human negative influences. In the context of a biodiversity offset, the main objective should be to first obtain an increase in the chimpanzee population, at least as large as the residual negative impacts on chimpanzees of the mining operations of the two companies in their concessions (the "net gain" requirement from PS 6, IFC, 2012). For that reason, the project has a strong emphasis on habitat regeneration within the park that should lead to an increase of forest cover, resulting in higher biomass production for the fauna, and more regular water flow beneficial to the chimpanzee populations as well as to the local human communities.

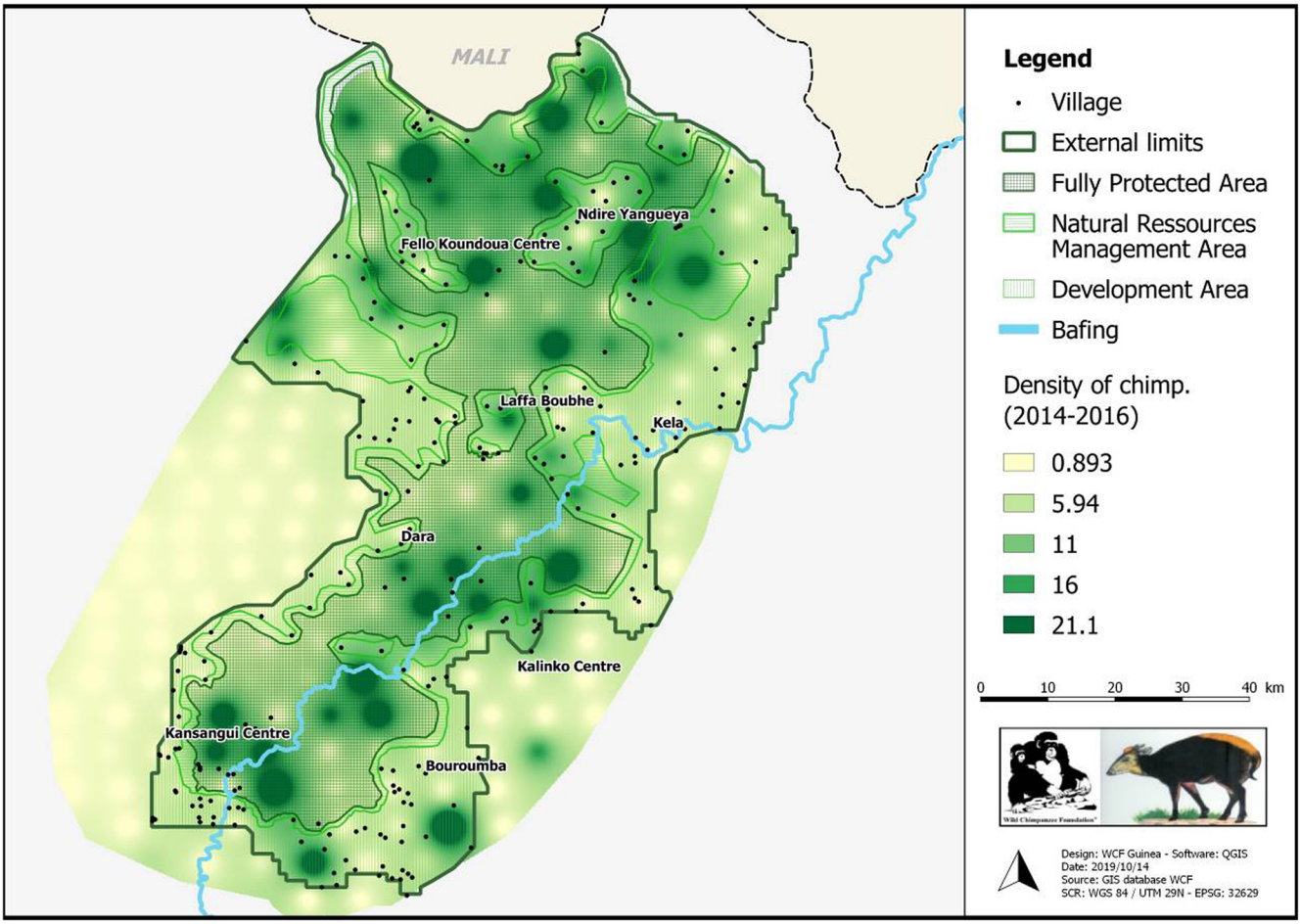

FIGURE 8 Chimpanzee density distribution (individuals/km^2) in the area of the future Moyen-Bafing National Park. The park limits were proposed on a large part based on this distribution, but as well taking into account the presence of human settlements and the state of the environment. In the proposed park limits of 6400 km^2, a population size of about 4600 chimpanzees have been estimated with the line transect method

To preserve this long-prevailing coexistence between humans and chimpanzees within the park, the WCF is developing an "integrative landscape approach" by taking into account both the environmental imperatives as well as the local community interests. The environmental context is being strongly affected by the worldwide climate change with decreasing rainfall and increasing temperature combined with deforestation, mainly due to traditional slash-and-burn agricultural practices that have increased in recent years due to decreasing soil fertility resulting from the decreasing rainfall (B. M. Campbell et al., 2016; Challinor et al., 2014; socioeconomic study, WCF, 2018a). Thus, humans and chimpanzees are facing similar challenges, and forest regeneration provides a common solution that could both improve food availability to the fauna and improve water access and crop protection for farmers.

To implement such an integrated landscape approach, it was necessary to obtain first detailed information about the situation within the National Park (Figure 8). From our biomonitoring survey preceding park identification, we had data on chimpanzees, other mammals, and the environment (WCF, 2016; Figure 8). However, we lacked adequate information about the local communities. In the first year of the project, the WCF documented the territory limits of all villages in the park and worked with the communities to record their land use within the territory (annual report, WCF, 2018b). At the same time, precise maps have been produced following Figure 9 either with the data we have been collecting in the Moyen-Bafing NP about the chimpanzee distribution and abundance, the other biodiversity, and the vegetation status or by analyzing the bushfires of the last 10 years to identify especially vulnerable areas. The combination of these data sets provides us with the framework under which to plan the urgently needed bushfire management schemes, as well as the data needed to initiate the discussion for the Village Territory Management Plans (VTMP).

To ensure the involvement of the local communities in the integrated landscape approach of the Moyen-Bafing NP, communities organized themselves into a governance structure called the "Conservation and Development Village Committee" that ensured representation of all local interest groups (Figure 10). In this way, the communities will be involved in the planning and implementation of

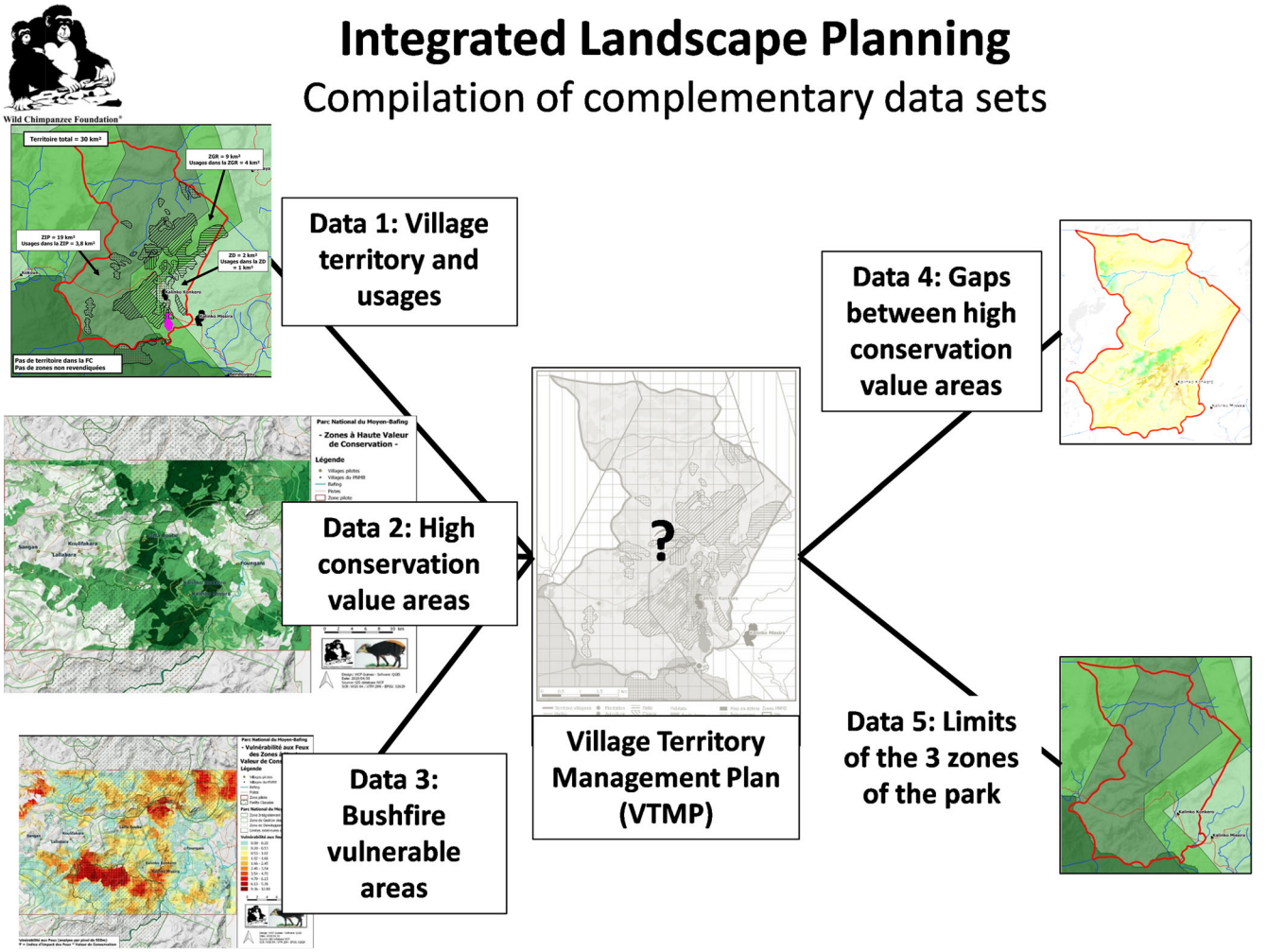

FIGURE 9 The Wild Chimpanzee Foundation Integrated Landscape Planning model for the protection of the Moyen-Bafing National Park in Guinea. The five data sets combined are presented here for only one village as an example of how environmental threats and sociocultural data are combined to promote a landscape approach allowing for protecting high conservation value areas, regenerate the connectivity, and promote sustainable agroecological activities

all activities of environmental regeneration within the NP and in the integration of their needs and vision into the VTMP. Different villages may have different needs or challenges to solve, and this remains possible by adopting this structure (Figure 10). The Moyen-Bafing NP teams facilitate and support all these activities at each level to ensure the main objectives of the park are fulfilled and that complaint and grievance procedures are in place. The higher levels at the rural communes and regions will help to integrate the VTMP into national and regional plans and benefit from government support. The OGPR has recently required such a governance plan to be implemented for each of the protected areas in the country.

Though the WCF environmental education has an impact on the communities' behavior and newly recruited ecoguards provide the communities with direct benefits, the positive impacts of forest regeneration will require more time to be of an effective benefit to the communities. However, forest regeneration cannot work without control over the bushfires that run through the park every year; our analysis shows that 32% of the park is directly affected by bushfires every year and almost the whole park is burned once in 10 years (annual report, WCF, 2018b). Thus, similar to our projects in Liberia, in 2019 the WCF in Guinea employed as many as 1200 young people from the communities spread throughout the park as bushfire regulators. Due to the size of the Moyen-Bafing NP, the plan is to hire many more so as to permit an effective regeneration of the forest in the middle-term. This will then allow the animal population to increase, as well as the river systems within the park to flow more consistently.

The project is still only in its second year, and therefore, it is too early to talk about success or failure. What we can say today is that the voluntary participation of members of the local communities in our training sessions in agroecological practices in 2019 surpasses our expectations with over 1400 active participants of which two out of three were women. We were welcomed by all villagers and their important participation in the VTMP discussions will provide a strong voice for the communities when planning their future and integrating their needs in the national development plans. Over the next

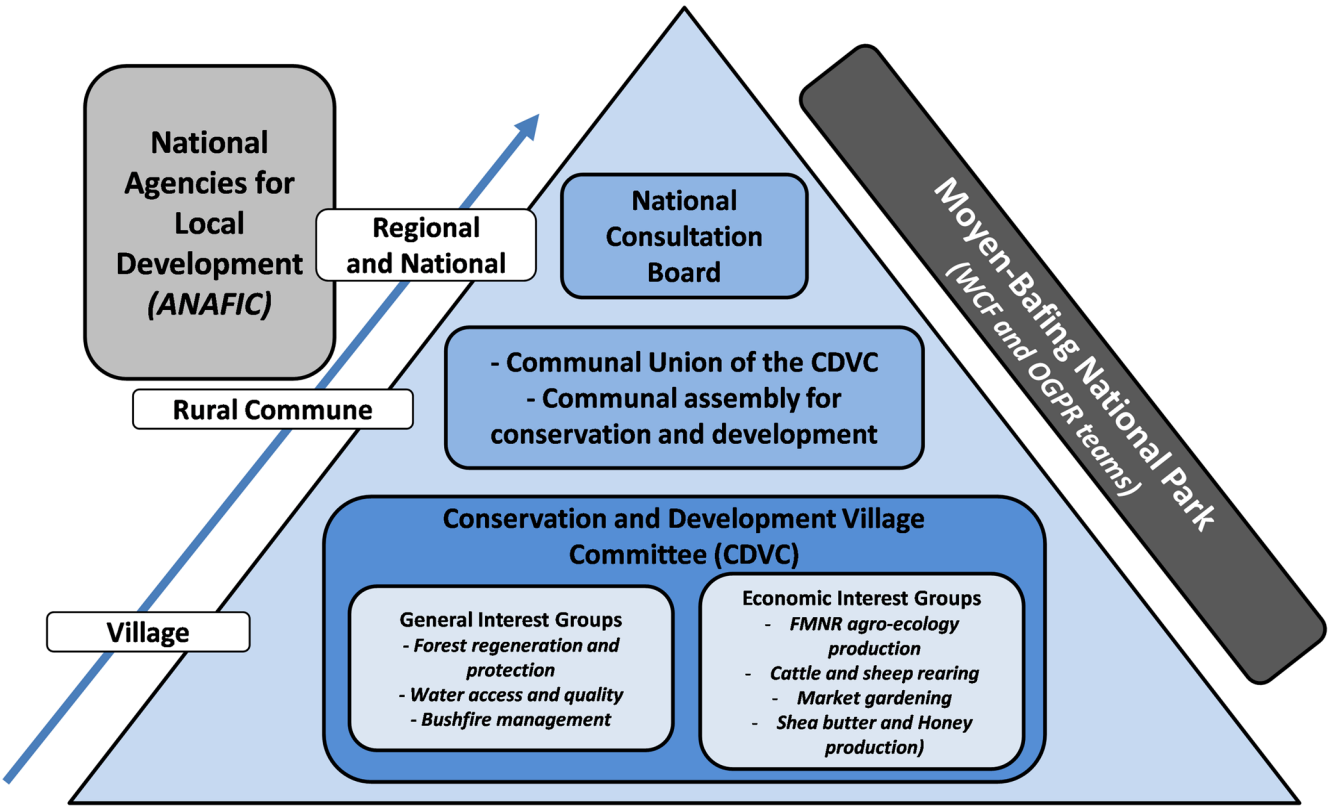

FIGURE 10 Structure of the local communities to integrate their work within the Moyen-Bafing National Park (NP). "Conservation and development village committees" (CDVC) are created in each village to coordinate the different "General Interest Groups" and "Economic Interest Groups" that the villagers want to implement within their village (the figure lists some of the examples). The Moyen-Bafing NP teams are working with them to implement both the conservation and development activities. At the rural commune level, the CDVCs possess a "Communal Union" representing their interest, whereas a "Communal Assembly" is established to address issues that concern more than one village within the rural commune. Finally, a "National Consultation Board" allows for the integration of the CDVC interest into regional or national development policies through different national agencies, like the ANAFIC that is the national agency for local development financing

3–4 years, the control of bushfires and hunting, with the regeneration of gallery forest along rivers and watersheds will hopefully promote an increase in the biomass of the ecosystem resulting followed by an increase in chimpanzees and other wildlife in the area.

5 | CONCLUSION

Returning to our earlier discussion of the conservation paradox that humans are both the problem and the solution to conservation issues, we have demonstrated some of the challenges in implementing such solutions. Even when the threats have been correctly identified and solutions are found, the individuals within the communities need to acquire the resources necessary to feed their families. It is often difficult to reconcile such short term needs with longer-term goals. The present review of some of the approaches used by WCF illustrates the need to have a reliable understanding of the threats faced by the species of concern in each specific context. The differences we observed between the Taï NP in Côte d'Ivoire and the Sapo NP, in Liberia are revealing. Notwithstanding being only 200 km apart in the same forest block, the socioeconomic context of the parks is so different that the threats to chimpanzees differ significantly between areas. With simple words, what works in the Taï NP context will not work in the Sapo NP context. Even more complex, the main threat found in Sapo NP is not such a pressing issue in neighboring Grebo-Krahn NP.

The conservation paradox to work with the same people that partly contribute to the biodiversity crisis is and will remain a challenge. The middle-term vision of conservation is sometimes difficult to reconcile with such short-term needs of families. Nevertheless, nowadays the tropics finding themselves at the forefront of climate change are confronted with these new challenges so that the communities include more frequently in their thinking the middle-term dimension than they did four or two decades ago.

The worldwide human population growth and the associated climate changes have confronted us, animal conservationists, with new and unexpected challenges following which we are expected to work with the very local communities that have contributed in part to the decline of the endangered animal species we want to protect. In addition, the scarcity of funding had many conservation projects finding themselves forced to contribute more to poverty alleviation than to achieve positive results for animal protection.

Thus, population growth and climate change could present an optimal balance for conservation with poverty alleviation, as in many places on the planet the conservation interest, such as reforestation and fighting desertification, overlap strongly with the pressing needs of the local communities. It is our conviction that the present consequences of the access to water and loss of soil fertility due to climate change opens an appropriate momentum for conservation, as we find ourselves regularly in situations where the solutions to improve nature conservation are also solutions important to increase the resilience of local human communities. So, we enter a time period, where it would pay for conservationists to be highly opportunistic and adaptable to seize opportunities that present themselves and think outside of the box to adjust to ever-changing local situations.

Forty years ago, some people living around Taï NP in Côte d'Ivoire, were still surviving without cultivating crops in fields and sustaining themselves mainly from hunting and gathering in the forest. During the last decades, with the disappearance of any intact primary forest patches outside Taï NP, farming has become mandatory to sustain a family. Moreover, during the same time period, the human population increased around the park by over 20-fold (Riezebos et al., 1994), so that access to good land to create fields has become harder and harder. This results in communities in that region becoming more open to the sustainability argument than they used to be, as well as discussing alternatives that are climate-resilient.

Similarly, in Guinea, belonging to one of the poorest regions in Africa, the effects of climate change are dramatic. It means that the local communities have witnessed year after year less rainfall, endured higher temperatures, and experienced decreasing soil fertility (B. M. Campbell et al., 2016; Challinor et al., 2014; Lebel & Ali, 2009). This all concurs to have the communities to resort to shorter rotation times in their slash-and-burn agricultural practice, which increases the deforestation of the area, and the water shortage issues. A practice the communities are largely aware that will increase their difficulties, but to which they have no adequate solution (socioeconomic study, WCF, 2018a). This allowed the WCF to propose to the communities welcoming solutions based on improving the forest cover to ensure more regular water flow in their rivers as well as higher biomass for the chimpanzees and other animals inhabiting the park.

Saving Apes through Engaging Communities is one example that has to become a reality in our present world. This paper presents some responses to how this could be done and shows that in some cases we do have data to show that it could be an effective means toward reaching our conservation goals.

5.1 | Recommendations

- A solution to the conservation paradox requires a good knowledge of the local situation so that different threats are identified and their relative importance is known allowing for the implementation of context-specific solutions.
- A flexible and dynamic evaluation program should accompany such a project so as to be able to react swiftly to any signs of degradation in the situation. This evaluation program should be done on the results of the target animal species and not only on the activities implemented as is done much too often.
- A sustainable solution to the conservation paradox needs the adoption of a middle term timeframe so that the specific activities adopted for the local communities can be evaluated over such a time period, as climate change preoccupations have to be included for any solution to reach sustainability.

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CONFLICT OF INTERESTS

The authors declare that there are no conflict of interests.

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