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Factors of Degradation and Conservation Strategies for Sacred Forests of Ramsar Sites 1017 and 1018 in Benin

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Abstract

Sacred sites (forests, lakes, mountains, etc.) play an important role in the sustainable use of natural resources and in particular the conservation of biodiversity. As such, in recent years they have been subject to threats related to land pressure, uncontrolled cutting of firewood, overexploitation of resources and multifaceted human pressures. The objective of this study was to determine the potential sources of degradation of sacred forests as well as conservation strategies for these forests. The study was conducted in 15 municipalities in southern Benin spread across the 1017 and 1018 Ramsar sites. The choice of these municipalities was based on the presence of sacred forests (SF) and the efforts made to protect these SF and strengthen the resilience of the environments while improving the living conditions of local communities. Thus, 42 sacred forests were visited and 148 people with direct contact with these SF were interviewed across the two Ramsar sites. The questions focused on 1) the factors responsible for the degradation of SF and the respondents' perceptions of these factors, 2) the local strategies developed to combat the degradation of SF. The results indicate that the main factors contributing to the degradation of SF include illegal deforestation (25%), pollution (19.59%), increasing urbanization, poaching and especially agriculture. The CA showed that adults perceive shifting agriculture, increasing urbanization and pollution as the main factors of degradation while the elderly perceive more poaching and conflicts of use. The main strategies contributing to the conservation of SF include the presence of

deities (25%), the installation of fetishes (20.27%) and the prohibition of entry (20.27%), protection rituals and tree planting (18%). The Correspondence Analysis (CA) showed that adults mainly perceived the prohibition of entry into the SF, the installation of fetishes and the planting of trees as the main strategies for the conservation of sacred forests, while the elderly perceived the presence of deities and protection rituals as strategies for the conservation of SF. In the immediate future, there is a need to raise awareness among local populations about the consequences of pressure factors on the conservation of sacred forests and the need to safeguard them.

Keywords

Degradation, Conservation, Sacred Forests, Ramsar Site, Benin

1. Introduction

Tropical forests play a crucial role in regulating greenhouse gases, maintaining major climate balances, meeting the diverse needs of rural populations (Ouattara et al., 2021), and serving as major biodiversity reservoirs. Given the fragmentation of forest landscapes due to human activities and climate variability, which is leading to biodiversity loss (Sanou et al., 2017; Zampaligre et al., 2019; Zida et al., 2020), the scientific community and policymakers are paying particular attention to the conservation of these ecosystems. Among the human activities that contribute to forest degradation are uncontrolled wildfires, excessive logging, overgrazing, and the overexploitation of non-timber forest products.

According to Ouédraogo & Thiombiano (2017) and Belem et al. (2018), despite the importance of forests for Africa's socioeconomic development and sustainable development, the rate at which forests are declining due to increasing deforestation, land degradation, and poor forest management practices is a source of serious concern. From 2000 to 2010, Africa lost approximately 3.4 million hectares of forest annually, ranking it second in the world for forest loss (Sanou et al., 2017). The main drivers of deforestation are illegal logging, agricultural expansion, fuelwood harvesting, human settlements, and wildfires, among others (Tankoano et al., 2016). Political, legal, institutional, technical, and economic constraints have also hindered the wider application of sustainable forest management principles in the West African region (Kaboré et al., 2019). Urgent measures are therefore needed to ensure the sustainable management and development of forest resources (Ouattara et al., 2022). An assessment of land use and its evolution between 2005 and 2015 highlights the problem posed by the rapid encroachment of agriculture. While cultivated land increased from 3.7 to 5.3 million hectares, forests decreased from 7.6 to 5.9 million hectares, representing a 14% reduction in area and a deforestation rate of 1.4% per year (Kaboré et al., 2019). This degradation is characterized by a significant decrease in the extent of vegetation formations and a con-

siderable reduction in woody resources (Gansaonré, 2018).

Benin, due to its geographical location and the influence of the Dahomey Gap phenomenon, has a very sparse forest cover that is also highly altered and degraded by human activities (Arouna et al., 2017).

Sacred sites (forests, lakes, mountains, etc.) play an important role in the sustainable use of natural resources and, in particular, in the conservation of biodiversity (Zida et al., 2020; Sanou et al., 2022). In countries like Benin, the importance of sacred forests, as a tool for maintaining ancient forest areas and their biological resources, has been the subject of much concern (Arun & Yeo, 2020). Although sacred forests provide the same benefits as other forest categories, the laws in force in Benin do not sufficiently take into account the specific nature of these ecosystems (Arouna et al., 2017). As a result, in recent years, they have been subject to threats related to land pressure, uncontrolled logging of firewood, overexploitation of resources, and various forms of human pressure. The laws governing forests and wildlife, the framework law on the environment, and other subsequent legislation do not explicitly address sacred forests. Due to the limited attention given to sacred forests, very few financial resources have been allocated to research or the development of conservation activities (Gnangle et al., 2022). With regard to resource conservation, these forests fall under the State's protected domain, according to the provisions of Article 10 of Law No. 93-009 of July 2, 1993, concerning the forest regime in the Republic of Benin. While they can certainly benefit from the provisions of the law for participatory management of natural resources, their nature and role warrant a specific conservation status that takes into account the perceptions and logics of local communities (Ahononga et al., 2021). According to Hunyet (2013), the conservation of sacred forests, particularly in Ramsar sites 1017 and 1018, has thus far relied on prohibitions.

To promote the rational use of natural resources, Benin signed the Ramsar Convention on Wetlands in 2000 and designated two Ramsar sites, corresponding respectively to the southwest zone (site 1017) and the southeast zone (site 1018). Within these Ramsar sites, sacred forests represent the main forest resources and play a fundamental role in their functioning (Mensah et al. 2022). In fact, Ramsar sites 1017 and 1018 are located in southern Benin, in the coastal zone. These sites extend approximately two kilometers into the sea (Houeto 2013; Lokossou et al., 2025a). They are therefore bordered to the south by the Atlantic Ocean, to the east by the Federal Republic of Nigeria, to the west by the Republic of Togo, and to the north by the Zou department, specifically between the geographic coordinates 1˚37'45" and 2˚42'35" East longitude and between 6˚12'37" and 7˚1" North latitude. On the continent, Ramsar sites 1017 and 1018 fully cover the departments of Atlantique, Mono, and Ouémé, and partially cover those of Plateau du Couffo and Zou. They cover an area of 9083.61 km^2, or approximately 8% of the country's area. In this region, four climatic seasons are distinguished: a long dry season from mid-November to mid-March; a major rainy season from mid-March to mid-July; a short dry season from mid-July to mid-September and a short rainy season from

mid-September to mid-November.

The evolution of belief systems within societies and demographic and land pressures are now factors in the desacralization and degradation of these forests (Akakpo et al., 2019). At the local level, although the populations of some communities that own sacred forests express their concern about the daily reduction of their forest areas, the capacity of traditional leaders to be involved in the management of these ecosystems has remained weak (Hunyet, 2013; Ouattara et al., 2022).

Several authors state that the knowledge of local or riparian communities of sacred forests is crucial for better understanding vegetation degradation and taking into account the concerns of the population as well as their involvement in the success of local development programs and improving the resilience of sacred forests (Sanou et al., 2017; Biaou et al., 2019; Ouattara et al., 2022). Thus, it is important to understand the relationship between household socioeconomic factors, environmental contexts, and the adoption of new technologies to improve the resilience of protected areas and their sustainable management in order to meet the needs of local populations (Sanou et al., 2017; Ouattara et al., 2022). In this study, we sought to examine the perceptions of local communities and managers of protected areas regarding potential sources of forest resource degradation and the factors that influence residents to change their production practices and their involvement in disturbance mitigation processes.

2. Materials and Methods

2.1. Study Area

The study was conducted in 42 villages located near forest ecosystems (SF) within the 2017 and 2018 Ramsar sites, distributed across 15 communes in southern Benin (**Table 1**, **Figure 1**). These villages were selected based on the presence of SF and the efforts undertaken to protect these SF and strengthen the resilience of the environment while improving the living conditions of local communities. On the mainland, Ramsar sites 1017 and 1018 fully cover the departments of Atlantique, Mono, and Ouémé, and partially those of Plateau du Couffo and Zou. They cover an area of 9083.61 km^2, or approximately 8% of the country's area. In this region, four distinct climatic seasons are observed: a long dry season from mid-November to mid-March; a long rainy season from mid-March to mid-July; a short dry season from mid-July to mid-September; and a short rainy season from mid-September to mid-November (Padonou et al., 2018). Rainfall occurs mainly between March and July, peaking in June (300 to 500 mm). In terms of annual rainfall, there are significant differences between the eastern and western coastal areas; the eastern area (Sèmè, Porto-Novo) receives considerably more rain (1300 to 1400 mm on average) than the area west of Ouidah, where annual rainfall ranges from 900 to 1100 mm (Mensah et al., 2022). This rainfall is distributed over an average of 80 to 120 days. The soil types found in this area are primarily poorly developed soils, vertisols, tropical ferruginous soils, and ferralitic soils (Houeto, 2013). Mo-

dally depleted, slightly desaturated ferralitic soils cover 52.70% of the study area. The weakly desaturated, depleted hydromorphic ferralitic soils are in islands and represent 1.43% (Mensah et al., 2022).

Table 1. Localities traversed by Ramsar site and number of people surveyed by SF.

Ramsar sites	Department	COMMUNE	Sacred forests	Number of people (110)	Percentage (%)
1017	Ouémé	BONOU	Gbèvozoun	1	0.68
			Soligbozoun	5	3.38
		ADJOHOUN	Bohouézoun	3	2.03
			Houèmèzoun	4	2.70
			Vazoun	6	4.05
		DANGBO	Kolé kotan	5	3.38
			Siligbozoun	5	3.38
		AVRANKOU	Zèpkonzoun	5	3.38
			Orozoun Ichaale	3	2.03
	Plateau	SAKETE	Igbo Agan	3	2.03
			Igbo Ifa	4	2.70
1018	Atlantique	ABOMEY CALAVI	Avazoun	2	1.35
			Bahazoun	4	2.70
			Sirigbadjazoun	4	2.70
		ALLADA	Agué-sakpatazoun	5	3.38
			Dèpkozoun	5	3.38
			Houédozoun	3	2.03
			Hepkazoun	4	2.70
			Palais royale	5	3.38
	Mono	COME	Danzounmè	2	1.35
			Tossouhon	1	0.68
		HOUEYORGBE	Honwi	6	4.05
			Houéhon	3	2.03
	Atlantique	KPOMASSE	Yènon	5	3.38
			Adjassouhon	4	2.70
	Mono	LOKOSSA	Houinyèhouevè	4	2.70
			Agondékè	5	3.38
			Lohunvodo	4	2.70
	Atlantique	OUIDAH	Houngbozoun	4	2.70
			Hounvèzoun	1	0.68
			Kpassè	4	2.70
			Odizoun	1	0.68

Continued

TOFFO	Ayrozoun	4	2.70
	Savèlokozoun	4	2.70
	Tohonvozoun	2	1.35
	Zounkidjazoun	4	2.70
TORI BOSSITO	Wlénazoun	3	2.03
	Zongnizoun	2	1.35
ZE	Zavozoun	2	1.35
	Assanmeyzoun	2	1.35
	Dominzoun	2	1.35
	Houézoun	3	2.03

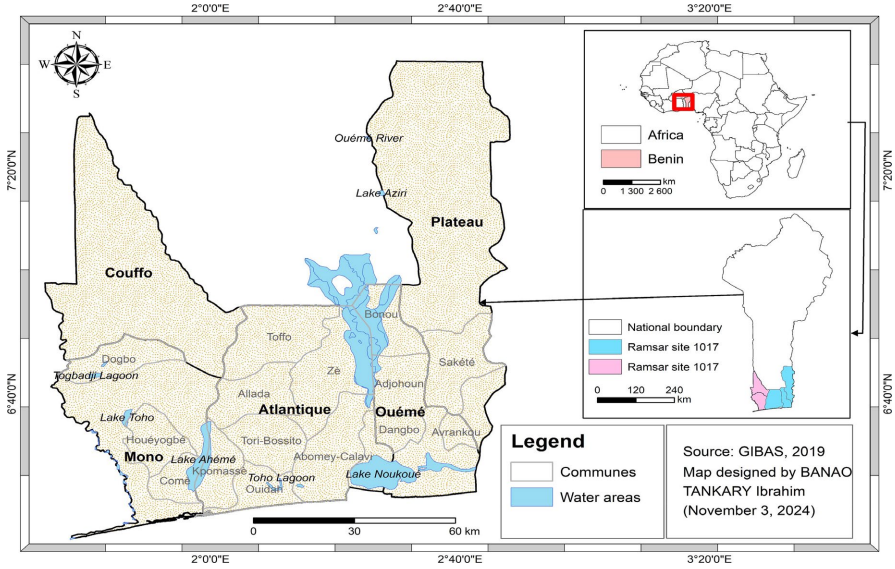


Figure 1. Location map showing the municipalities included in the study that contain the sacred forests under study.

2.2. Data Collection Methodology

The study is based on surveys of communities living near the security facilities of the selected Ramsar sites, and all respondents participated voluntarily. A field visit was conducted for pre-testing. This pre-test helped us refine the questionnaire for the main survey (Ouattara et al., 2022). The proportion P of respondents who have access to SF or play a role in the protection of SF was determined. Subsequently, the sampling method consisted of selecting 42 villages from the municipalities chosen for Ramsar sites 1017 and 1018. With the value of P, the sample size (N) was obtained using the normal approximation of the binomial distribution (1) proposed by Dagnelie (1986):

$$N = \left[\left(U_{1-\frac{\alpha}{2}} \right)^2 \times p(1-p) \right] \Big/ d^2 \quad (1)$$

with

With the value of P, the sample size will be calculated using the formula:

- n is the total number of people surveyed;
- $U_{1-\alpha/2} = 1.96$ for $\alpha = 0.05$;
- P is the estimated proportion of respondents during the preliminary phase, $P \approx 10\%$.
- d is the marginal error (d is equal to 5%).

In total, 110 people were surveyed, including 41 people in the department of Atlantique, 25 in Mono, 37 in Ouémé and 07 in the department of Plateau (**Table 1**). The surveys were conducted among the 110 heads of rural households in the four departments of the study area.

Using a questionnaire, a semi-structured interview was conducted with the sampled individuals. The questions focused on 1) the factors responsible for the degradation of SF and the respondents' perceptions of these factors, 2) the local strategies developed to combat the degradation of SF.

The interviewees sampled were 28 years of age or older. This age criterion was imposed by the fact that the degradation of sacred forests is slow and that it is relatively elderly people who can attest to this (Sangne et al., 2019). The head of household must also have lived in the same locality for at least 15 years (Kaboré et al., 2019). It is assumed that over 15 years, an individual memorizes certain significant facts about the evolution and changes in the natural environment. These interviews consisted of gathering: perceptions of the causes of natural resource degradation; perceptions of the intensity of natural resource degradation; and prospects for adopting innovative technologies for the sustainable management of natural resources. Responses could be expressed as "yes" or "no." At the end of the interviews, each respondent was asked to make suggestions for addressing the degradation problems. Some parameters were assessed using a score on a 4-point Likert scale (i.e., four possible response categories). The scales were: 1 = rarely, 2 = often, 3 = frequently, 4 = very frequently.

2.3. Statistical Analysis of Data

The descriptive analysis of the data consisted of calculating frequencies, percentages, means (± standard deviation or standard deviation) to explain the perception of local populations on the reasons for the degradation of the SF. For each factor contributing to the degradation and protection strategy of social and solidarity economy (SSE) systems, frequencies were calculated considering the characteristics of the respondents (ethnic groups, education, sex, age, household size, main activities). Furthermore, a correspondence analysis (CA) was performed to describe the relationship between sociodemographic characteristics, factors, and local strategies using the R software (R version 4.2.3) (R Core Team, 2019).

3. Results

3.1. Socio-Demographic Characteristics of the Respondents

Analysis of the collected sociodemographic data reveals that adults people (aged

≤ 30) (56%) represent the majority of respondents (Table 2). They are followed by older people. Similarly, men constitute the majority of respondents. They are also predominantly farmers (71%) and traders (26%).

Table 2. Socio-demographic characteristics of the people surveyed.

Variables	Modalities	Total (110)	Percentage (%)
Age	**Young** (age ≤ 30 ans)	3	3.14
	Adults (30 < age ≤ 60 ans)	62	56.1
	Old people (Age > 60 ans)	45	40.76
Sex	Male	105	94.99
	Female	5	5.01
Activities	Agriculture	78	71.16
	Craft industry	2	1.39
	Trade	28	26.19
	Livestock production	2	1.26

3.2. Factors Contributing to the Degradation of Sacred Forests in Ramsar Site 1017 and 1018

Figure 2 presents the different factors of degradation cited by local populations. The main factors contributing to the degradation of forest ecosystems include illegal deforestation (25%) and pollution from wildfires (19.59%) (Figure 2). Illegal intrusions were less responsible for the degradation of SF.

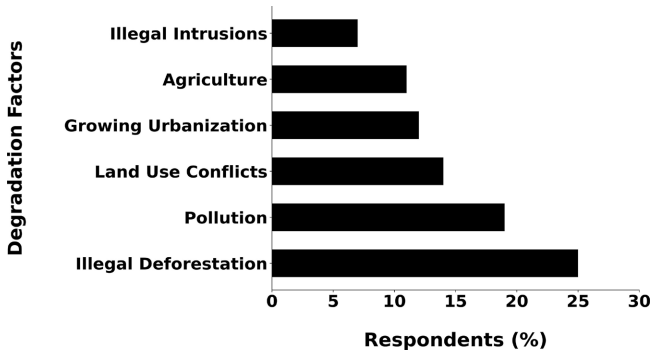


Figure 2. Factors responsible for the degradation of protected forests.

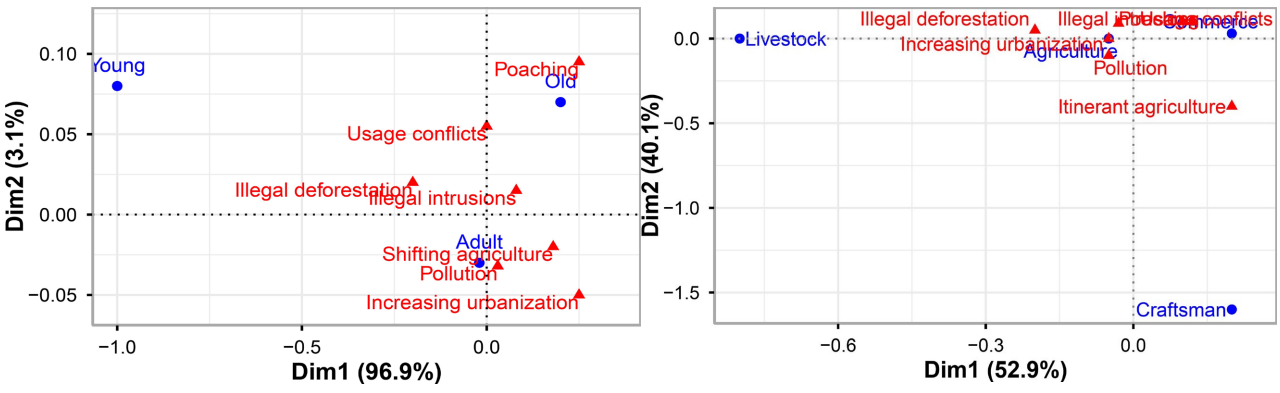
Table 3 presents the proportions of respondents according to sociodemographic characteristics and factors contributing to the degradation of sacred forests. This table shows that, considering age, adults most frequently cited deforestation (59.46%) and increasing urbanization (58.82%) as factors of sacred forest degradation in their area. Regarding gender, men were the most likely to cite factors of degradation, with poaching (100%) and pollution from bushfires (96.55%) being the most common. Considering occupation, farmers most frequently cited factors of degradation, notably illegal intrusions (81.82%) and pollution (75.86%).

Table 3. Proportions of respondents according to socio-demographic characteristics and factors contributing to the degradation of sacred forests.

		Percentage of respondents (%)							
Sociodemographic characteristics	**Modalities**	**Conflicts of use (n = 12)**	**Illegal intrusions (n = 10)**	**Pollution (n = 22)**	**Illegal deforestation (n = 29)**	**Poaching (n = 10)**	**Shifting cultivation (n = 14)**	**Increasing urbanization (n = 13)**	**Total (n = 110)**
Total	Young	5	-	3.45	13.51	-	-	-	3.14
	Adult	55	54.55	58.62	59.46	50.00	56.25	58.82	56.10
	Old people	40	45.45	37.93	27.03	50.00	43.75	41.18	40.76
Sex	Male	95	90.91	96.55	94.59	100.00	93.75	94.12	94.99
	Female	5	9.09	3.45	5.41	-	6.25	5.88	5.01
Activity	Agriculture	65	81.82	75.86	75.68	66.67	62.50	70.59	71.16
	Craft industry	-	-	3.45	-	-	6.25	-	1.39
	Trade	35	18.18	17.24	18.92	33.33	31.25	29.41	26.19
	Livestock production	-	-	3.45	5.41	-	-	-	1.26

n = Sample size.

The results of the Correspondence Analysis (CA) conducted to link age groups and activities to factors of degradation are presented in **Figure 3**. The factors responsible for the degradation of sacred forests (SF) vary according to age group (**Figure 3(a)**) and occupation (**Figure 3(b)**). On the one hand, adults perceive shifting cultivation, increasing urbanization, and pollution as the main factors of degradation, while older people are more likely to see poaching and conflicts over land use. In contrast, younger people have a weak perception of these factors as contributing to degradation. On the other hand, regarding occupational activities, farmers and traders, and to a lesser extent livestock breeder, perceive all seven factors as being responsible for the degradation of SF. In contrast, artisans have a weak perception of these factors.



(a) (b)

Figure 3. Projection onto the A-axis system Correspondence Analysis (CA) age groups (a) and activities (b) in relation to degradation factors.

Figure 4 presents the results of the Correspondence Analysis (CA) conducted to link forest species (SF) and factors of degradation. It reveals that the Ayrozoun forest is most threatened by agriculture, the Kpassè forest by conflicts over land use, the Savèlokozoun forest by poaching, and the Honwi, Houézoun, and Houèmèzoun forests by increasing urbanization. Conversely, the Agondékè, Bohouézoun, and Dominzoun forest species are threatened by illegal deforestation.

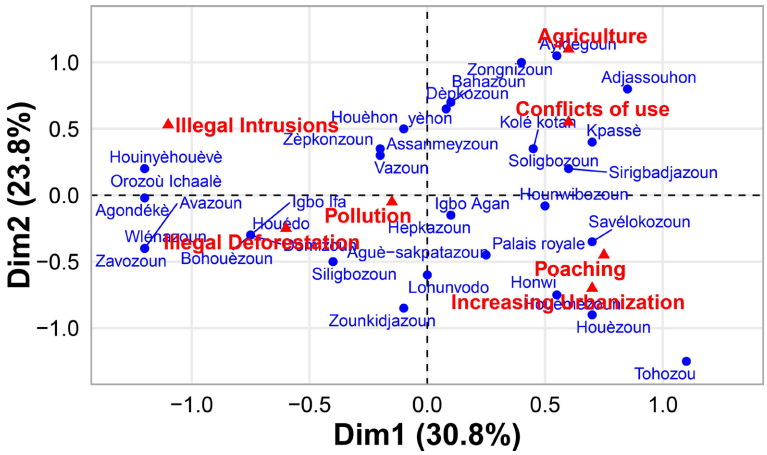


Figure 4. Projection of the sacred forests (SF) and degradation factors onto the axis system of the Correspondence Analysis (CA).

3.3. Local Strategy for the Conservation of Sacred Forests of Ramsar Sites 1017 and 1018

Figure 5 presents the different local strategies for conserving classified forests cited by local populations. The main strategies contributing to the conservation of classified forests include the presence of divinities (25%), the installation of fetishes (20.27%), and the prohibition of entry (20.27%) (Figure 5). Protective rituals and tree planting are cited less frequently as conservation strategies.

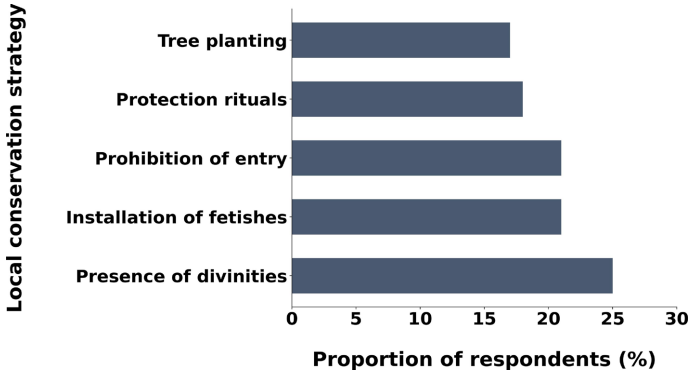


Figure 5. Local strategies for the conservation of classified forests.

Table 4 presents the proportions of respondents according to sociodemographic characteristics and local strategies for the conservation of sacred forests.

This table shows that, considering age, adults were more likely to cite conservation strategies, particularly the installation of fetishes (56.67%), protective rituals (57.69%), and exclusion zones (60.00%). Regarding gender, men were more likely to cite conservation strategies, with the presence of deities (97.30%) and the installation of fetishes (96.67%) being the most frequently cited. Considering occupation, farmers were the most likely to cite conservation strategies, particularly the presence of deities (64.86%) and the installation of fetishes (70.00%).

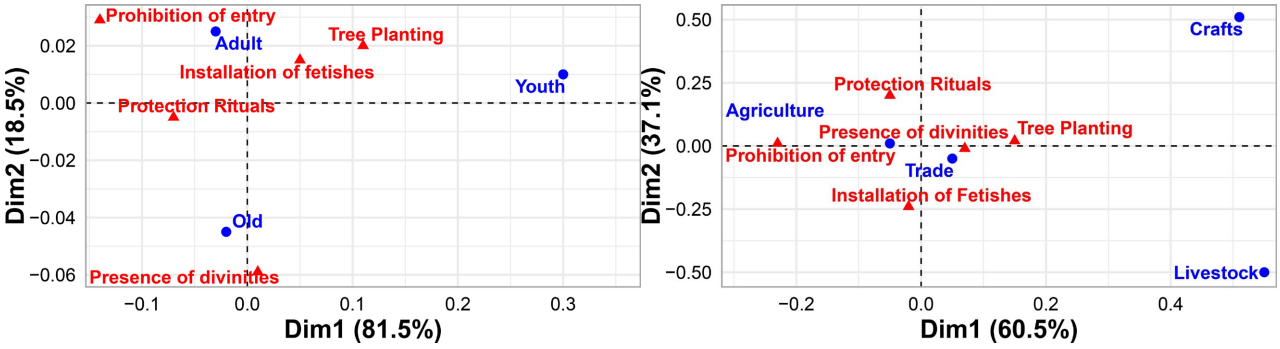
Table 4. Proportions of respondents according to socio-demographic characteristics and local strategies for the conservation of sacred forests.

		Percentage of respondents (%)					
Sociodemographic characteristics	Modalities	Presence of divinities (n = 28)	Installation of fetishes (n = 24)	Protection rituals (n = 21)	Entry prohibition (n = 22)	Tree planting (n = 15)	Total (n = 110)
Age	Young	5.41	6.67	3.85	3.33	8	5.45
	Adult	54.05	56.67	57.69	60.00	56	56.88
	Old people	40.54	36.67	38.46	36.67	36	37.67
Sex	Male	97.30	96.67	96.15	96.67	96	96.56
	Female	2.70	3.33	3.85	3.33	4	3.44
Activity	Agriculture	64.86	70.00	73.08	76.67	64	69.72
	Craft industry	2.70	-	3.85	-	4	2.11
	Trade	29.73	26.67	23.08	23.33	28	26.16
	Livestock production	2.70	3.33	-	-	4	2.01

The results of Correspondence Analysis (CA) conducted to link age groups and activities related to local sacred forest conservation strategies are presented in Figure 6. Sacred forest conservation strategies vary according to age group (Figure 6(a)) and occupation (Figure 6(b)). Adults primarily perceived entry restrictions, the installation of fetishes, and tree planting as the main sacred forest conservation strategies, while elders were more focused on the presence of deities and protective rituals. Young people, on the other hand, had a low citation frequency of these conservation strategies.

On the other hand, regarding professional activities, farmers and traders perceive a wide range of conservation strategies such as the presence of deities, the installation of fetishes, entry bans, and tree planting. In contrast, artisans and livestock breeders have a limited perception of these strategies.

Figure 7 presents the results of the Correspondence Analysis (CA) conducted to link sacred forests (SF) and local strategies for conserving sacred forests. The analysis shows that the Houézoun forest is locally conserved through the presence of deities, the Savèlokozoun forest through the installation of fetishes, and the Houèmèzoun forest through the prohibition of entry. The Zongnizoun, Vazoun,



(a) (b)

Figure 6. Projection in the axis system of the Correspondence Analysis (CA) of the age groups (a) and activities (b) in relation to local conservation strategies for sacred forests.

and Houézoun forests are primarily conserved through strategies such as protective rituals and tree planting. Furthermore, the Kpassè, Bohouézoun, and Agondékè forests are conserved through strategies such as tree planting and the prohibition of entry.

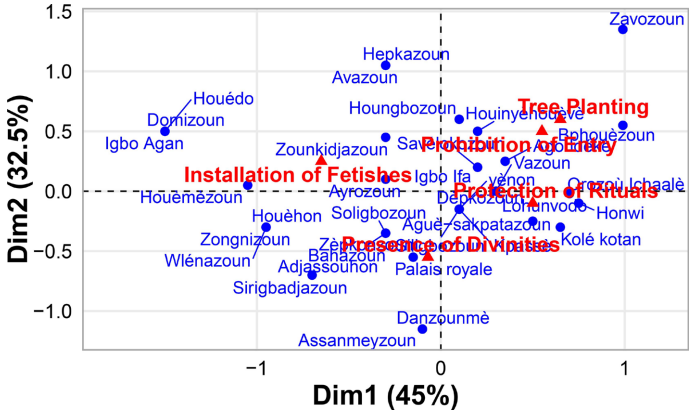


Figure 7. Projection of the sacred forests (SF) and local strategies for the conservation of sacred forests onto the axis system of the Correspondence Analysis (CA).

4. Discussion

Respondents have a good understanding of the factors contributing to the degradation of forest ecosystems. Regarding the causes of degradation, the results reveal that, according to the surveyed populations, the main factors are pollution, illegal logging, poaching, increasing urbanization, and especially shifting cultivation. These are the same causes identified in previous research (Akakpo et al., 2019; Belem et al., 2018; Gansaonré, 2018) among populations in the Benin and Burkina Faso regions. Of all these degradation factors, some authors state that the most significant are wildfires, while for others it is logging and slash-and-burn agriculture (Ouédraogo & Thiombiano, 2017). Our results corroborate those of Sanou et al. (2018), who found that the populations cited the most significant factors related to degradation, primarily anthropogenic rather than natural.

However, several authors have identified other factors of degradation, including climate variability, soil erosion, vegetation fires, degradation of vegetation cover (disappearance of landscape aesthetics), livestock farming, agriculture, the proliferation of invasive plants, the failure to adopt good agricultural practices, and the reduction of fodder (Zampaligre et al., 2019; Zida et al., 2020). According to Sanou (2020), climate variability is perceived as a factor affecting agricultural and forestry production through flooding, rising temperatures, and prolonged droughts. Soil depletion combined with population growth leads people to seek new arable land. As a result, livestock farmers face a shortage of grazing land (Ouattara et al., 2022). Despite restrictive measures (forestry code), these activities impact forest resources through the encroachment of boundaries and the enclosure of animals.

Field observations revealed that several portions of the savannahs were devastated by uncontrolled fires. Fire is a widespread seasonal phenomenon in savannah ecosystems (Belem et al., 2018). Vegetation fires have diverse origins. They are often used to flush out game in the vicinity of forests (Alohou et al., 2016). Furthermore, during field preparation, fires are often poorly controlled, so they can spread and set fire to part of the forest.

Human activities are thus recognized as the main drivers of forest ecosystem degradation (Ouattara et al., 2022; Lokossou et al., 2025b), confirming the results of this study. Agriculture, driven by the search for more fertile farmland, has been the primary threat to sacred forests. This is followed by the overexploitation of timber (illegal deforestation) and pollution from wildfires, which also constitute major threats to the conservation of these sacred forests. These observations confirm the findings of Ali et al. (2014) on sacred or community forests in the Lower Ouémé Valley in southeastern Benin, of Sambiéni et al. (2015) on landscape degradation in the Upper Ouémé Classified Forest in northern Benin, and of Ouattara et al. (2022) on sacred groves in Burkina Faso.

However, the order of importance of the degradation factors perceived by the populations differs according to these authors. This can therefore be explained by the difference between the socio-professional and ethnic groups living near each study site. Indeed, our results revealed that local perceptions of the factors determining pressure on the resources of sacred forests at Ramsar sites vary according to sex, age group (youth and adults), and socio-religious group (forest dignitary and religious leader). These results corroborate those of Savadogo et al. (2017), who found that local perceptions of natural threats in coastal areas vary according to specific groups (social group and age). The pressure factor "agriculture" is more frequently cited by adult men living around sacred forests. This can be justified by the fact that this activity is more commonly practiced by this category of actors.

On another level, the work of Alohou et al. (2016) revealed that the various political events that marked Benin's history, from the colonial period (before 1960) to the democratic era (after 1990), including the revolutionary period (1972-1990), influenced the decline of sacred forest areas. Indeed, according to these authors, during the colonial conquest at the beginning of the 20th century, the

policies implemented by administrators contributed to the disruption of the social fabric and the landscape. According to Akoègninou (2004), the introduction of colonial crops (cash crops) is largely responsible for the increase in deforestation at the expense of forest areas. These large-scale deforestation policies, coupled with evangelization campaigns largely supported by the colonial authorities, significantly contributed to diminishing the authority of Vodun religious leaders and disrupting the relationship between people and their deities. This led to a lack of recognition of the sacred nature of forests by some citizens and authorities, and the destruction of many of them (Adomou, 2005). Similarly, according to Alohou et al. (2016), since independence, particularly from 1975 to 1980, the Marxist-Leninist government of the People's Republic of Benin fought against the "obscurantist practices" of so-called "traditional or animist" religions, further resulting in the destruction of numerous sacred sites and forests used for religious and occult purposes. Religious leaders were forced to cease their practices. In this context, the prolonged and unusual drought of 1976 was interpreted by the public as a sign of divine wrath, which alarmed the government. Consequently, persecutions were reduced, though without truly acknowledging the sacred nature of the forests (Arouna et al., 2017). According to Agbo & Sokpon (1997), however, this decreases in tension between traditional religious leaders and the revolutionary government fostered a dynamic of "recreation" in some sacred forests. Nevertheless, this recognition and appreciation of traditions did not halt the decline and isolation of forests in general, and sacred forests in particular (Lokossou et al., 2025b). Indeed, population growth combined with logging for various purposes has been identified as the primary cause of forest decline, surpassing cultural and religious considerations, notably the weakening of traditional power and the rise of revealed religions. The decline of these forests is manifested primarily by the reduction in the size and shape of isolated patches (Ouattara et al., 2022). This situation constitutes a major threat to the survival of biological diversity (Akakpo et al., 2019). Indeed, Forest fragmentation produces the isolation of small areas of forest and leads to impoverishment and loss of biodiversity; which ultimately makes small populations vulnerable (Sanou, 2020).

In a region with limited forest resources, such as Ramsar sites 1017 and 1018, highly conservative management of sacred forests is a high priority for protecting exceptional and unique natural features, biodiversity, and associated habitats. According to Ahononga et al. (2021), this management first requires an understanding of their conservation dynamics and the potential threats to these ecosystems. The results of this study revealed that the installation of fetishes, protective rituals, and the prohibition of entry into sacred forests are the main conservation strategies identified by the interviewed communities. These findings corroborate those of Akakpo et al. (2019) on the sacred forest of Badja. In the current context of sacred forest degradation in Benin, more effective conservation strategies are needed to mitigate these threats. In order to restore and sustainably conserve these sacred forests, it will be necessary to consider mechanisms for eliminating the causes of

their degradation and reinforcing their sacred character (Alohou et al., 2016; Lokossou et al., 2025b). In the immediate term, it is essential to raise awareness among local communities about the impact of pressures on the conservation of sacred forests and the need to protect them. It should be noted that such awareness campaigns have proven effective in the conservation and restoration of sacred forests in Benin (Kokou & Sokpon, 2006; Akakpo et al., 2019), Madagascar (Ravaloharimanitra et al., 2015), and Cameroon (Nkongmeneck et al., 2010).

Similarly, a participatory management plan for the sacred forests of Ramsar sites 1017 and 1018 will need to be developed with local communities. It is also important to note that the value of involving various stakeholders lies in their participation at all levels and in all activities aimed at restoring and conserving the sacred forests (Ouattara et al., 2021). This would allow communities to better understand the ecological, socio-cultural, and economic issues related to these sacred forests and would facilitate the implementation and monitoring of the management plan. Finally, the long-term implementation and monitoring of the management plan will enable the effective restoration and conservation of the sacred forests of both sites (Akakpo et al., 2019; Lokossou et al., 2025b). Mid-term and final evaluations of the management plan will allow for adjustments to activities and the definition of new objectives for updating the plan.

5. Conclusion

This study revealed that communities living near sacred forests (SF) have a good understanding of the factors contributing to their degradation in their respective environments. These factors include illegal deforestation, pollution, increasing urbanization, poaching, and especially agriculture. The main strategies contributing to SF conservation include the presence of deities, the installation of fetishes, the prohibition of entry, protective rituals, and tree planting. Perceptions of these factors vary according to the groups of stakeholders and their age. However, in addition to the factors listed by the communities, climate change, manifested by floods and prolonged droughts, is now a significant and equally important factor in SF degradation. Immediate action is needed to raise awareness among local communities about the impact of these pressures on the conservation of sacred forests and the necessity of safeguarding them.

Conflicts of Interest

The authors declare no conflicts of interest regarding the publication of this paper.

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