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# SUSTAINABLE WETLAND MANAGEMENT IN CAMEROON: STAKEHOLDER INSIGHTS AND POLICY

**Joseph Iradukunda Ndayisenga**
Higher Technical Teacher' Training College of Ebolowa, University of Ebolowa (HTTTC), 886, Ebolowa, Cameroon.

**Abstract:** Wetlands, spanning approximately 15 million hectares globally, play a crucial role in supporting diverse ecosystems and sustaining livelihoods, particularly in tropical and subtropical regions. In Africa alone, these vital ecosystems cover over 3.2 million hectares, constituting 19% of the world's wetland coverage. This paper delves into the significance of wetland ecosystems and their associated fisheries, which are lifelines for an estimated 275 million people in developing countries. Traditional activities such as timber and non-timber forest product harvesting, fishing, and fuel wood collection form the cornerstone of livelihoods reliant on wetland resources.

Beyond their economic importance, wetlands serve as essential ecological, cultural, and aesthetic entities. They act as crucial exporters of materials supporting near-shore food webs, including prized commodities such as prawns and shrimp. Additionally, wetlands play a pivotal role in intercepting pollutants, land-derived nutrients, and suspended matter, thereby mitigating the adverse impacts of contaminants on deeper water bodies. Moreover, these ecosystems harbor rich biodiversity, providing habitats for a myriad of fauna, ranging from mammals and fish to crustaceans, reptiles, amphibians, avian species, and various aquatic and terrestrial insects.

Recognizing the multifaceted values of wetlands is imperative for informed conservation and management efforts. Conservation strategies must not only safeguard the ecological integrity of wetland ecosystems but also prioritize the sustainable utilization of their resources to ensure the continued well-being of dependent communities. Integrated approaches that balance ecological preservation with socio-economic development are paramount for achieving resilience and sustainability in wetland management.

This paper underscores the urgent need for collaborative action among policymakers, scientists, practitioners, and local communities to address the myriad challenges facing wetland ecosystems. By fostering dialogue, knowledge exchange, and innovative solutions, stakeholders can forge pathways towards the conservation and sustainable management of wetlands, safeguarding their invaluable contributions to biodiversity conservation, climate resilience, and human well-being.

**Keywords:** Wetlands, Ecosystem services, Biodiversity conservation, Sustainable livelihoods, Conservation management

## INTRODUCTION

Worldwide, wetlands cover approximately 15 million or subtropical climates. In Africa, there are over 3.2 hectares, predominantly in countries blessed with tropical million hectares of wetlands, accounting for 19% of the global wetland coverage. This corresponds to an area of about 20,410 km$^2$ (12% of the world's mangroves) (Ajonina et al., 2005; Alongi, 2009). The wetland ecosystem and its associated fisheries are critical to the livelihood of 275 million people in developing countries who traditionally harvest timber, non-timber forest products, shrimp, fish, and fuel wood from them (UNSG, 2011). Wetland ecosystems also support essential

ecological, cultural, and aesthetic functions. Specifically, they export materials that support near-shore food webs, including prawns and shrimp (Rodelli et al., 1984; Sasekumar et al., 1992); they intercept pollutants, land derived nutrients, and suspended matter before these contaminants reach deeper water (Marshall, 1994; Rivera-Monroy et al., 1995). Furthermore, wetlands host a wide variety of biodiversity, providing habitats for fauna including mammals, fish, crustaceans, reptiles, amphibians, avian species, and aquatic and terrestrial insects (Hogarth, 2015).

The anthropogenic activities impact land use and land cover across the extent of the world's mangroves (Thomas et al., 2017). Thus, wetlands perform multiple intangible and tangible services to humans and the environment. Unfortunately, this ecosystem is shrinking under heavy pressure from the intensification of human activities, environmental changes, rapid rising economies, and population growth (Short, 2003; Turner et al., 2002). The rate of wetland loss has reached the proportion of a national crisis (Wanzie, 2003). The recent loss of tropical wetlands area is a result of the conversion of wetlands to other land uses such as agriculture, mariculture, aquaculture, urbanization, coastal developments, forestry, and degradation due to pollution from pesticides and fertilizers. The loss of mangroves for oil palm plantations is a result of rising erosion, rising sea levels, and increased sedimentation, which are also causing mangroves to recede in Central Africa (Ajonina et al., 2008). According to FAO (2005), approximately 8% of mangrove cover in the last 25 years has been lost in the Eastern Africa region, with an average of 30% in WestCentral Africa since 1980 (UNEP-WCMC, 2007).

Globally, these provisioning services provided by wetland ecosystems are diminishing, putting the livelihoods of coastal communities at risk. The loss of wetlands has led to the loss of lives by increasing their vulnerability to natural phenomena such as tropical storms, surges, inundation, hurricanes, and tsunamis or cyclones. Moreover, the rapid growth of the human population has led to an increasing demand for fisheries resources in the Cameroonian market, and the technology made available to fishermen is of high quality and has therefore led to further destruction of wetland areas (Feka et al., 2009).

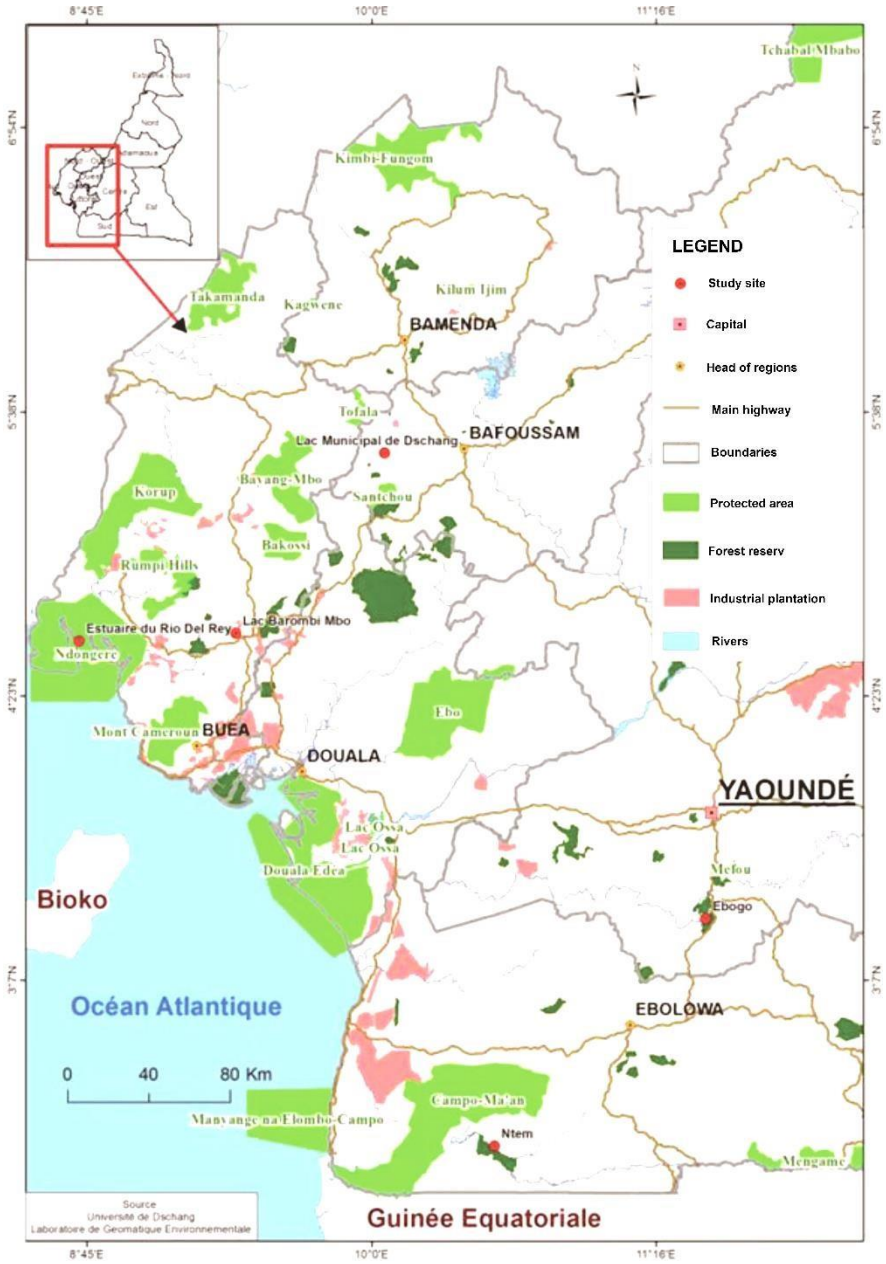
Given the importance of ecosystems and the risks involved in their disappearance, it is therefore mandatory to emphasize the sustainability of natural resources for poverty alleviation. The Cameroon government several non-government organizations (NGOs), such as the Cameroon Wildlife Conservation Society (CWCS), have set up and implemented strategies geared towards the conservation and better management of wetlands (Ajonina et al., 2016). Some studies have been done on the sustainable management and development of wetlands in Cameroon, but none of them have specifically focused on the national strategy for wetlands management in Cameroon. Mangroves, rivers, and oceans are frequently the subject of attention, but no overarching wetlands management strategy has yet been established. Wetland conservation has become increasingly accepted as an important issue. Cameroon ratified the Convention on Wetlands of International Importance (Ramsar) Convention that was adopted in 1971, amended in 1982, and ratified in 1987. On March 20, 2006, Cameroon gained access to the Convention on Ramsar and currently has 7 sites designated as Ramsar sites (about 827.060 ha) (Kometa, 2013; Kometa et al., 2018). In addition, the major recent achievements under the wetlands conservation program in Cameroon are as follows: promoting training activities and public education; actively promoting legislation and policy; strengthening the wetland management and protection institutions through the establishment of a national wetland management strategy (Ajonina et al., 2008; Kometa et al., 2018; Mzoyem et al., 2019; Wanzie, 2003). The implementation of a national strategy could contribute to both national wetlands conservation and global mitigation of climate change and will aim to address urgent problems related to wetland ecosystem conservation and management. Moreover, it can reduce poverty and the dependence of coastal communities on services rendered by wetlands. It is therefore crucial to know the perceptions of stakeholders in wetland management in order to better understand current realities and future challenges. The aim of this study

is to determine measures of wetland management in Cameroon, at which level they are implanted, and what are the strategic axes to be improved for the good management and sustainability of wetlands.

## MATERIALS AND METHODS

### Description of the study site

A total of 05 sites located in different regions of Cameroon (Latitude: 03°23'09"N - 5°26'57"N and Latitude: 8°43'E - 11°29'20"E) covering 208.400 ha were selected for this study. These sites included four Ramsar sites: the Ebogo wetland, the Cameroonian part of the Ntem River, Lake Barombi Mbo, the Rio Del Rey estuary, and one non-Ramsar site: the municipal lake of Dschang (Figure 1 and Table 1). The sites were those wetlands mostly managed under the Ministry of Environment and Sustainability (MINEPDED) or a private company. Site selection criteria included accessibility to riparian populations, financial resource availability, and safety status in the selected area. Semi- structured questionnaires, a digital camera, boots, a coat, a notebook, and a computer were used to facilitate data collection.




**Data collection**

Relevant data for the study were obtained from primary sources using structured questionnaires and interviews (Photo 1). A total of 277 questionnaires were administered across five sites during the period between November 2016 and June 2017. The target populations were the government institutions in charge of managing wetland (24.90%) (MINEPIA, MINFOF, MINEPDED, MINADER, MINEPAT, MINRESI, MINESUP), three NGOs (FAO, UICN, WWF), and the coastal communities (75.1%) (Table 2). The total number of participants was determined randomly, and every participant was chosen according to their availability during the field study period and their implications for wetlands. People of various sexes, ages, and groups involved in different stages of the activities in the wetland were consulted to provide a balanced picture of their perception. The information was collected on the following aspects: knowledge of wetland and the use of its resources; management policies; the existence of the laws that regulate the management of wetland; the main problems related to the regulated

management of wetland; their opinion on what has already been done in the management of wetland at different levels (local and national); and the implementation of a national wetland management strategy.

**Data analysis**

The socio-economic data were analyzed using simple descriptive statistics. The Chi-square and homogeneity test, and Pearson correlation were used to determine the independence of the parameters from the variables. SPSS software v23.0 was used for data sorting and analysis. The Chi-square is denoted by $\chi^2$, and the formula is (Ajonina et al., 2005):

$$\square 2 = \square (ni - ti)2 / ti ,$$

$i=1$

where $\chi^2$= Chi square value test; $n_i$= frequency observed in a class; and $t_i$ = Expected frequency.

**RESULTS AND DISCUSSION**

**General knowledge of the respondents regarding wetlands in Cameroon**

The survey of 277 hearings revealed that only 10.1% had a good knowledge of wetlands in general and their distribution in Cameroon in particular. This suggests that the majority of the respondents had limited or insufficient knowledge about wetlands and their geographical spread within the country. The survey results highlight the need for more awareness and education regarding wetlands among the general population. Indeed, some actors exploiting the resources of this ecosystem like fishermen had never heard of wetlands while using it for they daily income. Our study highlighted the need for improved communication strategies to raise awareness among the population. According to Abbot et al. (2001), there is a dearth of knowledge about wetlands due to insufficient awareness campaigns and educational programs. However, among the 10.1% of respondents with good knowledge, based on educational level, universityeducated had a better understood of the concept of wetland. This indicates that there was a higher awareness of wetland among university-educated respondents, possibly due to the higher level of environmental education they receive compared to those without university education. Based on respondents' daily activity, fishermen followed by farmers was those who have recognized wetlands and their importance. This was explained by the fact that their subsistence activities and sources of income depend on this ecosystem. The majority of activities carried out by riparian populations at its sites have been passed on from one generation to another. Although previous studies suggested a strong gender differentiation in the activity in the use of services provided by wetlands (Ajonina et al., 2005), indeed, our study showed that age and gender do not have a significant influence on their knowledge of wetlands ($P$=0.06). About 95.6% of actors involved in management thinks wetlands are important ($\chi^2$ = 21.965, ddl = 15, $P$ = 0.015). It also shows that there is a highly significant difference between the sector of activity ($\chi^2$=104.969, ddl = 5, $P$ = 01001).

**Perceptions of the respondents regarding wetland management in Cameroon**

***Perception of the local communities regarding wetland management by local communities in Cameroon***

The data analysis of the question based on the existence of effective regulation for wetland management reveals that 86.7% of respondents are not aware of the existence of any law or instrument in force. While 9.84% of them said with certainty that there was no law, 3.46% were not convinced of its existence. These results revealed a lack of awareness of wetland management. These results also reflect the lack of awareness of the management of these ecosystems and the penalties incurred. This lack of awareness can have detrimental effects on the preservation and conservation of wetland areas. Without proper knowledge of the laws, individuals may unknowingly engage in activities that harm the delicate ecosystem of wetlands. Additionally, a lack of awareness can hinder the enforcement of these laws, as people may not report violations or take necessary action to prevent damage to

wetlands. Therefore, as Jennifer and Loewenstein (2000) concluded, it is crucial to address this issue of awareness and educate the public about wetland management laws to ensure the effective preservation of these valuable ecosystems.

On the other hand, the Chi-$^2$ test shows as sex ($\chi^2 = 0.928$, ddl = 1, $P > 0.05$), age ($\chi^2 = 0.54$, ddl = 2, $P > 0.05$) and level of study ($\chi^2 = 3.517$, ddl = 2, $P > 0.05$) did not influence the perception of the respondents (Table 2). The perception of the existence of local management committees varied significantly from one site to another ($\chi^2 = 27.29$, $P < 0.05$) linked to the fact that the riparian communities tend to organize themselves for the sustainable management of their sources of daily incomes. However, there is a significant difference in perception of management measures from one site to another ($\chi^2 = 11.55$, $P = 0.021$) (Table 3). This result can be explained by the fact that the severity of the threat was not the same from the coast to the south. The presence of an effective local management community in some sites leads to awareness of its populations in the management of wetlands (biodiversity) in a sustainable manner. These differences can also be explained by the degree of use and the benefits to populations of wetland services. In line with our statement, previous wetland management laws, governments can wetland protection, restoration, and sustainable studies reported that by implementing robust establish clear guidelines and standards for use because these laws can help prevent further degradation, regulate human activities within wetland areas, and promote responsible land use practices (Clare et al., 2011; Jenni and Loewenstein, 1997). Therefore, there was a need for important actions to maintain a balance between the ecological potential of the remaining mangrove ecosystems and the needs of the local coastal communities.

**Table 1.** Description of the study sites

| Wetlands | Location | Administrative region | Areas (ha) | RAMSAR site N° |
|---|---|---|---|---|
| Municipal lake of Dschang | 5°26'57"N - 10°04'05"E | West | 40 | No classify |
| Barombi Mbo Crater Lake | 04°40'N - 09°22'E | South East | 415 | 1.643 |
| Estuaire of Rio Del Rey | 4°37'N - 8°43'E. | South West | 165.000 | 1.908 |
| Ebogo wetland | 03°23'09"N - 11°29'20"E | Centre | 3.097 | 2.068 |
| Cameroonian part of the Ntem River | 02°22'45"N - 10°33'13"E | South | 39.848 | 2.067 |

**Table 2.** Characterization of the stakeholders.

| Variable | Number of stakeholders | Sex ratio | | Age | | | Education level | |
|---|---|---|---|---|---|---|---|---|
| | | M | F | <35 | 35-55 | >55 | High school | University |
| Institutions | 60 | 93 | 7 | / | 70 | 30 | 6 | 94 |
| Coastal communities | 208 | 79.7 | 20.3 | 17.87 | 58.45 | 27.68 | 60.59 | 9.36 |
| NGOs | 9 | 90 | 10 | / | 69.57 | 30.43 | 5.88 | 94.12 |

**Table 3.** Analysis of respondents' perception of the existence of law on wetland management in Cameroon.

| Question | Response | Sex | Age | | | Level of education | | |
|---|---|---|---|---|---|---|---|---|
| | | | <35 | 35-55 | >55 | Primary school | Secondary school | University |

| | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **W** | **M** | W | M | W | M | W | M | W | | M | W | M | W | M |
| Is there a specific law on wetlands in Cameroon? | Yes | 3 | 24 | 0 | 3 | 3 | 20 | 0 | 4 | 0 | | 1 | 0 | 0 | 0 | 26 |
| | No | 2 | 39 | 0 | 3 | 2 | 28 | 0 | 9 | 0 | | 0 | 5 | 3 | 0 | 38 |
| Test of Chi$^2$ | **χ 2** | | | | | | | | | | | | | 3.517 | | |
| | P ddl | | 0.928 | | | | 0.54 | | | | | | | 0.172 | | |
| | | | 0.335 | | | | 0.763 | | | | | | | 2 | | |
| | | | 1 | | | | 2 | | | | | | | | | |
| | Sig | | NS | | | | NS | | | | | | | NS | | |

P: Probability; ddl: degree of liberty; Sig: significant; NS: non-significant; S: significant; W: women; M: male.

**Table 4.** Analysis test of existing management tools for the study sites.

| Question | Response | Sites | | | |
|---|---|---|---|---|---|
| | | Barombi | Dschang | Rio del Rey | Ebogo |
| **Ntem** | | | | | |
| Is there a local management committee for your wetland? | No | 42 | 118 | 60 | 88 |
| 101 27.294 0 | S | | | | |
| | Yes | 38 | 34 | 44 | 25 |
| 620 | | | | | |
| Are there any protection measures for wetland in your locality? | No | 80 | 154 | 104 | 110 |
| 159 11.55 4 0.021 | S | | | | |
| | Yes | 0 | 0 | 0 | 3 | 6 |

P: Probability; ddl: degree of liberty; significant; NS: non-significant; S: significant; W: women; M: male.

***Perceptions of institutional actors regarding wetland management in Cameroon***

The results presented in Table 4 show that there was a highly significant difference in the actor's perception of the institutional context, the existence of a wetland policy, or a global law for wetland management in Cameroon. The results also showed that the actors working in MINEPDED, MINFOF, and NGOs have better knowledge of the regulations relating to the management of wetland (ddl = 20, $P < 0.05$) compared to other institutions such as MINEPAT. Although 86.6% of its actors believed that there was a wetland management policy in Cameroon and 89.9% believed there were laws for wetland management in Cameroon, 66.5% of them agreed that the current institutional context in Cameroon was not conducive to the sustainable management of wetlands.

Although, according to the existing policy and legal framework review, this study indicated that there was no specific policy for wetland management in Cameroon. The management of mangroves, which are one type of wetlands, falls under Cameroonian legislation of 1994 on forestry, wildlife, and fishing. This result is in concordance with those found by Ajonina et al. (2008), who reported that Central African countries suffer from a lack of appropriate legislation.

**Perception of threats and consequences related to the management of wetlands in Cameroon**

***Shortcomings linked to or threatening the management of wetlands***

Here, we highlighted the thoughts of multiple actors involved in wetland management about the current institutional context in Cameroon. The different institutional problems mentioned were as follows: Weak institutional collaboration (28%) > insufficient legislative policy (24%); conflicts of interest (21%); insufficient funding (18%); lack of political will by the authorities (6%); insufficiently qualified personnel (3%). This highlights the importance of enhancing cooperation between institutions to address wetland management effectively. Other issues, such as insufficient legislative policy, conflicts of interest, and insufficient funding, contributed significantly to the overall complexities of wetland management. According to Calhoun et al. (2017), one significant challenge was the lack of coordination and communication among different stakeholders involved in wetland management. Additionally, these multiple gaps are linked to the absence of a specific institution responsible for the management of these highly vulnerable ecosystems. The absence of this organ leads to a lack of understanding of the role played by each actor in wetland management. Research conducted by Kometa (2013) revealed that insufficient training appears to be the least of the problems identified by the respondents, which suggests that the stakeholders were more focused on the financial aspect.

About the main threats to wetland in Cameroon, the respondents noted the following points: overexploitation, the presence of invasive species, urbanization, agriculture, pollution, ignorance of wetland values and their importance, natural causes (erosion, climate change, etc.) (Figure 2). According to Feka et al. (2009), about 42.839 m3 of mangrove wood is extracted annually around the Douala-Edea Reserve in Cameroon (Yoyo I, Yoyo II, and Mbiako) for fish cooking and/or smoking. The threat analysis revealed that overexploitation (37%), urbanization (23%), agriculture (21%), and pollution (12%) were the main threats exerting the greatest pressure on wetlands in relatively all the sites studied. This distribution varies from one region to another, probably because of the different challenges they face and their needs (Figure 2). The littoral region was dominated by overexploitation, urbanization, fisheries, agriculture, invasive species, and cultures. The same causes were identified in the West, but with less significance. The southwest region was dominated by insecurity. Overall, the littoral region was the one with the most threatened wetlands, followed by the west region and the south. By the way, it is well documented that mangrove wood, for instance, is an important livelihood and source of energy for coastal communities in WestCentral Africa (Walters et al., 2008).

Moreover, 72% of the respondents believed that this ecosystem is overexploited, which can be explained by the regulatory and institutional vacuum, hence the need to develop a specific national strategy for wetland sustainable management in Cameroon. These results were similar to those of the research conducted by Ellison and Zouh (2012) on mangrove management. The overexploitation of these environments included the loss of mangrove productivity services, disturbance of ecological processes, and harmful repercussions such as the decrease in the area of the sites, the disruption of the services rendered by this ecosystem, the emergence of new invasive species, the degradation of its habitats, water conflicts for agricultural and livestock breeding, the disappearance of some wildlife species, the reduction of water volume, and the increase in poverty as revealed by Kometa (2013) and Kometa et al. (2018).

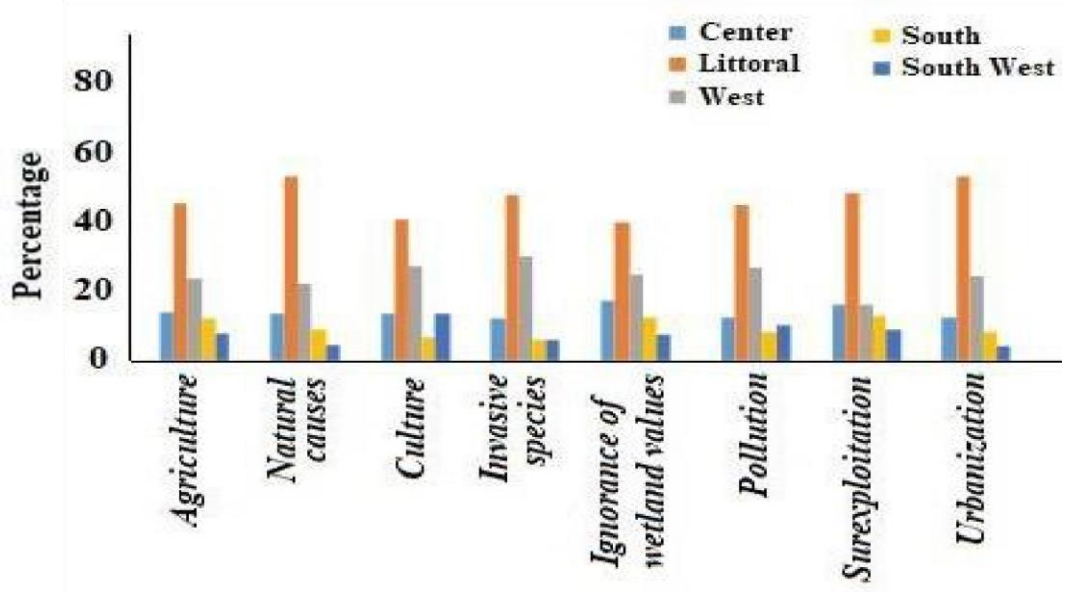



**Figure 2.** The different threats of wetland following the regions.

**Strengths and weaknesses of management tools**

Wetland conservation in Cameroon requires the implementation of various management tools to ensure the effective preservation and sustainable use of these valuable ecosystems. Several management tools have been employed in wetland conservation efforts in Cameroon, and their strengths as well as weaknesses are presented here.

***Strengths***

Cameroon, being rich in biodiversity, presents a unique set of challenges for wetland conservation. However, management tools have been developed to address these challenges and ensure the effective conservation of wetlands in the country. Some strengths of these management tools are: favorable international context with ratified conventions, including those that protect wetlands; the major players in the management of mangroves and associated wetlands are generally known; existence of comprehensive environmental protection regulations in Cameroon; several donors are interested in the sustainable management of Cameroon's wetlands. The framework law imposes the implementation of environmental impact studies on projects by industrial enterprises. According to Wanzie (2003), these tools have facilitated the involvement of various stakeholders, including local communities, government agencies, and non-governmental organizations, in the decision-making processes related to wetland conservation in Cameroon. This participatory approach allows for the incorporation of diverse knowledge systems, perspectives, and priorities, leading to more comprehensive and sustainable wetland management strategies.

***Weaknesses***

Management tools for wetland conservation in Cameroon have several weaknesses that hinder their effectiveness. Feka et al. (2009) reported that one of the major weaknesses in Cameroon was the lack of adequate funding and resources. Wetland conservation requires substantial financial investment for activities such as monitoring, restoration, and enforcement of regulations. However, the limited funding available for wetland management in Cameroon often results in inadequate staffing, a lack of equipment, and insufficient research and monitoring. Our study highlighted other factors, such as the physical framework of wetlands, which is still not well known. Lack of a national wetland management strategy in Cameroon; conflicts of jurisdiction between different administrations related to overlapping responsibilities, poor coordination, or insufficient capacity; weak EIA analysis focuses on wetlands for major investment projects or lacks monitoring of the implementation of environmental management plans; low inclusion of wetlands in global laws; policy gap and multisectoral strategy for sustainable wetland management; poor local organization of the population through the lack of local management committees; lack of developmental initiatives by the population; few Ramsar sites exist despite the diversity and richness of Cameroon's wetlands.

**Focal points for the establishment of a national strategy**

The analysis of the data showed that 90.9% of the respondents were in favor of the development and implementation of a national wetland management strategy. Regarding the approach to be followed, 77.78% of respondents were interested in a centralized approach, while 27.25% were in favor of a decentralized approach. The $\chi^2$ test carried out shows that there was no significant association between the way an individual perceives the development of a management strategy and his gender ($\chi^2 = 0.169$, ddl = 1, $P > 0.05$), his age ($\chi^2 = 1.031$, ddl = 2, $P > 0.05$) or his level of education ($\chi^2 = 0.432$, ddl = 2, $P > 0.05$) (Table 5 and 6). These challenges could be overcome by developing fundamental adaptive and sustainable strategies (Feka et al., 2009). The implementation of this strategy must integrate existing activities and initiatives in the process of starting up. At the level of local populations, several actions were underway. The development of this action plan was suggested to be based on the achievements of the present actions, which were achieved with good results by local communities. In addition, for reasons of complementarity, the action plan must integrate all the initiatives that are consistent with the provisions of the Poverty Alleviation Strategy and the national biodiversity strategy. Thus, the strategic axis formulated with regard to the current situation of wetland management in Cameroon is as follows (Table 7).

**Axis I: Regulating access to wetland resources and the rural economy of wetland**

By developing sustainable cultivation and breeding practices in wetlands and creating alternative activities to overexploitation that ensure conservation and renewal of resources.

**Axis II: Establish a governance system and a legal framework specific to wetlands**

This axe includes institutional and human capacity building. The establishment of a harmonized legal and institutional framework and the consideration of wetland at all levels of decision-making.

**Axis III: Preserve and reclaim wetlands**

Here, it includes participatory management of wetlands classified as Ramsar sites in order to promote sustainable management and research in wetland ecosystems; promote sustainable techniques for the exploitation of natural resources.

**Axis IV: Improve the management and planning of watersheds**

Restoration or rehabilitation of wetland ecosystems to curb and reverse their degradation in order to increase their production functions.

**Table 5.** Stakeholder knowledge analysis test of wetland management tools in Cameroon.

| Questions | Response | CTD | | MINADER | | MINEPAT | | MINESUP | | MINEPDED | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | 13 | | | | |
| Does the current institutional context favor the sustainable management of the wetland? | Yes | 6 | 7 | 15 | 45 | 12 | 19 | 20 | 4 | 6 | 7 | |
| | Don't know | 0 | 0 | 0 | 3 | 4 | 7 | 11 | 3 | 14 | 10 | |
| Is there a wetland management policy in Cameroon? | No | 0 | 23 | 21 | 37 | 17 | 7 | 42 | 4 | 37 | 14 | |
| | Yes | 10 | 4 | 10 | 36 | 7 | 32 | 20 | 0 | 15 | 14 | |
| | Don't know | 0 | 0 | 0 | 0 | 5 | 0 | 8 | 3 | 0 | 4 | |
| Is there a law for the management of wetlands in Cameroon? | No | 0 | 9 | 21 | 10 | 9 | 7 | 20 | 0 | 8 | 4 | |
| | Yes | 10 | 16 | 10 | 60 | 20 | 25 | 50 | 4 | 30 | 24 | |
| | Don't know | 0 | 2 | 0 | 3 | 0 | 7 | 0 | 3 | 14 | 4 | |

**Table 6.** Respondents' perceptions of the development of a national wetland strategy

| | | F | M | F | M | F | M | F | M | F | M | F | M | F | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| What do you think of the development of a national wetland strategy? | Need | 1 | 18 | 0 | 3 | 2 | 10 | 0 | 4 | 0 | 0 | 1 | 0 | 0 | 18 |
| | Important | 4 | 45 | 0 | 4 | 3 | 35 | 0 | 9 | 1 | 0 | 2 | 0 | 2 | 44 |
| Test Chi$^2$ | $\chi$2 P ddl | 0.169<br>0.681<br>1 | | | | 1.031<br>0.597<br>2 | | | | 0.432<br>0.806<br>2 | | | | | |
| | Sig. | NS | | | | NS | | | | NS | | | | | |
| What approach do you recommend? | Centralized | 5 | 40 | 0 | 4 | 5 | 32 | 0 | 4 | 0 | 1 | 0 | 2 | 4 | 38 |
| | Decentralized | 0 | 23 | 0 | 3 | 0 | 10 | 0 | 9 | 0 | 0 | 0 | 1 | 1 | 21 |
| Test Chi$^2$ | $\chi$2 P ddl | 2.758<br>0.097<br>1 | | | | 10.087<br>0.006<br>2 | | | | 0.52<br>0.771<br>2 | | | | | |
| | Sig. | S | | | | HS | | | | NS | | | | | |

Level of education

**Table 7. Strategic axes for the implementation of a national wetland management strategy.**

| GLOBAL OBJECTIVE: PROMOTING SUSTAINAB | | COSYSTEMS IN CAMEROON |
|---|---|---|
| **Specific objectives** | **Expected results** | **Activities** |
| **Axe 1: Regulating access to wetland resources and the rural economy of wetland** | | |
| Over-exploitation of wetlands is Reducing overexploitation of wetland resources reduced | | Strengthen the control of extractive activities;<br>Define periods and areas of exploitation;<br>Developing fish farming as an alternative to overfishing. |
| Enhance positive experiences and initiate actions<br>Wetland experiences are valued on wetlands in urban areas | | Valuing agricultural products from wetlands;<br>Developing ecotourism in wetlands |
| **Axe 2: Establish a governance system and a legal framework specific to wetlands** | | |
| Collaboration between Ensure collaboration between stakeholders stakeholders is ensured | | Encourage the establishment of local management committees;<br>Develop communication, awareness and training on wetlands |
| Harmonization of sectoral policies Sectoral policies are harmonized | | Develop/update mangrove policies and legislation<br>Integrating wetlands into the process of creating protected areas |
| **Axis 3: Preserve and reclaim wetlands** | | |
| Reduce encroachment on wetlands Wetland encroachment is reduced | | Develop participatory management plans for sites of international importance;<br>Develop participatory management plans for sites of international importance and accelerate the preservation of the most sensitive wetlands;<br>Control the proliferation of invasive species;<br>Reducing various forms of pollution |
| **Axis 4: Improve the management and planning of watersheds** | | |
| Managing wetlands in a rational way<br>Wetlands are managed rationally | | Reforest degraded mangroves;<br>Avoid wetland drainage |
| Improving knowledge of wetlands Wetland knowledge is improved | | Assess the potential for carbon storage by Cameroonian mangroves;<br>Assessing the animal and plant potential of wetlands;<br>Mapping wetlands and updating them to make them available to decision makers;<br>Increase awareness of wetlands (general public and school);<br>Strengthen the technical skills and capacities of actors for the sustainable management of Cameroon's wetlands. |

**Conclusion** management was identified as a constraint on general framework and of its natural resources. management at the national level. However, laws Wetland management tools are therefore based

The absence of specific laws on wetland do exist for the protection of the environment in a on regulatory modalities and are not well known.

At the institutional level, there is the national Ramsar committee. The main weaknesses are the fact that the national Ramsar committee has no function, conflicts of interest, and a lack of specified staff at the institutional level. The recommendations for integrated management are based on four strategic areas: (i) regulating access to wetland resources and the rural economy of wetland; (ii) establishing a governance system and a legal framework specific to wetlands; (iii) preserving and reclaiming wetlands; and (vi) improving the management and planning of watersheds.

## CONFLICT OF INTERESTS

The authors have not declared any conflict of interests.

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