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Institutional Management of Community Forests and Environmental Sustainability in Gabon

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Abstract

This chapter examines the influence of state institution involvement on environmental sustainability within community forest management in Gabon. Utilizing primary data collected through a questionnaire administered to 508 individuals across six provinces (Ogooué-Ivindo, Moyen-Ogooué, Ngounié, Estuaire, Woleu-Ntèm, Haut-Ogooué) from May to August 2024, the study employed a Tobit regression model for analysis. Results indicate a nuanced relationship, with some state interventions positively correlating with environmental sustainability while others exhibit negative impacts. Regional disparities were observed, particularly in Ogooué-Ivindo, where direct state intervention and collaborative participation demonstrated negative correlations with sustainability, likely stemming from conflicts between government representatives and local associations. These findings underscore the critical need for fostering consensus-building efforts among all stakeholders to ensure the long-term viability and success of community forests in Gabon.

Keywords

State Involvement, Community Forests, Environmental Sustainability, Gabon

1. Introduction

Community forest management is a critical issue for environmental sustainability, particularly in biodiversity-rich countries such as Gabon. Community forests, managed by local people, play an important role in conserving ecosystems, regulating climate and providing essential resources to communities. According to

Agrawal (2001), community institutions are often more effective at managing natural resources sustainably than centralised state structures (Mbarga, 2013). In Gabon, where forests cover about 88% of the territory[1], community management is all the more important. The country is recognised as a global leader in environmental conservation, having successfully maintained dense forest cover while reducing carbon emissions. This approach is supported by decentralisation policies that aim to strengthen the rights of local communities and promote participatory management of forest resources[2]. In addition, community forest management contributes to poverty reduction by providing economic opportunities for rural populations, as highlighted by Ngoumou Mbarga (2013). Therefore, studying the involvement of state institutions in the management of community forests in Gabon is relevant not only for the understanding of local conservation dynamics, but also for sustainable development strategies that can be applied to other similar contexts around the world.

Community forest management in Gabon faces several major challenges that undermine its sustainability and effectiveness. These challenges include the lack of a clear and coherent legal framework, which leads to management conflicts and unsustainable exploitation of forest resources (Yobo and Ito, 2016). In addition, the lack of technical and financial capacity of local communities limits their ability to effectively manage forests, exacerbating deforestation and ecosystem degradation (Meijaard et al., 2021). Conflicts of interest between different stakeholders, particularly between state authorities and local communities, exacerbate the situation and make it difficult to implement sustainable management practices (Cleaver and De Koning, 2015). The study aims to answer the following question: To what extent does the involvement of state institutions influence the environmental sustainability of community forest management in Gabon?

Therefore, the main objective of this research is to analyse the influence of the involvement of state institutions on the environmental sustainability of community forest management in Gabon. Based on primary data collected from 508 individuals in six provinces of Gabon, this study aims to identify state interventions that promote or hinder environmental sustainability. In particular, we observed different forms of government intervention, such as technical and financial support, participatory management and direct supervision that affect the sustainable management of community forests. This research builds on the work of Hajjar et al. (2021) and Fischer et al. (2023), who have examined the social and environmental outcomes of community forests globally. By understanding local dynamics and the impact of government policies, we would like to formulate practical recommendations to improve community forest management in Gabon and potentially in other similar contexts.

This study makes a significant contribution to the understanding and the

[1]https://www.un.org/africarenewal/fr/magazine/novembre-2022/le-gabon-un-mod%C3%A8le-de-pr%C3%A9servation-de-lenvironnement.

[2]https://www.foei.org/wp-content/uploads/2018/04/La-gestion-communautaire-des-forets_FR-1.pdf.

improving community forest management and environmental sustainability in Gabon. By analysing the influence of government institutions on the sustainability of community forests, our research provides valuable insights into government interventions that can be optimised to strengthen sustainable management of forest resources. The results of this study will help to develop practical recommendations for policy makers and forest managers, highlighting best practices and effective strategies for the conservation of forest ecosystems. Theoretically, this research enriches the body of knowledge on environmental governance and natural resource management, building on the work of Ribot and Peluso (2003) and Ostrom (1990), who examined power dynamics and local institutions in the management of common pool resources.

The remainder of this thesis is structured as follows: after this introduction, we present the literature review (section 2), followed by the methodology (section 3), results and discussion (section 4), and conclude with recommendations and implications for policy and practice (section 5).

2. Literature Review

This section is organised into two sub-sections: theoretical foundations and empirical evidence.

2.1. Theoretical Basis for State Involvement in Community Forest Management

Two major theories underpin the involvement of the state in community forest management: neo-institutional theories and economic theories. The neo-institutional current analyses the success and failure of community forest management initiatives (Agrawal, 2001; Quinn et al., 2007). Three factors are essential: human behaviour influenced by norms and institutions (Giddens, 1984; Schmidt, 2008), the robustness of institutions requiring a solid foundation (Anderies, Janssen, & Ostrom, 2004; Ostrom, 2009a), and the evaluation of the effects of institutions on various sectors (Dressler et al., 2017; Ostrom, 1990, 2009b). Ostrom et al. (2002) show that institutional flexibility allows rules to be adapted to changes in society (Bardhan & Ray, 2008; Forsyth & Johnson, 2014; Ostrom, 2009b).

In contrast to the neo-institutional approach, two new approaches in the field of CBM challenge its three characteristics: critical institutionalism and the practice-based approach. Critical institutionalism, with the concept of "institutional bricole", suggests that humans improvise rules according to their needs (De Koning, 2011; Cleaver and De Koning, 2015), mobilising various institutions and neglecting others. This critique aims to refine neo-institutional principles by incorporating human improvisation and emphasising that institutional robustness does not guarantee buy-in. Qualitative studies are needed to understand the adoption or rejection of new regulations in GFC. The practice-based approach, according to Arts et al. (2014) and Bourdieu (1990), asserts that humans follow rules perceived as legitimate and practical, acting according to social logics rather than

institutional rules, unless the latter are embedded in society.

Economic theories, such as the theory of the tragedy of the commons (Hardin, 1968), collaborative governance (Ansell and Gash, 2008), decentralisation (Ribot, 2002) and adaptive management (Holling & Walters, 1978), emphasise the crucial role of the state in the management of community forests. Hardin (1968) shows that without regulation, shared resources are over-exploited, as illustrated by common grazing land. This theory highlights the need for state intervention to regulate the use of forest resources, establish quotas, monitor and punish abuses, thereby guaranteeing sustainable management and preventing degradation.

Complementing this theory, collaborative governance (Ansell and Gash, 2008) emphasises that resource management requires collaboration between the state, local communities and NGOs. This approach emphasises cooperation and coordination for the sustainable management of natural resources, such as community forests. The state plays an essential role in facilitating and coordinating management efforts, acting as mediator and facilitator. It helps to bring stakeholders together, develop participatory governance mechanisms and promote sustainable management policies and practices. State involvement is crucial to ensure that the interests of all parties are taken into account and that sustainable solutions are developed to preserve forest resources.

Ribot's (2002) theory of decentralisation suggests that transferring natural resource management powers to local levels can improve efficiency and equity. In the case of community forests, this would make it easier to respond to local needs and encourage sustainable management. This approach, aligned with collaborative governance, involves local people in decision-making and gives them greater autonomy. However, state supervision is still needed to ensure sustainability, fairness of benefits and prevent abuse. The state must therefore supervise and coordinate efforts, while leaving a degree of autonomy to local players.

Holling & Walters (1978) highlight the need for flexible and adaptable management of natural resources, capable of adjusting to environmental and social changes. For community forests, this means that the state must adopt policies and practices that take account of the complexity of forest ecosystems. An adaptive approach enables the State to respond more effectively to climatic challenges, human pressures and the needs of local communities, thereby guaranteeing the long-term sustainability of forests and meeting the changing needs of ecosystems and populations.

In short, the Tragedy of the Commons (Hardin, 1968) highlights the need for state regulation to prevent the over-exploitation of resources. Collaborative governance (Ansell & Gash, 2008) highlights the importance of cooperation between the state, local communities and NGOs for sustainable management. Decentralisation (Ribot, 2002) proposes that local management improves efficiency and equity, but requires state supervision to ensure sustainability. Adaptive management (Holling & Walters, 1978) recommends a flexible approach to respond to environmental and

social changes. These theories converge towards sustainable management requiring regulation, collaboration and decentralisation. A review of empirical studies is essential to understand their application and impact.

2.2. Empirical Evidence

The management of community forests has evolved, influenced by various policies and legal frameworks. Yobo and Ito (2016) highlight their crucial role in the conservation of forest resources, despite their limited proportion. Karsenty et al. (2010) note the varied appropriation of the concept by the Gabonese government, requiring better integration into the decentralised matrix of municipalities. Atyi (2006) points out that all of Gabon's forests belong to the national forest estate, which is the exclusive property of the state, complicating their implementation. Robinson et al. (2013) show that involving local communities in forest management in Tanzania can reduce deforestation. Meijaard et al. (2023) highlight the importance of community involvement for conservation in Indonesia. Houballah et al. (2021) indicate that infrastructure improves forest multifunctionality, relevant for community forests. Brandt et al. (2017) show the importance of state policies in preserving unprotected forests.

Recent research on the management of community forests in sub-Saharan Africa, particularly in Gabon, shows various aspects of the involvement of the State and local communities. Legault and Cochrane (2021) highlight the lack of a legal definition of community forests in Gabon, which complicates their management. Tsanga et al. (2022a, 2022b) discuss the environmental and socio-economic impacts of community forestry in Cameroon, with perspectives for Gabon. Kimengsi et al. (2022) examine forest management institutions and the influence of community initiatives on ecosystems. Dupuits and Ongolo (2020) highlight the importance of participatory community inclusion in the Congo Basin. Smith et al. (2024) show the ecological and socio-economic benefits of community forest management in Nepal. Rochmayanto et al. (2023) demonstrate that decentralisation in Indonesia reduces deforestation. Fa and Luiselli (2024) highlight the conservation role of community forests in West Africa. Hordijk et al. (2024) identify trends in tree species dominance and rarity, influencing state management strategies.

The empirical literature on community forest management in general and in Gabon in particular also highlights several relevant studies, but none focus specifically on the environmental outcome of state involvement in community forest management. For example, Yobo and Ito (2016) and Karsenty et al. (2010) highlighted policies and legal frameworks, while Robinson et al. (2013) and Meijaard et al. (2023) instead considered the involvement of local communities in forest management. However, it is crucial to analyse the environmental outcome of state involvement in community forest management, especially in a context where the Gabonese state holds exclusive ownership of the forests (Atyi, 2006). State involvement in community forest management, not only through the legal framework governing this activity but also through the construction of infrastructure,

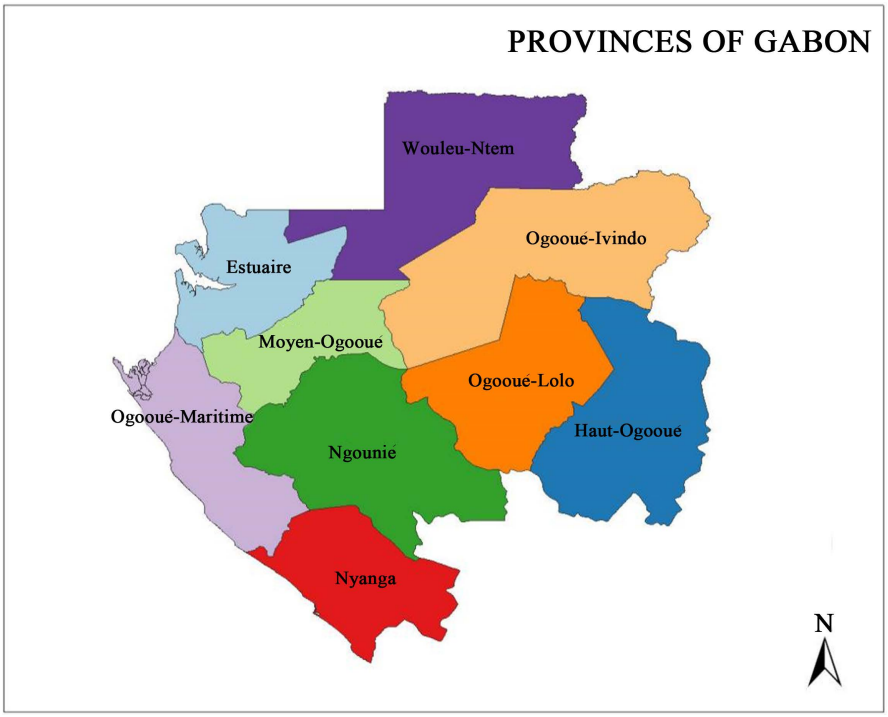
could improve not only environmental results but also the well-being of local communities. The next section is devoted to the methodological approach.

3. Methodological Approach

This section aims to highlight the methodological tools needed to achieve the objectives of this chapter. To this end, it is organised around two subsections. The first highlights the presentation of the study area, while the second sets out the data collection and analysis techniques that will be used to obtain our results.

3.1. Presentation of the Study Area

This study focused on six of Gabon's nine provinces: Wouleu-Ntem, Haut-Ogooué, Ogooué-Ivindo, Moyen-Ogooué, Estuaire, and Nyanga. These provinces were selected as they serve as pilot areas for community forest management and collectively encompass over 90% of all community forests in Gabon with finalized agreements. Provinces with less than 10% of these forests, such as Ogooué-Maritime, Ogooué-Lolo, and Ngounié, were excluded from the scope of this study (Figure 1).



Source: Authors.

Figure 1. Map of Gabon's provinces.

According to the Direction Générale des Forêts, the total area of community forests in Gabon under definitive agreement encompasses 297282.86 hectares. These forests are allocated for various activities, with agroforestry accounting for 36.2% and other activities comprising the remaining 63.8% (see Chapter 1 for detailed breakdown).

3.2. Data Collection Method and Estimation Technique

This study adopts a positivist epistemology. Epistemology, as defined by Demaizière and Narcy-Combes (2007), encompasses the study of how knowledge is constructed and managed. Positivism, as a research paradigm, emphasizes the identification of regularities within observed phenomena to achieve predictive outcomes. This approach seeks to explain reality by identifying its inherent essence.

This study employs a hypothetico-deductive approach to investigate the causal relationship between state involvement in community forest management and environmental sustainability in Gabon. This research framework, rooted in the explanatory paradigm, seeks to understand how variations in state involvement influence environmental sustainability outcomes. Quantitative research, often utilizing questionnaires and large sample sizes (typically exceeding 30 observations), is well-suited for this approach. This methodology allows for the systematic analysis of relationships between variables, enabling researchers to identify potential causal links between state involvement and environmental sustainability.

3.2.1. Data Collection Process

This study relies on primary data collected through face-to-face interviews using a questionnaire. The target population consists of all state representatives involved in community forest management within each province. To gather data, we employed a non-probability sampling technique, specifically purposive sampling. This method allows the researcher to select respondents based on specific criteria, in this case, their role as state representatives involved in community forest management. This approach, while providing valuable insights into the perspectives of these specific individuals, may not be generalizable to the entire population of state representatives due to the inherent bias associated with non-probability sampling.

3.2.2. Estimation Technique

This chapter outlines the econometric model employed in the study, as the choice of estimation technique is contingent upon the model's structure. The primary objective of this chapter is to analyse the effect of state intervention on environmental sustainability within community forest management. Drawing upon the work of Hajjar et al. (2021) and Fischer et al. (2023) on environmental sustainability, the following econometric model has been formulated:

$$DE_i = K_i'\beta + \varepsilon_i; \{i = 1, 2, 3, \cdots, N\} \quad (1)$$

where DE_i is the sustainability indicator for community i, β a vector of unknown parameters, K_i' is the vector of control variables and ε_i the random term independently distributed according to a normal distribution with mean 0 and variance σ^2 and N is the number of observations.

The dependent variable, environmental sustainability, is linked to ecological balance. According to Nkemgha et al. (2024), human actions, particularly intensive agriculture, are impacting the planet through degradation and deforestation, leading to climate disruption. This study measures environmental sustainability

via three dichotomous variables: 1) wood harvesting for domestic use, 2) regular use of wood from the community forest as a source of energy, and 3) ability to assess the quantity of wood used on a daily basis. The sustainability indicator is the average of these three variables, varying between 0 and 1. The OLS model indicators do not converge, requiring Tobit-type modelling (Table 1).

Table 1. Construction of the durability index.

DE_index	Freq.	Percent	Cum.
0	53	10.43	10.43
0.3333333	65	12.8	23.23
0.6666667	226	44.4	67.61
1	164	32.37	100.00
Total	508	100.0	

Source: Authors.

The independent variable of interest (State involvement in community forest management) is captured in this study by six dichotomous variables coded as follows. The first variable is coded 1 if the state is directly involved in community forest management and 0 if it is not. Here, direct involvement takes the form of representation by the governor, prefect or central services in the process of allocating and managing the community forest.

The second variable takes the value 1 if community forest management can be carried out without technical and financial support from the State, and 0 otherwise. The third is coded 1 if the management process is participatory or collaborative, and 0 otherwise. The fourth is coded 1 if community forests can be managed without the technical and financial support of the municipality, and 0 otherwise. The fifth value is 1 if the local population is only marginally involved, and 0 otherwise. Finally, the sixth is 1 if the community's financial and technical capacity is weak, and 0 otherwise. These variables capture the weakness of governance and the technical and financial capacity to make the necessary adjustments. To avoid variable omission bias, we took into account control variables such as education, standard of living (average income) and average age. Clarke (1993) has shown that education promotes sustainable development. The level of household income has a significant influence on the environment (World Bank, 2007). Yang and Wang (2020) and Shi et al. (2023) have established the relationship between population ageing and carbon emissions. Table 2 below describes the variables in this chapter.

3.3. Estimation Technique

The estimation technique used is maximum likelihood applied to the Tobit model, which is often used when many observations have a zero endogenous value. Here, the environmental sustainability of communities varies between 0 and 1. The

dependent variable is censored by including observations with a zero value. The latent variable (DE_i^*) depends on the involvement of the State, the management mode, the technical and financial autonomy of the community, the commitment of the population and characteristics such as education, standard of living and average age (McDonald and Moffitt, 1980).

Table 2. Summary of study variables and their description.

Variables	Description	Obs	Mean	Std. Dev.	Min	Max
Environmental sustainability	Environmental Sustainability Index	408	0.763	0.223	0	1
Direct involvement of the State	1 if the State and other stakeholders are directly involved in community forest management and 0 if not	481	0.096	0.294	0	1
Technical and financial support from the State	1 if community forests can be managed without technical and financial support from the state and 0 if not	354	0.556	0.498	0	1
Collaborative management	1 if participative or collaborative management and 0 if not	424	0.774	0.156	0	1
Technical and financial support from local authorities	1 if community forests can be managed without technical and financial support from the municipality and 0 if not	354	0.226	0.419	0	1
Low public involvement	1 if there is little public involvement and 0 if not	470	0.074	0.263	0	1
Low tech capacity and community purpose	1 if the community's financial and technical capacity is low and 0 if it is not	470	0.104	0.306	0	1
Average age	Average age of the community	481	44.335	14.205	15	90
Level of education	1 if primary education; 2 if secondary education and 3 if tertiary education.	425	1.8	0.528	1	3
Standard of living	Average income in the community	450	157111.1	113395.6	50,000	1,000,000

Source: Author.

4. Presentation of Results

Our results are presented in three sections: analysis of the correlation matrix, interpretation of the main results, and consideration of heterogeneity in the analysis.

4.1. The Correlation Matrix

Table 3 presents the correlation matrix, revealing several key findings. Firstly, the absence of any correlation coefficient exceeding 0.8 between explanatory variables confirms the absence of severe multicollinearity. Secondly, education level and standard of living demonstrate positive correlations with environmental sustainability, while average age exhibits a negative correlation. Finally, the correlation between state involvement and environmental sustainability varies depending on the specific indicators of state intervention. It is crucial to remember that

correlation does not imply causation. Therefore, we will proceed to interpret the results of our econometric model to establish more robust causal relationships.

Table 3. Correlation analysis between the different variables in the study.

Variables	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
(1) durability	1.000									
(2) implication_direc	−0.055	1.000								
(3) State_Support1	−0.132*	−0.005	1.000							
(4) collaborative management	0.221*	−0.060	0.111	1.000						
(5) Support_commune	0.012	−0.031	−0.605*	−0.201*	1.000					
(6) low1	0.023	−0.033	−0.156*	−0.012	0.051	1.000				
(7) weakness 2	0.075	0.017	−0.139*	−0.019	0.101	−0.097*	1.000			
(8) average age	−0.116*	−0.016	0.097	0.019	0.012	−0.010	0.004	1.000		
(9) Level of education	0.059	0.061	−0.209*	0.013	0.006	−0.075	0.100*	−0.135*	1.000	
(10) Standard of living	0.034	0.070	−0.042	0.019	−0.024	−0.031	−0.006	−0.073	0.190*	1.000

***$p < 0.01$, **$p < 0.05$, *$p < 0.1$. Source: Author.

4.2. Main Results

Analysis of the effect of State involvement on environmental sustainability in Gabon using the Tobit method yields results that are shown in **Table 4**. As a reminder, the variable of State involvement in community forest management is captured in this work by six indicators: direct involvement of the State, absence of technical and financial support from the State, collaborative management, absence of technical and financial support from the communities, low involvement of the local population and low technical and financial capacity of the community.

Direct state involvement is not significantly correlated with environmental sustainability in Gabon (Column a). This means that representation of the governor, prefect or central services in the community forest allocation and management process is not sufficient to improve environmental sustainability.

The absence of technical and financial support from the State has a negative and significant effect on environmental sustainability (Column b). This result could be explained by the fact that technical assistance and financial support from the State are useful for training and equipping local communities (which are structured into associations) in the management of community forests. Although considerable efforts are being made by non-governmental organisations to support local associations, state support, whether technical or financial, is still necessary for these associations, the objective being the sustainable management of community forests. This result can be justified by the gap that may exist between the texts organising the management of community forests from the point of view of State

support and the reality on the ground. This situation highlights the principle of the "institutional bricoleur" and the "logic of practice", on the one hand, and raises the problem of the robustness of institutions, on the other. For the first case, the basic assumption of this principle is that humans do not really follow rules but improvise them according to their needs (De Koning, 2011; Cleaver and De Koning, 2015). To achieve their goals, bricoleurs will mobilise a combination of institutions (those embedded in society, those that are bureaucratic and those that are legal) and neglect others. This principle is similar to what Bourdieu (1990) calls the "logic of practice" in social life. According to this author, people act according to the logics rooted in society rather than according to the (new) rules, norms and incentives of institutions, unless the two worlds coincide. When it comes to the robustness of institutions, it is not enough simply to introduce new institutions but also to ensure that they are firmly rooted in society in order to produce the desired effects (Anderies, Janssen and Ostrom, 2004; Ostrom, 2009a). In the context of the GFC, for example, this involves imposing sanctions in the event of non-compliance with regulatory provisions and resolving potential conflicts (Dressler et al., 2017; Ostrom, 1990, 2009b).

Table 4. State involvement in CF management and environmental sustainability in Gabon.

	a	b	c	d	e	f	g
VARIABLES	sustainability	sustainability	sustainability	sustainability	sustainability	sustainability	sustainability
Direct involvement of the State	−0.0430 (0.0392)				−0.0215 (0.0552)	−0.000143 (0.0565)	0.0609 (0.0705)
Technical and financial support from the State		−0.0595** (0.0261)			−0.0907*** (0.0316)	−0.0854*** (0.0324)	−0.0393 (0.0426)
Collaborative management			0.319*** (0.0747)		0.427*** (0.0880)	0.441*** (0.0880)	0.408*** (0.106)
Technical and financial support from local authorities				0.00659 (0.0313)	−0.0325 (0.0371)	−0.0351 (0.0372)	0.0329 (0.0462)
Low public involvement						−0.0376 (0.0493)	−0.0343* (0.0585)
Low tech capacity and community purpose						0.0751* (0.0425)	0.104** (0.0492)
Average age							−0.00232* (0.00124)
Level of education							0.00463 (0.0306)
Standard of living							3.73e−09 (1.85e−07)
Constant	0.769*** (0.0115)	0.790*** (0.0187)	0.517*** (0.0592)	0.758*** (0.0150)	0.498*** (0.0747)	0.462*** (0.0785)	0.508*** (0.125)
Comments	508	508	508	508	508	508	508

Source: Author. Note: values in brackets are standard deviations of coefficients ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

In contrast to the absence of technical and financial support from the State, collaborative management has a positive and significant effect on environmental sustainability (Column c). This result is compatible with the collaborative management approach developed by Ansell and Gash (2008), which puts forward the idea that effective resource management requires collaboration between different stakeholders, including the state, local communities and NGOs. This approach emphasises the importance of cooperation and coordination between these actors to achieve sustainable management of natural resources, such as community forests. In this context, the state plays an essential role in facilitating and coordinating community forest management efforts. By acting as a mediator and facilitator, the state can help to bring the different stakeholders together, develop participatory governance mechanisms and promote the implementation of sustainable forest management policies and practices.

The lack of technical and financial support from the local authorities has no influence on environmental sustainability (Column d). This shows that better management of community forests cannot be achieved without the support of the commune. This can also be interpreted as a real absence of decentralisation. However, the theory of decentralisation formulated by Ribot (2002) puts forward the idea that decentralisation of natural resource management powers to local levels can improve efficiency and equity in the management of these resources. In the case of community forest management in Gabon, decentralisation could enable the needs and interests of local communities to be better taken into account in the management of forest resources.

In the same vein, strong support from local people is also necessary to achieve the desired objectives of the community forest. Weak local community involvement is negatively and significantly correlated with environmental sustainability. This result would be justified by behaviours or actions that hinder the achievement of the community forest's objectives (Column e). For example, illegal logging. This situation is compatible with the free rider theory, which postulates that any collective system generates free rider behaviour on the part of groups or individuals wishing to benefit from its advantages without paying the costs. In the context of sustainable development, this is the behaviour of individuals or groups who benefit from the efforts of others to improve the environment without bearing the costs. The generalisation of this type of behaviour is an obstacle to the management of public goods in the context of sustainable development policies. The stowaway theory has been used to explain the failure of joint management of a resource.

As for the community's low technical and financial capacity, it has a *reduced* positive and *significant* effect (0.0751) on environmental sustainability compared with the community that has no resources at all (Column f). This result would mean that technical and financial assistance from the government and/or the commune would enable local communities to better equip themselves to manage community forests optimally.

In the light of the above, it is clear that some indicators of State involvement in community forest management are conducive to environmental sustainability (collaborative management and the community's low financial and technical capacity), while others are more of a hindrance (the lack of technical and financial support from the State and the low level of involvement of local people).

In terms of control variables, standard of living and level of education have no effect on environmental sustainability. On the other hand, the average age of residents has a positive and significant effect on environmental sustainability (Column g). An increase of one unit in the average age of residents is associated with a 0.23% reduction in environmental sustainability. The behaviour and consumption habits of the elderly differ from those of the younger population due to the solidification of ideologies and the decline in physical functions. Taking energy use as an example, older people tend to spend a lot of time indoors, which implicitly increases the share of household energy consumption (Shi et al., 2023). These factors confirm the close relationship between ageing and carbon emissions.

The above results are for all six provinces in our study. Given that the six provinces do not have the same characteristics, an analysis specific to each region can highlight the disparities within our sample.

4.3. Taking Heterogeneity into Account

The aim of taking heterogeneity into account is to carry out a specific analysis of the involvement of the State in the management of community forests in each province. The results of this analysis are shown in **Table 5**.

Analysis of this table reveals several disparities. The first highlights the negative and significant correlation between direct state intervention and environmental sustainability in Ogooué-Irvindo. In contrast, no significant association was observed between the two variables in the other five provinces. This result can be explained by the fact that direct state involvement is reflected in inefficient management of community forests. The management of natural resources by representatives of the State is tainted by acts of corruption and bribery, which loggers use to avoid complying with environmental regulations, such as cutting protected species and not complying with technical logging standards, as they sometimes cut logs below the minimum logging diameter (MLD), which contributes to hindering environmental sustainability. When it comes to mapping community forests, the province of Ogooué-Irvindo represents a major challenge, as it contains 45% of all the community forests in Gabon. This is one of the reasons why the State should be heavily involved in this part of the country. This situation gives people the feeling that they are strangers in their own country. This leads to a lack of respect for authority and undermines the effectiveness of forestry policies (Mouloungui, 2010).

Table 5. Estimated impact of institutional management on environmental sustainability, by province.

	Ogooué Ivindo	Moyen-Ogooué	The Ngounié	Estuary	Woleu-Ntèm	Haut-Ogooué
VARIABLES	durability	durability	durability	durability	durability	durability
involvement_State2	−0.05729*	−0.0419	−0.1591	0.20	−0.0419	−0.0419
	(0.0927)	(0.0927)	(0.1349)	(0.133)	(0.22)	(0.0927)
State_Support2	0.5364***	0.666*	0.1022	0.133	−0.136**	0.119
	(0.100)	(0.100)	(0.2052)	(0.133)	(0.100)	(0.100)
participative_management	−0.0496***	0.4375	−0.0930	1.4**	−0.5076***	0.894***
	(0.197)	(0.197)	(0.0043)	(0.400)	(0.197)	(0.197)
State_Support1	0.0565	0.110	0.0043	−0.333**	0.110	0.110
	(0.0846)	(0.0846)	(0.1401)	(0.172)	(0.0846)	(0.0846)
difficulties2	0.0565	0.0728	0.2252**	0.0728	−0.253	0.0728
	(0.107)	(0.107)	(0.083)	(0.107)	(0.107)	(0.107)
difficulties4	0.0543	0.0442	0.1353**	0.0442	−0.0560	0.0442
	(0.0866)	(0.0866)	(0.083)	(0.0866)	(0.0866)	(0.0866)
Cons	0.4028	0.0155	0.7855***	−0.733	0.809***	0.0155
	(0.179)	(0.159)	(0.1867)	(0.418)	(0.040)	(0.217)
Obs	213	51	114	41	62	27

Source: Author. Note: values in brackets are standard deviations of coefficients ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$.

The analyses also reveal that the absence of technical support and financial assistance from the State would help to promote environmental sustainability in Ogooué-Irvindo and Moyen-Ogooué. The previous paragraph highlighted that the heavy involvement of the State is an obstacle to the management of community forests in Ogoué-Irvindo. Consistently, a reduction in this presence or a regulated presence of the State would enable representatives of local associations to better manage community forests in both Ogooué-Irvindo and Moyen-Ogooué. On the other hand, technical and financial support from the State would be very useful in the province of Woleu-Ntèm. This means that the associations located in Ogooué-Irvindo and Moyen-Ogooué are sufficiently equipped to manage their community forests effectively, which is not the case with those in Woleu-Ntèm, which will not be able to manage their community forests effectively without State support.

As far as participatory management is concerned, it has a negative and significant effect on environmental sustainability in both Ogooué-Irvindo and Woleu-Ntèm, which would indicate the existence of a conflict of interest between the State and the representatives of the local community associations. This conflict of

interest could be explained by the fact that State representatives are seeking to usurp the prerogatives that fall to local community associations. This outcome is consistent with the principle of the 'institutional bricoleur', which states that humans do not really follow the rules but improvise them according to their needs (De Koning, 2011; Cleaver and De Koning, 2015). To achieve their goals, bricoleurs will mobilise a combination of institutions (those embedded in society, those that are bureaucratic and those that are legal) and neglect others.

The positive correlation between participatory management and environmental sustainability in Estuaire and Haut-Ogooué shows the absence of conflict of interest between the state and local associations, underlining the importance of collaborative governance (Ansell and Gash, 2008). In contrast, the lack of technical and financial support from the commune is negatively correlated with environmental sustainability in the Estuaire, indicating that communal support is crucial to improving community forest management.

The results show that the low level of commitment and financial capacity of local communities in Ngounié favours environmental sustainability. This is explained by the absence of environmentally damaging actions and suggests that technical capacity building and financial support would improve forest management (Dalimier et al., 2022).

5. Conclusion

The general objective of this chapter is to analyse the effect of government involvement in community forest management in Gabon. The methodological approach was based on primary source data collected as part of the CERDIMO survey of 508 people (local communities, government representatives in decentralised services and commune agents) in six provinces of Gabon (Ogooué-Ivindo, Moyen-Ogooué, Ngounié, Estuaire, Woleu-Ntèm, Haut-Ogooué) by means of a questionnaire between May and August 2024. Based on three questions, we defined an environmental sustainability index. Given that the dependent variable is continuous and limited, we used Tobit as the estimation technique. Our analyses show that the lack of technical and financial assistance and the low level of commitment on the part of the local population are obstacles to environmental sustainability. On the other hand, collaborative management has a positive and significant influence on environmental sustainability. The specific analysis of each sub-region has enabled us to identify a number of disparities. Direct state intervention is negatively correlated with environmental sustainability in Ogooué Ivindo. Furthermore, technical and financial support from the state would be more useful in Woleu-Ntem than in Ogooué-Ivindo and Moyen-Ogooué. Finally, participatory management is an obstacle to environmental sustainability in the latter two provinces.

6. Recommendations

The results show that municipalities lack of resources hampers community forest

management, as they are unable to provide the necessary technical and financial assistance. In addition, state intervention in some provinces has been counterproductive, leading to conflict or ineffective intervention. It is recommended that the Gabonese State revise the texts on the creation of community forests to bring them into line with changes in the environment, decentralising resources to municipalities so that they can support local communities. The State must play two major roles in this process. The first role is to transfer available resources (material or financial). The second role is to monitor the effective use of these resources. Over and above this control, the State must constantly monitor whether the laws governing the community forest management process are being respected. These controls are part of its regalian missions. This permanent watch is also intended to dissuade its decentralised services from using the authority of the State to overstep the limits of their functions or usurp the prerogatives that fall within the remit of the local community associations. It is in this way that participative management will be inclusive and non-confrontational, to the great benefit of the environment. What's more, the associations responsible for managing community forests need to be trained or equipped in the means of recourse in the event of disagreement or dispute. First and foremost, the path of dialogue and consensus should be favoured. If consensus fails to resolve a dispute between stakeholders, the courts could be the last resort. In any case, the survival of the community forest and the achievement of sustainable development objectives in Gabon depend on agreement within the associations, between the associations, the public authorities and the other players in the chain involved in the community forest management process.

7. Limit and Further Research

Two main limitations derive from this study. The first highlights the absence of the alternative index of sustainable development that may be useful to perform the sensitivity analysis. Concerning the second limitation, it underlines the absence of the qualitative analysis, which is featured by the deep analysis on a given question or relationship. Therefore, the future study will combine both the qualitative and quantitative analyses. In addition, it will design a questionnaire that can gather information to construct two or three indicators of the environmental sustainability, with the aim to perform the robustness of our results.

Conflicts of Interest

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

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