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Development of Carbon Credits in the Congo Basin: Current Status, Climate Finance Challenges and Prospects in COMIFAC Countries

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Abstract

In the face of intensifying climate change, carbon market mechanisms are emerging as key instruments for mobilizing climate finance in favor of developing countries. The member countries of the Central African Forest Commission (COMIFAC), which host the Congo Basin the world's second-largest tropical forest play a crucial role in global climate regulation and carbon sequestration. This article provides an overview of the current state of carbon credit development in COMIFAC countries. In this study, "carbon credit development" is defined as the set of processes including: (i) the establishment of policy and institutional frameworks, (ii) the preparation and implementation of carbon projects, (iii) the generation and certification of carbon credits, and (iv) the mobilization of associated financing. The study is based on a documentary and institutional analysis drawing on sources from international organizations, scientific publications, and regional reports. The results show that, despite considerable ecological potential, the effective integration of COMIFAC countries into carbon markets remains limited. This situation is mainly explained by weak institutional frameworks, land tenure uncertainties, high certification costs, and still insufficient technical capacities in measurement, reporting, and verification (MRV) of emissions. The analysis also distinguishes between different carbon financing channels, including voluntary carbon markets, results-based REDD+ payments, and mechanisms under Article 6 of the Paris Agreement, which present varying requirements and levels of maturity across the region. The study highlights the need to strengthen public policies, institutional capacities, and governance mechanisms in order to enable countries in the region to better leverage their forest capital in carbon markets.

Keywords

Carbon Credits, Climate Finance, COMIFAC, Congo Basin, REDD+, Forest Governance

1. Introduction

Climate change is currently one of the major challenges to sustainable development at the global scale. Greenhouse gas (GHG) emissions resulting from human activities—particularly deforestation, agriculture, and the use of fossil fuels—are recognized as the main drivers of global warming [1]. In order to limit the increase in global temperatures, the international community has developed several economic instruments aimed at reducing emissions, including carbon markets and carbon credit mechanisms.

Carbon credits are based on the principle that activities that reduce or sequester greenhouse gas emissions can generate tradable units on specialized markets [2]. These mechanisms have gradually evolved from the Kyoto Protocol to the Paris Agreement, which explicitly recognizes the role of market-based instruments in mobilizing climate finance [3].

Under the Paris Agreement framework, it is important to distinguish three main mechanisms: (i) voluntary carbon markets, (ii) results-based REDD+ payments, and (iii) international cooperation mechanisms under Article 6. These instruments differ in terms of governance, certification, and financing modalities, and should not be considered interchangeable.

In this context, the member countries of the Central African Forest Commission (COMIFAC) occupy a strategic position in the fight against climate change. The region hosts the Congo Basin, which is the second-largest tropical forest in the world after the Amazon and plays a crucial role in global climate regulation [4].

Despite this considerable ecological potential, the effective participation of COMIFAC countries in carbon markets remains relatively limited. Carbon projects are still few in number and face several institutional, technical, and economic constraints [5].

To what extent are COMIFAC countries able to leverage their forest potential through carbon credit mechanisms, and what factors limit the development of this market in the region?

The main hypothesis of this study is that the limited development of the carbon credit market in COMIFAC countries is primarily explained by institutional constraints related to insufficient regulatory frameworks, technical constraints linked to limited emission monitoring capacities, and economic constraints associated with the high costs of certification and carbon project development.

The overall objective of this study is to analyze the current state of development of the carbon credit market in COMIFAC member countries.

The specific objectives are:

1) To analyze the forest and carbon potential of the Congo Basin;

2) To identify the main types of carbon projects developed in the region;

3) To analyze the institutional, technical, and economic constraints limiting the development of the carbon market.

2. Materials and Methods

The study area corresponds to the member countries of the Central African Forest Commission (COMIFAC). This regional organization comprises ten countries: Cameroon, Central African Republic, Republic of the Congo, Democratic Republic of the Congo, Gabon, Equatorial Guinea, Chad, Burundi, Rwanda, and São Tomé and Príncipe (see Figure 1).

These countries host a large portion of the Congo Basin, which covers approximately 240 million hectares of tropical forests and represents one of the world's major carbon sinks [4].

The forest ecosystems of this region play a key role in:

1) carbon sequestration,

2) biodiversity conservation,

3) regional and global climate regulation,

4) the livelihoods of millions of rural populations.

These characteristics give the region significant potential for the development of carbon credit projects based on nature-based solutions.

Note: Source: Atyi *et al.* [6]

Figure 1. Map of the Congo Basin showing COMIFAC member countries and carbon sequestration potential.

3. Methodology

The methodology adopted in this study is based on a qualitative approach combining documentary analysis, comparative analysis, and institutional analysis.

Sources were selected according to an explicit protocol: the databases consulted include Google Scholar, Web of Science, as well as institutional platforms (FAO, CIFOR, COMIFAC, OFAC, World Bank). The period covered extends from 2010 to 2024 in order to capture recent developments related to the Paris Agreement. The inclusion criteria were based on scientific relevance, institutional credibility, and data timeliness.

The comparative analysis consisted of classifying the identified carbon projects according to their typology (REDD+, reforestation, conservation), while the institutional analysis made it possible to group constraints into three categories—namely institutional, technical, and economic—based on an analytical framework inspired by the literature on climate governance.

This approach relies primarily on the use of secondary sources, including institutional reports, scientific publications, and technical documents produced by international organizations involved in forest management and carbon markets in the Congo Basin.

1. Analysis of the Forest and Carbon Potential of the Congo Basin

To assess the forest and carbon potential of the Congo Basin, an in-depth documentary analysis was conducted. This analysis was based on reports and databases produced by the Central African Forest Commission and the Central African Forest Observatory, which provide up-to-date information on forest extent, carbon stocks, and deforestation dynamics in the region [7] [8].

Data from reports by the Food and Agriculture Organization of the United Nations and the Center for International Forestry Research were also used to analyze the contribution of Congo Basin forests to carbon sequestration and their role in climate change mitigation [9] [10]. This analysis highlights the strategic importance of the region in international climate-related mechanisms.

2. Identification of the Main Types of Carbon Projects Developed in the Region

The identification of carbon project typologies developed in Congo Basin countries was based on a comparative analysis of existing initiatives. This analysis focused on projects identified in institutional reports and databases of international initiatives operating in the region.

The information collected was drawn in particular from publications by the Central African Forest Initiative (CAFI), COMIFAC, and various scientific studies on climate finance mechanisms [7].

This comparative analysis made it possible to identify the main categories of carbon projects developed in the region, including projects aimed at reducing emissions from deforestation and forest degradation (REDD+), reforestation and afforestation projects, as well as initiatives related to sustainable forest management and forest landscape restoration.

3. Analysis of Institutional, Technical, and Economic Constraints to Carbon Market Development

The analysis of constraints limiting the development of carbon markets in Congo Basin countries is based on an institutional and analytical review of regulatory frameworks and public policies related to carbon markets and climate change.

This analysis relies on the examination of national climate strategies, legal frameworks governing carbon projects, as well as documents produced by international organizations operating in the region [7] [9] [10].

It aims to identify the main institutional, technical, and economic barriers, including weaknesses in regulatory frameworks, limited technical capacity for the design and certification of carbon projects, and difficulties in accessing international financing required for the implementation of these initiatives.

4. Results

4.1. Forest and Carbon Potential of the Congo Basin

The documentary analysis of data from reports by the Central African Forest Commission and the Central African Forest Observatory shows that the Congo Basin is one of the largest forest carbon reservoirs in the world. Forests in this region cover approximately 240 million hectares, representing nearly 6% of global forest area [4] (see **Table 1**).

These forest ecosystems play a major role in carbon sequestration and storage, with estimated stocks exceeding 60 billion tons of carbon, thereby contributing significantly to global climate regulation [8] (see **Table 1**).

Furthermore, the analysis shows that nature-based solutions—including reforestation, agroforestry, and conservation of natural forests—offer significant potential for generating carbon credits while producing environmental and socio-economic co-benefits such as biodiversity conservation, improved livelihoods, and the restoration of degraded landscapes [11].

Table 1. Forest and carbon potential of the Congo Basin.

Indicator	Estimated value	Source
Total forest area	~240 million ha	[8]
Share of global forests	~6%	[4]
Total forest carbon stock	~60 billion tons	[8]
Contribution to tropical carbon sinks	~25%	[10]

These results confirm that the Congo Basin represents a strategic area for the development of carbon markets, particularly within the framework of international climate change mitigation policies.

4.2. Typology of Carbon Projects Developed in the Region

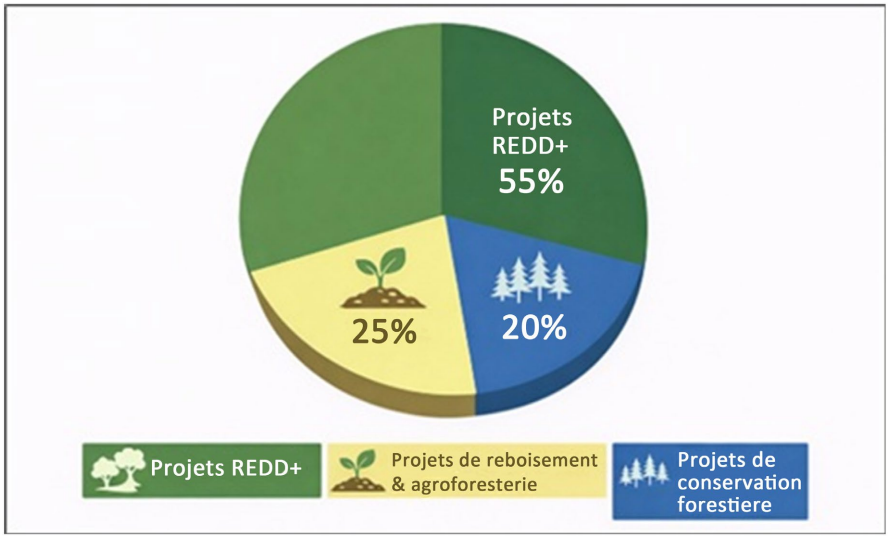
The comparative analysis of initiatives identified in COMIFAC member countries

highlights a diversity of carbon projects, mainly concentrated in three major categories: REDD+ projects, reforestation and afforestation projects, and forest conservation initiatives.

REDD+ projects (Reducing Emissions from Deforestation and Forest Degradation) constitute the most represented category in the region. They aim to limit forest cover loss while improving the sustainable management of natural resources.

Reforestation and afforestation projects are also being developed in some countries to restore degraded forest landscapes and increase carbon stocks.

Finally, forest conservation projects primarily focus on protecting intact forests and areas of high ecological value (Figure 2 and Table 2).



Note: Source: Peters-Stanley & Yin [12].

Figure 2. Typology of carbon projects.

Table 2. Typology of carbon projects in Congo basin countries.

Type of carbon project	Main objective	Examples of activities
REDD+	Reduction of emissions from deforestation	Sustainable forest management, combating illegal logging
Reforestation/ Afforestation	Increase in carbon stock	Tree planting, landscape restoration
Forest conservation	Protection of intact forests	Establishment of protected areas, forest monitoring

These projects make it possible to generate certified carbon credits that can be traded on voluntary carbon markets or within certain international climate finance mechanisms [5].

4.3. Constraints to Carbon Credit Development

Despite the considerable potential of the Congo Basin, institutional analysis re-

veals several major constraints that limit the development of carbon projects in the region (Table 3).

1. Institutional constraints

One of the main constraints relates to the absence or insufficiency of clear legal frameworks regarding land tenure and carbon rights. In several countries in the region, land tenure systems remain characterized by strong state centralization of forest ownership, which may complicate the implementation of carbon projects involving local communities [13].

Moreover, governance mechanisms related to carbon credit management are still under development in some countries.

2. Technical constraints

The implementation of carbon projects requires the establishment of Measurement, Reporting, and Verification (MRV) systems to accurately assess emission reductions or the amount of carbon sequestered.

However, several Congo Basin countries still have limited technical capacities, particularly in remote sensing, forest inventories, and carbon modeling [14].

3. Economic constraints

Carbon projects also involve high costs related to project design, validation, certification, and monitoring. These costs may constitute a significant barrier for local project developers, particularly community-based organizations and small national entities [15].

Table 3. Main constraints to the development of carbon projects.

Type of constraint	Description
Institutional	Incomplete legal frameworks, uncertainty regarding carbon rights
Technical	Limited MRV capacity, lack of reliable forest data
Economic	High certification costs and limited access to financing

A comparative analysis among COMIFAC member countries highlights significant differences. For example, the Democratic Republic of the Congo and Gabon show more advanced progress in REDD+ frameworks and MRV systems, whereas other countries such as Chad or the Central African Republic exhibit lower levels of institutional readiness.

Similarly, carbon project activity is more developed in countries benefiting from structured international support and stronger environmental institutions.

5. Discussion

The results confirm the initial hypothesis that institutional, technical, and economic constraints explain the limited development of carbon credits in the region. Evidence from the documentary analysis shows that:

1) institutional constraints are reflected in the absence of clear legal frameworks governing land tenure and carbon rights;

2) technical constraints are demonstrated by gaps in MRV systems and the lack of reliable forest data;

3) economic constraints are characterized by high certification costs and limited access to international financing.

These findings also highlight the strategic role that the Congo Basin could play in international climate finance mechanisms based on carbon markets. The analysis of forest potential confirms that this region represents one of the largest forest carbon reservoirs in the world, with approximately 240 million hectares of forests and more than 60 billion tons of carbon stored in forest ecosystems [4] [8]. These figures corroborate findings from several scientific studies indicating that Central African forests constitute a major global carbon sink, significantly contributing to climate regulation and greenhouse gas mitigation [10]. In this context, the development of carbon credits appears as an important opportunity to mobilize international financing for forest conservation and sustainable management.

The results related to the typology of carbon projects show that existing initiatives in the region are mainly concentrated in three categories: REDD+ projects, reforestation and afforestation projects, and forest conservation initiatives. The predominance of REDD+ projects in the Congo Basin is largely explained by the extent of intact forest areas and the high potential for reducing emissions from deforestation and forest degradation. This trend is consistent with findings from studies conducted in several tropical countries, which show that REDD+ projects currently represent one of the main instruments for generating carbon credits in forest regions [5]. However, the results of this study also suggest that nature-based solutions—such as reforestation, agroforestry, and forest landscape restoration—offer complementary opportunities to increase carbon credit generation while producing environmental and socio-economic co-benefits, particularly in terms of biodiversity conservation and improved rural livelihoods [11].

Despite this considerable potential, the institutional analysis highlights several major constraints limiting the development of carbon markets in Congo Basin countries. Institutional constraints emerge as one of the most significant barriers. The absence of clearly defined legal frameworks regarding land tenure and carbon rights creates uncertainty for investors and project developers. In several countries in the region, land tenure systems are characterized by strong state centralization of forest ownership, which may limit the effective involvement of local communities in carbon projects and complicate the establishment of benefit-sharing mechanisms [13]. Clarifying these rights therefore appears to be a critical condition for securing investments and promoting large-scale carbon project development.

Technical constraints also represent a major challenge for the credibility and viability of carbon projects in the region. The implementation of such projects requires robust Measurement, Reporting, and Verification (MRV) systems to accurately quantify emission reductions or carbon sequestration. However, in many Congo Basin countries, national capacities in forest inventories, remote sensing, and data analysis remain limited [14]. Strengthening technical and institutional capacities

is therefore a key lever for improving the quality of carbon data and enhancing the environmental credibility of carbon credits generated in the region.

Furthermore, the economic constraints identified in this study show that the costs associated with developing carbon projects can constitute a significant barrier for local actors. Project design, validation, certification, and monitoring processes often require substantial financial investments as well as the involvement of specialized experts. These costs may limit access to carbon markets for local organizations and rural communities, which are often overshadowed by international investors and large organizations [15]. In this context, the establishment of appropriate financing mechanisms—such as carbon project support funds or public-private partnerships—could facilitate the emergence of local initiatives.

Moreover, the issue of equitable benefit-sharing represents a central challenge for the sustainability of carbon projects in the Congo Basin. The results of this study emphasize the importance of involving local communities in the design and implementation of projects to ensure social acceptability and long-term effectiveness. Benefit-sharing mechanisms should enable a fair distribution of revenues from carbon credits among governments, investors, and local populations, particularly those directly dependent on forest resources for their livelihoods [16]. Inclusive and transparent governance thus appears to be a key condition for preventing land conflicts and ensuring the long-term sustainability of carbon initiatives.

Finally, the findings suggest that carbon credits should not be considered as a standalone solution to the challenges of financing forest conservation, but rather as a complementary instrument within a broader sustainable forest management strategy. This strategy should integrate other climate finance mechanisms, such as international climate funds, payments for ecosystem services, and sustainable rural development programs. In this perspective, carbon credits could contribute to strengthening national policies to combat deforestation while supporting sustainable development goals in Congo Basin countries.

Furthermore, differentiating between carbon financing mechanisms helps to better understand the observed dynamics. Voluntary carbon markets offer short-term opportunities but present uncertainties in terms of pricing and credibility. Results-based REDD+ payments are more structured but require high institutional capacity. Article 6 mechanisms represent an emerging opportunity; however, their implementation remains limited in COMIFAC countries.

Thus, the development of carbon markets in this region will largely depend on the ability of states to strengthen their institutional frameworks, technical capacities, and governance mechanisms in order to create an enabling environment for investment while ensuring sustainable benefits for local populations and forest ecosystems.

Conflicts of Interest

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

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