



# American Journal of Environmental Economics (AJEE)

ISSN: 2833-7905 (ONLINE)

VOLUME 4 ISSUE 1 (2025)



PUBLISHED BY  
E-PALLI PUBLISHERS, DELAWARE, USA

## The Future of Carbon Offset Markets in Africa: Towards Equitable Climate Finance

Richard Mulenga<sup>1\*</sup>

### Article Information

**Received:** September 19, 2025

**Accepted:** October 25, 2025

**Published:** December 06, 2025

### Keywords

*Africa, Carbon Colonialism,  
Carbon Offset Markets, Climate  
Finance, Climate Policy*

### ABSTRACT

This study critically examines the adoption and implementation of carbon offset markets in Africa through a systematic literature review guided by the PRISMA framework and complemented by a bibliometric analysis using VOSviewer. Drawing on peer-reviewed articles and reports published between 2000 and 2025, the review assesses key dimensions, including project design, governance structures, stakeholder engagement, and environmental outcomes. Findings reveal that Africa's offset carbon markets are expanding but remain hindered by weak governance, limited transparency, and inequitable benefit-sharing, which often allow intermediaries to capture disproportionate value, fueling perceptions of "carbon colonialism." Inadequate baseline methodologies and weak monitoring, particularly in forestry and cookstove projects, further erode the credibility of the offset markets. Nevertheless, Africa's comparative advantage in nature-based solutions, including forestry and blue-carbon ecosystems, presents vast potential for generating high-integrity credits that benefit biodiversity and livelihoods. The study proposes a framework emphasising free, prior, and informed consent (FPIC), transparent benefit-sharing, independent monitoring, and digital, monitoring, reporting and verification (MRV) systems to enhance integrity and community trust. It further recommends establishing transparent price-discovery mechanisms and Paris Agreement Article 6-aligned national registries to prevent double-counting and strengthen regulatory coherence. By advancing community-centred governance and high-integrity standards, African carbon offset markets can mobilise substantial climate finance and contribute effectively to global emission reduction goals, positioning the continent as a credible partner in the low-carbon transition. JEL Classifications: Q54, O13, F18.

### INTRODUCTION

This study conducts a critical examination of the adoption and implementation of carbon offset markets in Africa through a systematic literature review guided by the PRISMA framework and complemented by a bibliometric analysis using VOSviewer. Drawing on peer-reviewed articles and reports published between 2000 and 2025, the review assesses key dimensions of the carbon offset market in Africa, including project design, governance structures, stakeholder engagement, and environmental outcomes. The Intergovernmental Panel on Climate Change, IPCC (2022), ranks the African region as one of the most climate-vulnerable regions in the world. It is experiencing rising temperatures, unpredictable rainfall patterns, and an increasing frequency of droughts and floods. With the rise in global climate goals, carbon offset markets have become central to global climate finance. Carbon markets have become crucial to international climate finance and mitigation efforts. Carbon compliance markets (CCMs) facilitate significant emission reductions through enforceable mechanisms, while voluntary carbon markets (VCMs) are crucial for funding innovative, community-driven climate solutions (ICAP, 2023). However, VCMs face challenges like credibility, greenwashing, and inconsistent standards (ACMI, 2023). Improving transparency and aligning voluntary credits with Article 6 of the Paris Agreement could enhance their legitimacy and effectiveness. Carbon offsets are mechanisms under VCMs. They represent

reductions or removals of greenhouse gases (GHGs, also referred to as tonnes of carbon dioxide equivalent (tCO<sub>2</sub>e). (ICAP, 2023). Africa, rich in biodiversity and endowed with extensive land-based carbon sinks, has emerged as a key player in the voluntary offset market. The African Carbon Markets Initiative (ACMI, 2023) report highlights the benefits of high-integrity carbon markets in Africa. It highlights the role of voluntary carbon projects in promoting job creation, enhancing food security, fostering climate resilience, and supporting biodiversity, all of which align with the Sustainable Development Goals (SDGs). Nevertheless, ACMI (2023) acknowledges that global although global carbon markets have flaws, they however, can yield carbon markets are not without flaws; however, they can yield significant environmental and economic advantages for communities, provided that a concerted effort is made. Despite the potential opportunities presented by carbon offset markets, VCMs in the African region continue to face various challenges. These challenges include corruption and integrity related to offsets originating from Africa, weak governance systems, and a lack of organization and transparency among offset carbon markets in Africa (ACMI, 2023; UNEP, 2022). Against this backdrop, this study conducts a systematic and critical literature review regarding the adoption and implementation of carbon offset markets in Africa, guided by the PRISMA framework and a bibliometric analysis conducted using VOSviewer. The study analyses peer-reviewed articles and reports from

<sup>1</sup> Department of Economics, ZCAS University, Lusaka, Zambia

\* Corresponding author's e-mail: [richardmulenga2@gmail.com](mailto:richardmulenga2@gmail.com)

2000 to 2025 from relevant academic and professional databases, focusing on project design, governance structures, stakeholder engagement, and environmental

impacts. Carbon markets are generally categorised into two types: compliance carbon markets (CCMs, also known as cap-and-trade or emissions trading systems,

**Table 1:** Key Differences between Compliance and Voluntary Markets

Aspect	Compliance Market	Voluntary Market
Regulation	Mandated by international(national)law e.g., EU ETS,	No legal requirement, participation is voluntary
Participants	Companies with emission reduction obligations or mandates	Individuals, local communities, NGOs, companies
Price Stability	Generally, highly stable as the prices are regulated	Usually, the prices are more variable as they are dictated by the market forces of demand and supply
Purpose	To meet legal obligations and Nationally Determined Contributions, NDCs	To meet corporate social responsibility (CSR), reputational benefits and Net-Zero Pledges
Scale	Relatively larger, with billions of tons of greenhouse gases (GHGs) traded annually	Relatively more minor but growing rapidly, with expected USD 50Billion in trade by 2030 (Taskforce on Scaling VCM, 2021)

Source: Adapted from ICAP 2023, ACMI, 2023, IPCC, 2022, & Taskforce on Scaling up VCM, 2021

ETS) and voluntary carbon markets (VCMs). Table 1 reports the key differences between CCMs and VCMs.

**Types and Processes of Carbon Offset Projects in Voluntary Carbon Markets**

The process of how carbon offsets work in VCMs involves the generation of carbon offsets, certification, purchase and retirement (ACMI, 2023). Offsets are typically generated via projects that remove or reduce carbon emissions via activities such as methane capture, renewable energy, reforestation and improved cookstoves, among others (Gold Standard, 2021). Certification basically involves verification by third-party standards such as Gold Standard, Plan Vivo, to ensure real, additional and permanent reductions, whereas the purchase and retirement stage aims at the purchase and retirement of offsets to claim carbon neutrality (or net-zero pledges) by corporations or firms (World Bank, 2022). Arising from the carbon offset process, three types of offset projects are generally observed in voluntary carbon markets. The first type is called Nature-Based Solution (NBS) projects. This involves afforestation and reforestation, Wetland and mangrove restoration, and avoiding deforestation through Reducing Emissions from Deforestation and

Forest Degradation plus (REDD+) Projects such as Zambia’s community forestry and Kenya’s Chyulu Hills initiatives that generate offsets and augment biodiversity simultaneously (Bastos Lima *et al.*, 2021). The second type is known as Energy and Technology (E&T) projects, which involve renewable energy projects (for instance, hydro, solar and wind), methane capture from livestock and landfills and clean cookstoves for reducing biomass fuel use in rural households (ACMI, 2023; World Bank, 2022). Blue Carbon (BC) projects, the third type, focus on carbon stored in coastal ecosystems, such as mangroves and seagrasses. This is relevant for African states such as, among others, South Africa, Mozambique, Congo DRC, Kenya, Namibia and Tanzania.

**Survey of Jurisdictions with Carbon Offsets in Africa**

Table 2 reports the countries of African governments that have implemented an official carbon-offset mechanism, which includes REDD+ ERPAS, Paris Agreement Article 6 authorisations, carbon market regulations, or carbon taxes with offsets.

According to the survey, twenty one of the fifty four countries in the African region have implemented carbon offset mechanisms. This implies that 38% of the countries

**Table 2:** Survey of Carbon Offset Mechanisms in Africa: 2000-2025

Country	Mechanism type	year started	Official Legal Reference
South Africa	Carbon tax with offsets (Carbon Offsets Regulations)	2019	treasury.gov.za
Kenya	National carbon markets regulations; Article 6.2 bilateral; JCM partner	2024	Kenyalaw.org
Tanzania	JCM partnership (Article 6-based bilateral)	2025	mofa.go.jp
Ethiopia	JCM partnership; Jurisdictional REDD+ ERPA (ISFL/OFLP)	2013	mofa.go.jp
Uganda	Climate Change Mechanisms Regulations (Article 6 domestic rules)	2025	nema.go.ug

Rwanda	National Carbon Market Framework	2023	rema.gov.rw
Zambia	Carbon Market Framework (guidelines & Act)	2023	mgee.gov.zm
Zimbabwe	Carbon Credits Trading Regulations	2023	veritaszim.zm
Ghana	Article 6.2 cooperative approach; FCPF ERPA (REDD+)	2019	bafu.admin.ch
Senegal	Article 6.2 bilateral with Switzerland; JCM partner	2021	click.ch.senegal
Ivory Coast	REDD+ ERPA (FCPF, jurisdictional)	2021	forestcarbonpartnership.org
Cameroon	REDD+ ERPA (FCPF, jurisdictional)	2019	forestcarbonpartnership.org
Republic of the Congo	REDD+ ERPA (FCPF, jurisdictional)	2021	documents1.worldbank.org
Mozambique	REDD+ ERPA (FCPF, jurisdictional)	2019	worldbank.org.mozambique
Madagascar	REDD+ ERPA (FCPF, jurisdictional)	2020	worldbank.org.madagascar
Gabon	REDD+ results-based payments (CAFI)	2019	undp.org.gabon
Nigeria	Climate Change Act (framework enabling carbon markets)	2021	fao.org.nigeria
Egypt	Regulated voluntary carbon market (EGX/EGCX)	2024	egcx.com.eg
Tunisia	Article 6.2 bilateral with Switzerland; JCM partner	2023	click.ch.tunisia
Morocco	Article 6 cooperation (MoU); Article 6.4 host participation	2023	unfccc.int.morocco

Source: Author's elaboration from various official sources as indicated in the links.

Notes: According to UNECA (2023) and ACMI (2023) reports, several other countries, such as Namibia, Botswana, Liberia, Sierra Leone, and Malawi, are drafting or considering carbon-market regulations (Paris Article 6 pathways) but had not fully operationalised them at the time of writing this paper. These were not included in the survey.

in the region have carbon offset markets. Eighteen of these countries are in Saharan Africa (SSA), and three are in the Middle East and North Africa (MENA) region. According to ICAP's (2025) Status Report, as of July 2025, no ETS were in force in Africa. South Africa's carbon tax is the continent's only compliance carbon credit market.

### Empirical Literature Review

#### The Theoretical Models Guiding Carbon Offset Mechanisms

Carbon offset markets have emerged as a significant mechanism for addressing climate change by assigning value (or price) to carbon emissions and their reductions. The theoretical foundations of these markets are rooted in economics, environmental policy, and institutional design. This section outlines the key theories that underpin carbon offset markets, specifically externality theory, the Coase theorem, commons and public goods theory, and market-based regulation. It also connects them to wider sustainability and financial frameworks.

#### Externality Theory

Pigou (1920) asserted that pollution constitutes a negative externality, resulting in social costs that are not accounted for in private market exchanges. The socially optimal level of emissions is attained when the marginal social cost

(MSC) is equal to the marginal social benefit (MSB)  
 $MSC(Q) = MPC(Q) + MEC(Q)$  ....(1)  
 Where MPC is the marginal private cost and MEC is the marginal external cost. Carbon offset markets seek to rectify this imbalance by assigning a price to emissions via offsets. Companies have the option to either reduce emissions on their own or acquire credits from initiatives that mitigate emissions in other locations, thereby aligning private interests with societal welfare (Stavins, 1997).

#### The Coase Theorem-Property Rights Approach

Coase (1960) proposed that when property rights are distinctly articulated and transaction costs are minimal, parties can negotiate efficient results irrespective of the original distribution of rights. This concept is evident in carbon markets, which operate through tradable carbon allowances or credits, imposing a constraint on firms:  
 $E_i \leq A_i + C_i$  ....(2)  
 Where  $E_i$  is the emission of firm  $i$ ,  $A_i$  is allocated pollution allowances,  $C_i$  are purchased credits. Through trading, firms with high abatement costs can buy credits from those with low costs, helping to achieve cost-effective carbon (GHG) reductions (ICAP, 2022).

#### Commons and Public Good Theory

The atmosphere constitutes a global common, while climate stability is regarded as a public good characterised

by being non-excludable and non-rivalrous in consumption (Markusen, 1975; Hardin, 1968). In the absence of intervention, the phenomenon known as the “tragedy of the commons” emerges, wherein each participant seeks to maximise individual gain to the detriment of the collective. This situation can be articulated as:

$$\max U_i = B(E_i) - C(E_i) \quad \dots(3)$$

Subject to  $\sum E_i \leq E^*$ , where  $E^*$  is the global emission threshold.

Carbon offset markets aim to incorporate this constraint by establishing enforceable boundaries and distributing accountability among various stakeholders.

### Market-Based Environmental Regulation

Market-based instruments (MBIs), which include carbon taxes and tradable permits, are perceived as more efficient than command-and-control regulations (Baumol & Oates, 1988). In the CMs (Cap-and-trade or Emissions trading systems, ETS), firms minimize costs by solving:

$$\min \sum_i C_i(E_i) \text{ subject to } \sum_i E_i \leq \bar{E} \quad \dots(4)$$

Where  $C_i(E_i)$  is firm  $i$ 's abatement cost function, and  $\bar{E}$  is the emissions cap. Offsets expand this market mechanism by permitting reductions beyond regulated jurisdictions, increasing flexibility and reducing compliance costs (Ellerman *et al.*, 2010).

### Broader Theoretical Foundations

Carbon offset markets, rooted in financial economics, act as hedging tools against regulatory and reputational risks (Calel & Dechezleprêtre, 2016). Sustainability theories highlight co-benefits such as poverty reduction and biodiversity, while institutional economics stresses the importance of governance and verification (Ostrom, 2009).

### Status of Voluntary Carbon Markets in Africa

VCMs in Africa originated from early smallholder/Plan Vivo and community forestry initiatives during the 2000s, progressed into nature-based solutions (NBS) throughout the 2010s, experienced a significant increase in 2021 to 2022, and subsequently encountered a correction focused on integrity in 2023–2024, with governance reforms reaching maturity in 2024–2025 (Ecosystem Marketplace, 2024-2025; ACMI, 2022, 2024–25). Africa's involvement in VCMs is still in its early phases as of 2023, when compared to other regions like Asia and Latin America. Nonetheless, the continent has demonstrated significant room for expansion, as more and more projects in a variety of industries are being developed (Ecosystem Marketplace, 2023). The main drivers of demand for African carbon credits are international businesses looking to offset their carbon footprints and achieve sustainability goals. Soil carbon sequestration projects which aim to improve agricultural practices to enhance soil carbon storage are becoming more prevalent across the continent. There are still a number of challenges the African VCM must overcome. The market is extremely

fragmented, making it difficult for projects to scale up due to limited access to infrastructure, funding, and technical know-how (Goldstein *et al.*, 2022; ACMI, 2023).

### LITERATURE REVIEW

#### Sources of Carbon (GHG) Emissions in Africa

This section presents an overview of the major contributors to Africa's carbon footprint. The energy sector, particularly the heavy reliance on fossil fuels for electricity generation, transportation, and industrial activities, appears to be the predominant source of emissions across the continent. South Africa ranks as the largest emitter in Africa, followed by Egypt and Algeria (International Energy Agency, IEA, 2023). The combustion of fossil fuels, including coal, oil, and natural gas, for energy production and transportation is the main driver of carbon emissions. Additionally, deforestation and the decomposition of solid waste contribute to increased carbon emissions (Greenly, 2023). Although agriculture is not as critical as the energy sector, it still plays a notable role in the carbon emissions landscape of Africa. Activities such as burning crop residues and applying fertilisers release significant greenhouse gases (African Development Bank, AfDB, 2024). Nonetheless, it is essential to acknowledge the potential of agriculture in mitigating climate change in Africa. Implementing sustainable land management and enhancing agricultural practices can aid in carbon sequestration (AfDB, 2024). Changes in land use, particularly deforestation, also represent a significant source of greenhouse gas emissions in Africa. Forests serve as carbon sinks, and their removal disrupts this vital process. Although there has been a decline in deforestation rates in recent years, the ongoing loss of forests remains a pressing issue (ACMI, 2023).

#### Challenges and Opportunities of Carbon Markets in Africa

This section provides a literature review to elucidate the current state, challenges, and potential opportunities associated with carbon markets in developing countries, particularly in the African region. It appears that voluntary carbon markets (VCMs) are becoming more prominent than compliance markets within the African context. According to ICAP's (2025) Status Report, there were no ETS in force in Africa as of July 2025. South Africa's carbon tax was the continent's only compliance carbon credit market as of July 2025.

The study by Kongnso *et al.* (2025) examines the potential for municipalities in Cameroon to access carbon credits through enhanced waste management, particularly through composting. Rapid urbanisation has led to an increase in household solid waste, challenging municipal capacity despite decentralisation efforts. Using a mixed-methods and participatory observation approach, the study quantifies methane sequestration from composting activities in Dschang Municipality. Findings reveal that in 2023, Dschang generated 27,514.9 tons of waste annually, with only 32% collected and 55.21% of that composted.

Between 2017 and 2023, composting avoided 17,989 tons of CO<sub>2</sub> emissions and generated about 150,000 euros in carbon credit revenue. Despite these financial and environmental gains, the sector faces constraints, including inadequate equipment, weak organisation, and restrictive carbon market regulations. The authors conclude that sustainable progress requires policy reforms, system reorganisation, and more accessible carbon credit mechanisms for municipalities.

Obonyo (2024), in the study titled “Creating Credible Carbon Markets in Africa”, examines the increasing trend of voluntary carbon trading within Africa, particularly in the Middle Eastern North African (MENA) region. The research emphasizes the necessity of maintaining integrity in the trading of high-quality carbon credits as part of the broader effort towards significant decarbonization in Africa. Furthermore, the study contends that climate finance must be procured and utilized efficiently to address the challenges posed by climate change in Africa. In 2023, the African Carbon Markets Initiative (ACMI, 2023) highlights the benefits of high-integrity carbon markets in Africa, showing how carbon projects create jobs, improve food security, enhance climate resilience, and support biodiversity in line with Sustainable Development Goals. However, ACMI (2023) acknowledges global carbon markets have flaws but can offer significant environmental and economic benefits if stakeholders collaborate. Skepticism exists among African stakeholders regarding the reliability of emissions reductions from carbon credits, particularly in initiatives like Zimbabwe’s Kariba project and those promoting eco-friendly stoves, which made up 90% of Africa’s carbon credit market in 2021. Concerns include the motivations of credit buyers, who may use these credits to continue polluting under the guise of environmental responsibility (greenwashing). Additionally, ACMI (2023) notes ongoing debates about whether land-use carbon credits lead to land dispossession for Africans, allowing developed nations to maintain pollution, which some view as a form of recolonisation. These issues contributed to a 22% drop in global carbon credit demand in 2023, with prices falling 30-50% from their peak, returning to 2022 levels. Pagop and Savard (2024) explore the opportunities and challenges of African involvement in voluntary carbon markets (VCMs), highlighting the need for strategic engagement to maximise benefits for sustainable development and climate change mitigation. This study looks into the growing interest in VCMs in Africa, pointing out the potential pros and cons of African participation. With significant financial incentives and market growth, VCMs are emerging as a viable solution for climate change in Africa, though debates continue about the legitimacy of carbon credits and their importance in climate change mitigation and adaptation. According to Pagop and Savard (2024), VCM projects across Africa hold immense potential as drivers of local job creation. These initiatives, spanning various sectors, offer a unique opportunity to address unemployment challenges while contributing to

the continent’s sustainable development goals.

The study by Sani *et al.* (2025) examines global trends in carbon-neutral construction and their relevance to Bangladesh’s sustainable development. The construction industry contributes over 40% of global CO<sub>2</sub> emissions, making carbon-neutral building practices essential for climate mitigation. Bangladesh faces unique challenges such as rapid urbanization, limited access to green financing, and insufficient government support. High costs, lack of local expertise, and weak policy implementation further hinder adoption of sustainable building technologies. The authors review successful international examples that demonstrate the benefits of energy-efficient designs and public-private collaboration. They recommend increased investment in green infrastructure, easier access to financing, and stronger policy incentives.

However, despite this potential and the significant opportunities that VCMs offer to Africa, the adoption and implementation of the VCM in the African region still face some challenges. These challenges include corruption and integrity concerns surrounding offsets from Africa. Coupled with weak carbon market governance systems, there is a lack of organization in these markets which exacerbates credit quality and transparency problems. Intermediation in the VCMs in Africa is another problem. Intermediaries play a significant role in Africa due to their relational capital, responsible for bringing African credits to international markets and sometimes claiming a substantial share of the created value. The lack of information about the percentages taken by brokers and their reluctance to disclose such information (in some cases, this can be as high as 70% of the value of a credit) result in reduced funding for Africa and decreased income for local communities involved in voluntary offset projects. ‘Carbon or green colonialism’ is another challenge faced by VCMs in Africa. This refers to the exploitation of carbon offset mechanisms by investors or companies from developed economies when they control the environment through the acquisition of cheap land in ways that disproportionately disadvantage local communities and indigenous populations in Africa. This poses a threat not only to VCMs but also to the perception of local populations regarding this system (ACMI, 2022). Kabukuru’s (2023) report, titled “Africa is chasing billions,” argues that although Africa is responsible for only four per cent (4%) of global carbon emissions, it is one of the region’s world regions most severely impacted by the climate change crisis. He notes that while the carbon compliance market in Africa is nearly non-existent, voluntary carbon markets are growing. However, these voluntary markets on the continent are contentious, facing criticism for being opaque, discriminatory, unfair, and ineffective in addressing development and climate policy. Kabukuru (2023) concludes with a call to action, stating that for Africa’s involvement in carbon markets to genuinely benefit the continent, its people, and its environment, the approach must change. He emphasises

the need for fair cost-sharing, transparency, respect for indigenous land rights, and truly sustainable projects without greenwashing.

**MATERIALS AND METHODS**

**The Search Strategy-Inclusion & Exclusion Criteria**

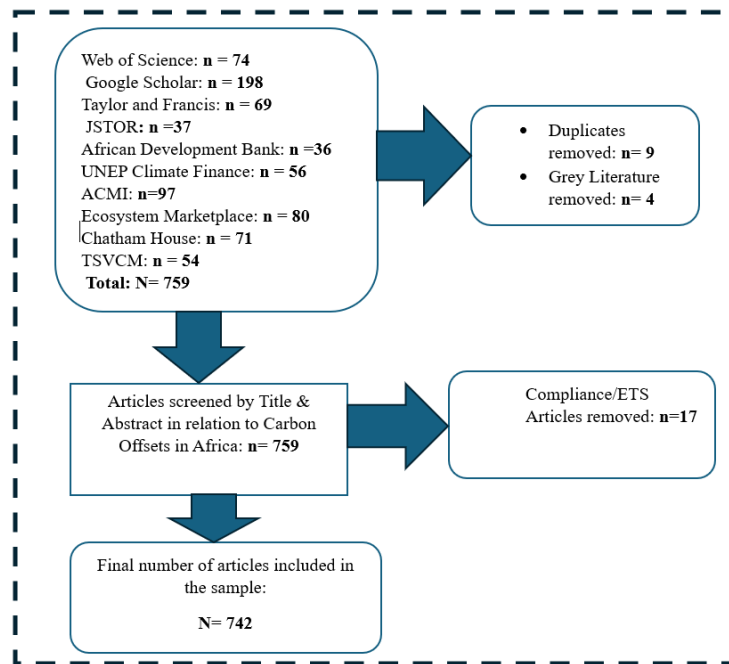
The study employed a systematic literature review (SLR) methodology, as described by de Freitas Netto *et al.* (2020), allowing researchers to situate their work within the existing knowledge framework. The survey focused on publications and reports published in English between 2000 and 2025.

The SLR approach guarantees a thorough identification of relevant studies while reducing bias and subjectivity (Higgins *et al.*, 2021). The review adhered to PRISMA guidelines (Page *et al.*, 2021) and examined voluntary carbon market mechanisms, focusing on the African region through a Boolean Proximity search to unravel related terms or phrases such as “carbon offsets in Africa”, “voluntary carbon markets Africa,” “carbon finance and Africa”, “carbon colonialism Africa,” “carbon brokers Africa”, “carbon market integrity Africa” and “carbon credit governance Africa”, among others. A VOS viewer

software mapping technique was employed to help filter out duplicate papers by constructing bibliometric networks based on citation metrics (Moya-Clemente *et al.*, 2021). The academic databases surveyed in this study included multidisciplinary academic databases such as the Web of Science (WOS) and Google Scholar. In addition, subject-specific databases such as Taylor and Francis online (Specifically, African Development, Governance and Environmental Studies) and JSTOR (Focusing on African Studies, governance, and political economy of carbon markets) were also surveyed. The African Development Bank (AfDB) publications and the United Nations Environment Program (UNEP) Climate Finance Portal were surveyed for policy and development databases. The industry literature surveyed was the African Carbon Markets Initiative (ACMI), Chatham House (for policy reports on carbon finance and Africa), Taskforce on Scaling Voluntary Carbon Markets (TSVCM) and Forest Trends’ Ecosystem Marketplace.

**RESULTS AND DISCUSSIONS**

The search protocol between August 1 and August 31, 2025, yielded 759 peer-reviewed articles, industry reports,



**Figure 1:** PRISMA 2021 Flow Diagram: Article Inclusion and Exclusion Protocol

and policy reports published in English. Google Scholar yielded the largest number of papers (n=198). 9 duplicates and 4 grey literature were removed.

Similarly, 17 compliance or Emissions Trading Systems (ETS) papers were also removed. This results in the final sample of 742 papers. Table 3 reports a summary of

**Table 3:** Summary of Paper Categories per Country

Country	Peer-reviewed paper	Conference Proceedings	Industry & Policy Reports	Sub-Total
South Africa	11	6	47	64
Kenya	26	15	17	58
Tanzania	13	9	24	46

Ethiopia	10	4	14	28
Uganda	9	2	6	17
Rwanda	21	7	18	46
Zambia	11	5	13	29
Zimbabwe	16	8	23	47
Ghana	18	7	20	45
Senegal	12	2	12	26
Ivory Coast	7	1	15	23
Cameroon	5	0	11	16
Congo DRC	9	3	11	23
Mozambique	6	3	6	15
Madagascar	7	4	11	22
Gabon	4	0	10	14
Nigeria	34	11	41	86
Egypt	20	9	34	63
Tunisia	14	6	13	33
Morocco	17	9	15	41
Total: N	742			

papers in each respective country surveyed in this study. It is easy to see from Table 3 that industry and policy reports dominated the number of papers surveyed in most countries in the sample. Grey literature, especially industry and policy reports, is vital in influencing the understanding and practices within Africa’s carbon offset markets. In contrast to peer-reviewed academic articles, grey literature offers timely, practical, and context-specific insights that are crucial in a swiftly changing policy and market landscape in Africa. Reports from industry consultancies, registries, and carbon standard organisations frequently provide current data on carbon credit prices, issuance volumes, project pipelines, and co-benefits, which are seldom found in academic publications (World Bank, 2023). Likewise, policy reports and white papers released by African governments, the African Carbon Markets Initiative (ACMI), and multilateral entities such as the African Development Bank (AfDB) deliver essential guidance on regulatory frameworks, benefit-sharing mechanisms, monitoring systems, and financing models that influence project feasibility (ACMI, 2022; AfDB, 2021). In Africa, where carbon markets are still developing, grey literature often acts as the primary evidence base for policymakers, investors, and project developers, particularly in sectors such as forestry, cookstoves, and blue carbon (Huxham *et al.*, 2023). Moreover, since many developments in African carbon markets are closely linked to international negotiations (e.g., COP processes), industry and policy briefs frequently serve as the initial sources to document changes in global standards and financing trends. Although this literature does not undergo the rigorous peer review typical of academic work, its frequency and accessibility ranging from annual flagship “state of the market” reports to quarterly market trend updates and event-driven policy

briefs, render it essential. Users are encouraged to cross-reference multiple reputable sources to address concerns regarding bias or inconsistent methodological quality. In summary, grey literature addresses data deficiencies and offers actionable intelligence that supports the development and governance of carbon offset markets in Africa.

#### Opportunities Gleaned from Literature

The literature underscores numerous opportunities to advance climate action in Africa by implementing carbon offset markets and related initiatives. The opportunities include the following:

#### Climate Finance and Employment

The Africa Carbon Markets Initiative (ACMI) outlines a potential path for expanding voluntary carbon market (VCM) activities, projecting an increase from approximately 22 million tonnes of CO<sub>2</sub> equivalent (MtCO<sub>2</sub>e) retired in 2021 to several hundred million tonnes of CO<sub>2</sub> equivalent (MtCO<sub>2</sub>e) annually by 2030 to 2050. If this anticipated growth is achieved with strong integrity and governance frameworks, it could yield billions of dollars in revenue and create significant job opportunities (ACMI, 2022; ACMI, 2024–2025; Sustainable Energy for All, n.d.).

#### Nature-Based Solutions (NBS)

Africa’s diverse ecosystems, including forests, savannas, and blue-carbon systems such as mangroves and seagrass, present considerable opportunities for carbon mitigation. These nature-based solutions capture carbon and offer additional benefits for biodiversity and resilience. Successful community-driven models in Kenya, such as Mikoko Pamoja and Vanga, illustrate the potential for

achieving measurable social and environmental benefits (Wylie *et al.*, 2016; Huxham *et al.*, 2023; International Finance Corporation, IFC, 2023).

### Energy Access and Health

Initiatives focused on clean cooking are crucial to Africa's carbon markets. Reducing dependence on biomass fuels can provide significant health and gender benefits. Recent research suggests that methodologies aligned with integrity can enhance the environmental and social impacts of these programs (Gill-Wiehl *et al.*, 2024; Reuters, 2024/2025).

### Energy Access and Health

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### Market Architecture Reforms

The Integrity Council for the Voluntary Carbon Market (ICVCM) has introduced Core Carbon Principles (CCPs), while the Voluntary Carbon Markets Integrity Initiative (VCMI) has established a Claims Code. These frameworks are designed to enhance buyer confidence and enable price premiums for high-integrity carbon credits. As of May 2024, ICVCM approvals included programs responsible for nearly 98% of carbon credits.

### Challenges faced by Carbon Offset Markets in Africa

Corruption, Weak governance, and Limited transparency tend to reduce the quality and integrity of carbon offsets in Africa. Intermediaries capture a significant share of carbon credit value, sometimes as high as 70%, leaving less funding for local communities (Pagop & Savard, 2024). Additionally, "carbon colonialism" emerges when foreign investors exploit cheap land for offsets, disadvantaging indigenous or local populations. This weakens trust in Africa's carbon offset market system (ACMI, 2022).

### Carbon Offsets Credit Integrity Challenges

Voluntary carbon markets face significant challenges regarding credit integrity, particularly in terms of additionality, baselines, leakage, and permanence. Recent analyses have revealed trends of over-crediting in various methodologies, such as cookstove initiatives and avoided deforestation projects, often due to unrealistic baselines or inadequate monitoring (Probst *et al.*, 2024; Gill-Wiehl *et al.*, 2024). This has led standard-setting organisations to update methodologies to restore credibility and ensure credits reflect genuine climate benefits. Without strong credit integrity, the effectiveness of carbon offset markets in Africa as a climate solution remains at risk.

### Social Safeguards, Benefit Sharing and Carbon

### Colonialism

As part of the VCMs, Carbon offsets also face challenges related to social safeguards and the equitable distribution of benefits. Evidence from large-scale forest carbon programs, such as the Mai-Ndombe initiative in the Democratic Republic of Congo, illustrates recurring tensions over Indigenous Peoples' and Local Communities' (IPLCs) rights, grievances, and benefit-sharing arrangements (Rainforest Foundation UK, 2020; CIFOR-ICRAF, 2024). The African Forestry Impact Platform (AFIP) bankrolled by European development finance institutions, Japanese oil interests, and an Australian investment firm, exemplifies green colonialism. Despite AFIP's claim of promoting "green-based solutions," in Africa, there is a worrisome trend of exploitation and greenwashing that underscores its investments, stakeholders, and financial backers. AFIP's first acquisition is Green Resources, a Norwegian plantation forestry and carbon credit company, is notorious for its history of land grabbing, human rights violations, and environmental destruction across Uganda, Mozambique, and Tanzania. Other examples include the Kariba Carbon Offset projects in Zimbabwe (Vida, 2024), the Northern Kenya Grassland Carbon Project (Survival International, 2022) and the evictions in Tanzania's Ngorongoro Area (Bariyo and Parkinson, 2023). In all these situations, communities have frequently reported being excluded from decision-making processes, having limited access to revenues, and having insufficient grievance mechanisms. These findings underscore the importance of incorporating robust social safeguards and anti-carbon/green colonialism measures to ensure that climate finance supports local livelihoods and rights.

### Market Volatility and Demand Uncertainty

Following a significant increase in transactions throughout 2021–2022, the Voluntary Carbon Markets (VCMs) encountered a deceleration in 2023–2024, characterised by a decline in trading volumes and a stabilisation in retirement levels. This fluctuation has amplified uncertainty for both project developers and investors, as buyer confidence becomes increasingly dependent on the perceived reliability of credit and the changing requirements for corporate disclosure (Ecosystem Marketplace, 2023, 2024, 2025; Financial Times, 2024). The divergence in buyer expectations and the absence of uniform global standards have exacerbated this uncertainty, highlighting the necessity for more definitive integrity signals and coordinated governance.

### Regulatory Complexity and Double Counting

Regulatory complexity continues to pose a fundamental challenge to the expansion of VCMs (carbon offset markets) in Africa. The merging of voluntary markets with compliance frameworks, particularly in relation to Article 6 of the Paris Agreement, introduces challenges concerning accounting practices, the risk of double counting, and the necessary adjustments corresponding

to national climate commitments (World Bank, 2024; Voluntary Carbon Markets Integrity Initiative, VCMI, 2023). Although guidance is progressively developing, the lack of standardized regulations and the potential for conflicting assertions among nations and corporations persist in undermining confidence and investment. Consequently, aligning VCMs with national climate strategies is crucial to guarantee both environmental integrity and political legitimacy.

### **What the Evidence Says-Selected Cases from the African Region**

#### **Community Forestry and Smallholder Agroforestry-Uganda**

Community-based forestry initiatives have revealed both the opportunities and obstacles associated with smallholder participation in voluntary carbon markets. A notable instance is Trees for Global Benefits (TGB) in Uganda, which was initiated in 2003 under the Plan Vivo Standard. TGB has effectively facilitated the involvement of smallholder farmers in long-term crediting schemes through agroforestry practices, resulting in the generation of verified credits while fostering biodiversity and sustainable land management (Plan Vivo/ECOTRUST, 2003). Nevertheless, critical evaluations raise concerns regarding the fairness of benefit distribution and the relatively high transaction costs that smallholders encounter when engaging in carbon markets (Schreckenber, 2011; Global Forest Coalition, 2020). Although TGB underscores the viability of smallholder participation, it also emphasises the necessity of creating inclusive systems that alleviate administrative burdens and guarantee equitable outcomes.

#### **Blue Carbon Initiatives in Kenya**

Kenya has emerged as a leader in blue carbon initiatives, exemplified by projects such as Mikoko Pamoja and the Vanga Blue Forest, which serve as global benchmarks for integrating ecosystem restoration with carbon credit systems. These projects prioritise the conservation and restoration of mangroves, yielding climate mitigation advantages along with additional benefits such as improved fisheries, coastal protection, and enhanced biodiversity (Wylie *et al.*, 2016; Huxham *et al.*, 2023). Furthermore, they are distinguished by their robust community governance, with generated revenues allocated to education, water supply, and other local needs (GLF/CIFOR, 2018). However, the issues of governance and equitable benefit-sharing are crucial for their sustained legitimacy, as concerns linger regarding the fairness of resource distribution among the communities involved. These examples underscore blue carbon's promise while emphasising the necessity for inclusive and transparent governance frameworks.

#### **Cookstove Projects and Methodological Integrity**

Enhanced cookstoves have historically been a favoured segment within voluntary carbon markets; however,

recent empirical research indicates considerable over-crediting associated with traditional methodologies. Investigations have demonstrated that the assumptions regarding stove utilisation and emissions reductions were overly optimistic, resulting in inflated credit allocations (Gill-Wiehl *et al.*, 2024). In light of this, standard-setting organisations and the Integrity Council for the Voluntary Carbon Market (ICVCM) have initiated revisions to methodologies, with new regulations focusing on metered usage and real-world monitoring to enhance precision (UC Berkeley, 2024; Reuters, 2025). These modifications are essential for reinstating environmental integrity and sustaining buyer trust in a prominent project category that directly impacts household energy accessibility and health.

#### **National Rulemaking and Regulatory Frameworks**

African nations are progressively working to create national frameworks that govern participation in voluntary carbon markets. For example, Kenya's 2024 Carbon Trading Regulations, Zimbabwe's Statutory Instruments (2023, 2025), and Ghana's Carbon Registry exemplify a broader continental movement towards formalizing access, approvals, benefit-sharing, and registry systems (Kenya Gazette, 2024; Veritas, 2023; Ghana GCR, 2024). These regulatory advancements address previous governance deficiencies, where inadequate oversight rendered projects susceptible to inequities and global criticism. By establishing definitive legal frameworks, these countries seek to enhance domestic control over carbon revenues, ensure compliance with national climate obligations, and foster trust among local stakeholders.

#### **Where Consensus is Emerging**

##### **High-Integrity Architecture as a Prerequisite for Scaling Up**

Within the voluntary carbon market (VCM) realm, there is a growing consensus that establishing a high-integrity architecture is crucial for rebuilding trust and driving substantial growth. The Core Carbon Principles (CCPs) set forth by the Integrity Council for the Voluntary Carbon Market (ICVCM), along with the claims framework of the Voluntary Carbon Markets Integrity Initiative (VCMI) and the emerging national regulations, are progressively acknowledged as the predominant pathway forward (ICVCM, 2024; VCMI, 2023). Initial indicators are promising, with ICVCM declaring coverage of the majority of significant crediting programs and investors exhibiting renewed assurance. However, experts emphasize that reforms at the method level and reliable enforcement mechanisms are essential to ensure that integrity principles yield tangible climate impacts in the real world (Reuters, 2024).

#### **Africa's Strength in Nature-Based Solutions and Associated Benefits**

Africa possesses a significant comparative advantage due to its extensive potential for nature-based solutions (NBS), especially in areas such as forestry, savannas, and

**Table 4:** Proposed Framework for Addressing Identified Gaps in Carbon Offset Markets

Gap	Framework Element	Rationale & expected contribution
Design for consent and Equity	Embedding FPIC, transparent benefit-sharing, grievance mechanisms, and independent monitoring ensures fair outcomes for Indigenous Peoples, Local Communities, and stakeholders in carbon offset initiatives.	Guarantees that carbon offset initiatives honor community rights, mitigate the dangers of "carbon colonialism," and bolster local legitimacy. Incorporating consent and transparency measures promotes equity and fortifies long-term sustainability (Rainforest Foundation UK, 2020; Kengoum, 2024).
Upgrade MRV Systems	Expanding the availability of cost-effective digital and metered Measurement, Reporting, and Verification (MRV) systems for cookstoves and renewable energy sources can improve the precision of credits and leverage the capacity of Africa's offset carbon market.	Transitioning from theoretical benchmarks to practical usage data mitigates over-crediting and enhances credit quality. Implementing digital MRV bolsters credibility and draws in purchasers seeking high-integrity credits (Gill-Wiehl <i>et al.</i> , 2024).
Price Discovery and Demand Signals	Establish transparent price-tracking platforms for Core Carbon Principles (CCP)-labelled credits, monitor the Science Based Targets initiative (SBTi) guidance, and assess Africa's project bankability implications.	It helps African developers predict changes in demand, mitigate market fluctuations, and offer reliable standards for negotiations. Tracking the adoption of CCP and the establishment of corporate regulations improves investment preparedness and boosts buyer confidence (Ecosystem Marketplace, 2025; Reuters, 2024).
Clarify the Paris (2025) Agreement	Expand national registries and approval processes per Article 6 guidelines. Adjust international credit claims to align with evolving corporate claims standards, such as VCMI.	It avoids the issue of double-counting between corporate purchasers and host nations' Nationally Determined Contributions (NDCs). This enhances Africa's bargaining power in international markets and fosters greater alignment between voluntary and compliance markets (World Bank, 2024; VCMI, 2023; Kenya Gazette, 2024; Ghana EPA/GCR, 2024).

blue carbon ecosystems. These solutions can provide both carbon and non-carbon co-benefits, including biodiversity conservation, improved livelihoods, and enhanced adaptation strategies. However, for these projects to scale successfully, it is essential that the rights, consent, and equitable value-sharing with Indigenous Peoples and Local Communities (IPLCs) are integrated from the beginning (Rainforest Foundation UK, 2020; Kengoum, 2024; Reuters, 2024). Without robust safeguards, there is a danger of perpetuating extractive practices that could erode community legitimacy and foster what is termed 'carbon colonialism.' Nevertheless, well-structured jurisdictional and large-land initiatives have the potential to serve as exemplary models of integrated climate and development benefits, provided that governance frameworks emphasise fairness and accountability.

**CONCLUSION**

This study presents a systematic review of carbon offset markets in Africa, conducted through a PRISMA-guided systematic literature review and a bibliometric analysis of peer-reviewed and grey literature published between 2000 and 2025. The findings underscore Africa's vast potential in carbon offsets, rooted in its biodiversity and natural resource endowment, while also unravelling persistent

challenges that undermine the effectiveness and equity of carbon offset markets in Africa. Governance deficiencies, corruption, lack of transparency, and inequitable benefit-sharing remain major barriers to credibility and sustainability of carbon offset markets in the region (ACMI, 2022; UNEP, 2022). Furthermore, exploitative intermediation and "carbon colonialism" have limited community participation and raised ethical concerns over land ownership and justice (Kabukuru, 2023). Methodological weaknesses, especially in forestry and cookstove projects, have led to overestimation of emission reductions and compromised market integrity (Gill-Wiehl *et al.*, 2024). However, notwithstanding the challenges, the literature also identifies key opportunities in carbon offsets, which include leveraging nature-based solutions (NBS), such as blue carbon and reforestation, to deliver co-benefits for climate, biodiversity, and livelihoods (Huxham *et al.*, 2023). The study proposes a reform framework anchored in free, prior, and informed consent (FPIC), digital and metered measurement, reporting, and verification (MRV) systems, transparent carbon pricing mechanisms, and harmonization of national registries with Article 6 of the Paris Agreement (World Bank, 2024; VCMI, 2023). Implementing these measures could

strengthen credit integrity, attract sustainable investment, enhance Africa's position in global carbon markets and ensure that carbon trading contributes equitably to the continent's sustainable development goals.

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