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Mozambique's Carbon Credits: Low Revenues, Rising Deforestation, and Limited Benefits for Communities

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Abstract

To combat climate change and preserve its natural forests, Mozambique Initiated the Zambezia Integrated Landscape Management Program (ZILMP), with the aim of reducing deforestation across nine districts over the period 2018–2024 and generating 50 million USD in carbon credit revenues. However, program progress has been limited by slow fund disbursement and rising deforestation. So far, only 25% of ZILMP's overall emissions reduction target and 14% of the overall revenue target have been achieved, with minimal benefits reaching local communities. Benefits shared with communities, the private sector, district and provincial authorities, and the Gilé National Reserve amount to only about 3% of the originally estimated program benefits. Additionally, among the ten districts with the highest tree cover loss in Zambezia from 2018 to 2023, six are part of ZILMP. Current carbon finance initiatives in Mozambique thus fail to deliver sufficient environmental and social benefits. While protecting forests is vital, the increase in subsistence agriculture—a primary driver of deforestation in Zambezia—also reflects the necessity for local communities to secure their livelihoods. This contrasts sharply with the world's largest greenhouse gas emitters, which continue large-scale emissions while buying inexpensive voluntary carbon credits to reduce their net emissions and to appear environmentally responsible. Robust regulatory frameworks and enhanced community engagement are essential to minimize corruption risks, and ensure environmental integrity, and climate justice.

1. Introduction

Despite contributing minimally to global greenhouse gas emissions, Mozambique suffers severe consequences from climate change due to its geographical vulnerability to extreme weather events. In 2022, Mozambique's total greenhouse gas emissions, excluding land use change and forestry (LUCF), were approximately 0.07% of global emissions, or 40 million tonnes of carbon dioxide equivalent (tCO2e) (Crippa et al., 2023).[1,2] Including LUCF, estimated greenhouse gas emissions were about 109 million tCO2e in 2021 (Climate Watch, 2024).

Mozambique ranks among the ten most vulnerable countries to climate change globally and is ranked the most vulnerable in Africa. The 2021 Global Climate Risk Index identified Mozambique as the country most affected by climate change in 2019, with a GDP loss of about 12% and between approximately 600 and 900 fatalities due to the tropical Cyclone Idai (Eckstein et al., 2021; Disasters Emergency Committee, 2021; Ministério da Saúde et al. 2019).[3] This vulnerability stems from its location, extensive coastline, and vast low-lying hinterland. Climate impacts are expected to intensify, with rising temperatures, irregular rainfalls, and sea level rise increasing the frequency of droughts, desertification, floods, and cyclones. The World Bank (2023a) projects that rising temperatures could increase poverty rates by 5% and reduce GDP by up to 9% by 2050 in Mozambique due to negative impacts on labor productivity and agriculture. Gender inequalities could also worsen due to gender-specific responsibilities in water resource access. As droughts become more frequent, women will need to walk longer distances to collect water, increasing their risks of sexual harassment, exploitation, and abuse.

Between 1950 and 2018, Mozambique experienced over 90 tropical cyclones. From 1980 to 2020, floods and storms were the most frequent natural hazards, affecting around 8.5 million and 6.2 million people, respectively. Cyclones primarily impacted Nampula, Zambezia, Inhambane, Cabo Delgado, and Sofala, while floods were most frequent in Sofala, Zambezia, and Nampula. Droughts affected about 46% of the country's population annually, with significant effects on child nutrition, particularly in Zambezia, Manica, Gaza, Sofala, and Inhambane (World Bank, 2023a).

To limit global warming to 1.5°C above pre-industrial levels, global greenhouse gas emissions must peak before 2025 and be reduced by 60% by 2035 relative to 2019 levels, with global net zero emissions achieved in the early 2050s. Achieving this target would significantly reduce risks to marine biodiversity, fisheries, ecosystems, and their functions and services to humans (IPCC, 2023). The international climate change legal framework requires all countries to adopt mitigation measures to achieve the common objective of limiting global temperature increases to "well below" 2°C, while allowing each country the freedom to choose specific measures and policies to meet their emissions reduction targets (UNCTAD, 2023).

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1 CO2 equivalent is a unit of measurement used to compare the emissions of different greenhouse gases based on their global warming potential. It converts the quantities of various gases into an equivalent amount of carbon dioxide that would have the same warming effect on the earth's atmosphere.
2 Per capita emissions in Mozambique were 1.1 tCO2e per year in 2022. This is similar to neighboring countries like Malawi (1.0), Tanzania (1.3), Zambia (1.5), and Zimbabwe (1.6), but considerably below Eswatini (2.3) and South Africa (8.9). Emissions per capita are also lower than those in India (2.8), the EU (8.1), China (12.6), and the USA (17.9). Due to the significant role of the fossil fuel sector, Mozambique's emissions relative to economic output, at 1.0 tCO2e per 1,000 USD, are higher than those in neighboring countries (Malawi: 0.7, Tanzania: 0.5, Zambia: 0.5, Zimbabwe: 0.9, Eswatini: 0.3, South Africa: 0.7) and higher than in the EU (0.2), the USA (0.3), India (0.4), and China (0.6) (Crippa et al. 2023).
3 The reported fatalities from the tropical cyclones Idai and Kenneth, which hit Mozambique in 2019, vary depending on the source. According to Ministério da Saúde et al. (2019), Cyclone Idai resulted in 603 fatalities, 1,641 injuries, 83,885 internally displaced people, and 141,475 cases of malaria. Cyclone Kenneth, which also struck Mozambique that same year, caused 45 deaths, 91 injuries, 284 cases of cholera, and over 78,018 cases of malaria. The actual figures for both cyclones are expected to be higher.

Without carbon pricing, the costs and risks of climate change are not adequately reflected in market prices of goods and services. The primary objective of carbon pricing is to reduce emissions by internalizing the social and environmental costs of greenhouse gas-emitting activities and providing incentives for emission reduction activities. By altering the prices of carbon-emitting activities, carbon pricing has the potential to shift consumption and production away from greenhouse gas-intensive activities towards more sustainable alternatives. It can further generate fiscal revenues, create jobs, and improve incomes for community members.

The Paris Agreement, an international treaty on climate change adopted in 2015 and signed by 197 countries, specifically includes carbon pricing as an instrument to reduce emissions.[4] Mozambique is one of the signatories to the Paris Climate Agreement and has committed to reducing greenhouse gas (GHG) emissions by 40 million tCO2e by 2025 through adaptation and mitigation efforts. Despite this commitment, the country lacks an adequate national monitoring system and data to track progress against its commitments (USAID, 2023).

Carbon markets are platforms that facilitate the buying and selling of carbon credits, which represent the reduction or removal of carbon dioxide or its equivalent in other greenhouse gases. There are two main types of carbon markets: compliance markets and voluntary carbon markets (VCMs).[5] VCMs allow carbon emitters to offset their emissions by purchasing carbon credits from projects aimed at removing or reducing greenhouse gases from the atmosphere. These projects can include reforestation, renewable energy, energy efficiency improvements, and other activities that result in measurable carbon reductions. Companies, organizations, and individuals participate in VCMs to voluntarily offset their carbon footprint, often as part of corporate social responsibility initiatives or to demonstrate environmental stewardship.

Mozambique aims to restore one million hectares of forests by 2030 through its *Reducing Emissions from Deforestation and Forest Degradation* (REDD+) projects (República de Moçambique, 2016). REDD+ is a voluntary climate change mitigation framework developed under the United Nations Framework Convention on Climate Change (UNFCCC). Revenues from REDD+ projects are shared with local authorities and communities. USAID (2023) estimates that carbon markets could create half a million jobs in project development and carbon monitoring in Mozambique by 2030. However, ongoing deforestation in REDD+ areas and delays in fund dispersals to local communities highlight the need for more effective implementation.

This study offers a comprehensive evaluation of Mozambique's voluntary carbon markets, focusing on their effectiveness in reducing greenhouse gas emissions and generating local revenues. Drawing on governmental and institutional reports—including those from the World Bank—the analysis pays particular attention to Mozambique's REDD+ initiatives, especially the Zambezia Integrated Landscape Management Program (ZILMP). Furthermore, the study incorporates a critical review of recent literature addressing structural and methodological concerns in REDD+ projects. To assess environmental performance, publicly available satellite imagery is used to demonstrate forest cover loss and deforestation trends in ZILMP districts. By examining the dynamics of voluntary carbon credit markets—including substantial price fluctuations—the study underscores the challenges and risks associated with emission reductions based on these markets. Key risks highlighted include the potential overestimation of emission reductions and uncertainties surrounding carbon pricing.

The remainder of this study is organized as follows: Section 2 describes REDD+ and critically evaluates its implementation, focusing on Mozambique's largest project in Zambezia. Section 3 provides estimates of Mozambique's annual revenue potential for carbon credits, highlighting the significant risks associated with price fluctuations. Finally, Section 4 summarizes the main findings and offers policy recommendations.

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4 See Annex of this study for a brief explanation of Article 6 of the Paris Agreement.

5 There are currently no carbon compliance markets in Mozambique. In compliance markets, a governing body usually sets a limit on the total level of emissions allowed for certain sectors or the entire economy. Companies are allocated or can purchase a certain number of allowances that permit them to emit a specific amount of greenhouse gases. If a company emits less than its allowance, it can sell the surplus credits to other companies that exceed their emissions limits. This system incentivizes companies to reduce their emissions to stay within their limits or to profit from selling excess allowances.

2. Carbon finance in Mozambique

a. REDD+ overview

The primary goal of the REDD+ framework is to encourage developing countries to reduce greenhouse gas emissions through various forest management strategies, including reducing emissions from deforestation and forest degradation, as well as the conservation, sustainable management, and enhancement of forest carbon stocks. The REDD+ framework, established as part of the Paris Agreement, supports the broader objective of climate change mitigation by providing technical and financial assistance to nations committed to preserving and enhancing their forest resources (UNFCCC, 2024a).

The REDD+ framework operates through a structured three-phase approach: (i) readiness, (ii) implementation, and (iii) results-based payments. The first phase involves developing national strategies, action plans, and capacity-building activities necessary for tackling deforestation and forest degradation. In the second phase, countries implement these policies and strategies, moving towards effective forest management and conservation practices. The final phase focuses on results-based payments, which are made after the verification of emission reductions, thus providing financial incentives for countries to sustain their efforts in reducing greenhouse gas emissions (Green Climate Fund, 2024).

Baselines for REDD+ projects estimate the amount of deforestation that would occur without the project's intervention. This reference emission level represents the expected emissions from deforestation in the absence of the project. By comparing observed deforestation to the baseline, the project's effectiveness can be measured. Success is determined by the reduction in actual deforestation below the baseline, with the difference representing the carbon credits earned, adjusted for factors such as uncertainty.[6]

The UNFCCC (2023) evaluated Mozambique's implementation of REDD+ activities for 2014-2016. Over these three years, Mozambique achieved an estimated reduction of almost 79 million tCO2e, compared to an assessed Forest Reference Emission Level (FREL) of 39 million tCO2e per year. Initially, the UNFCCC report noted a lack of detailed information in Mozambique's calculations, including applied equations, formulae, and a land-use change matrix. The UNFCCC team recommended enhancing transparency and data completeness by making the information used for estimating results available at the REDD+ website of the *Unidade de Monitoria, Relatório e Verificação* (MRV) of the National Fund for Sustainable Development (FNDS).[7] During the evaluation process, Mozambique addressed some transparency issues by providing additional data and references to publications used for calculations.

By addressing the drivers of deforestation and promoting sustainable forest management, REDD+ not only aims to mitigate climate change but also to support rural poverty alleviation, biodiversity conservation, and the provision of vital environmental services. The approach recognizes the essential role that forests play in global carbon cycles and the need to compensate countries for their efforts in forest conservation. Through REDD+, low-income nations can contribute to global climate goals while benefiting from the financial incentives provided for their efforts (UNFCCC, 2024a).

Mozambique's current carbon market regulation builds on the 2018 REDD+ Decree, which outlines rules for REDD+ projects and establishes guidelines for emission reduction transactions and transparency in monitoring emissions. The decree establishes state ownership of all emission reductions generated in Mozambique (República de Moçambique, 2018). Currently, this decree is the sole regulatory framework guiding the implementation of REDD+ projects.

Muhate (2023) argues that Mozambique's government bodies have limited institutional capacity regarding carbon processes. There is a lack of clarity about roles and responsibilities among government actors in monitoring, reporting, verification, and community engagement. Additionally, there is a shortage of trained personnel to measure and update greenhouse gas emissions inventories, and a lack of an information management system with comprehensive emissions and project monitoring data. The current REDD+ Decree from 2018 does not sufficiently address critical issues such as carbon credit trading, benefit-sharing, emissions leakage, monitoring and enforcement. The decree also excludes

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6 For example, say historical data showing the average deforestation level in the reference area has been 1% of the forest per year. Now, assume that the estimated carbon stock per hectare of forest in the project area is 300 tonnes and that the project area is 100 hectares. Baseline emissions would be calculated based on the assumption that a certain number of hectares of forests, each containing 300 tCO2e, will be lost. So, the baseline value is calculated as 1% (deforestation rate) x 100 (hectares) x 300 (tCO2e) = 300 tCO2e per year. This baseline value represents the expected average emissions resulting from deforestation in the area without any project intervention (Carbon Market Watch, 2023).
7 The MRV unit supports the national forest inventory, reports on deforestation and emission reference levels, monitors forest cover changes, develops carbon estimation methodologies, and provides related data and reports for REDD+ initiatives (MRV, 2024).

emissions from important sectors such as energy, waste, and industrial processes like cement or chemical production. This inadequate regulatory framework undermines the credibility and transparency of carbon projects in Mozambique, as it is required to report emissions and mitigation efforts.

Following a 2023 meeting between the Government of Mozambique and the Africa Carbon Markets Initiative (ACMI), an inter-ministerial task force, led by the Ministry of Economy and Finance *(Ministério da Economia e Finanças, MEF)* and co-chaired by the Ministry of Land and Environment *(Ministério da Terra e Ambiente, MTA)*, was established to develop more comprehensive carbon market regulations. These regulations aim to address various aspects, including project approvals, carbon credit transfers, the establishment of a carbon registry, revenue management, improved benefit-sharing mechanisms with local communities and the necessary institutional arrangements. The aim for 2024 is to finalize these regulations and secure their approval by the Council of Ministers. The period from 2024 to 2026 intends to operationalize these regulations, create carbon finance instruments, and activate the carbon markets (Maunze, 2024).

b. Zambezia Integrated Landscape Management Program

Mozambique has faced rapid deforestation and forest degradation driven by small-scale agriculture, charcoal production, timber exploitation, and illegal logging. High population growth and rural poverty have exacerbated these issues. From 2003 to 2013, Mozambique lost approximately 267,000 hectares (ha) of forest annually. This corresponds to a deforestation rate of around 0.79% or 46 million tCO2e each year, accounting for more than 42% of the country's total greenhouse gas emissions.

To combat this, the Zambezia Integrated Landscape Management Program (ZILMP) was officially launched in 2019 through the Forest Carbon Partnership Facility (FCPF), though its reporting period covers activities from 2018 to 2024.[8] This initiative, part of the national REDD+ strategy, aims to reduce deforestation in nine districts of Zambezia across a total area of 5.3 million ha, of which 49% are covered with forests. ZILMP focuses on avoiding emissions by preventing deforestation and forest degradation while implementing nature-based solutions to manage and restore forest ecosystems sustainably. The program seeks to decouple rural income growth from forest loss through sustainable land-use practices, with emission reductions verified and compensated by the FCPF Carbon Fund (World Bank, 2018; FCPF, 2024).

ZILMP was scheduled to be implemented from 2018 to 2024, with a targeted overall reduction in emissions of 12.6 million tCO2e relative to the reference period from 2005 to 2015.[9] While the project implementation period ends in December 2024, the lifetime of the FCPF Carbon Fund concludes at the end of 2025 (World Bank, 2018).[10] The World Bank, acting as the trustee of the FCPF Carbon Fund, agreed to pay up to 50 million USD for 10 million tCO2e reductions generated by ZILMP. This corresponds to a price of 5 USD per tCO2e.

Deforestation and emission reductions within ZILMP are measured annually by the MRV unit within the FNDS. The reported reductions are then verified by a third party contracted by the World Bank. Payments by the FCPF Carbon Fund are based on these third-party verification reports or interim progress reports if verification does not occur annually (World Bank, 2018).

The Government of Mozambique agreed to distribute the payments related to the emission reductions according to the following benefit-sharing plan: 70% of payments are allocated to community projects, 20% to the private sector, 4% to district authorities, 4% to the Gilé National Park administration, and 2% to the provincial government. Net payments for benefit sharing are based on gross payments minus a 5% performance buffer to address potential non-performance in a reporting period and operational costs estimated at around 2.5 million USD over the project lifecycle for technical support and program management. Under full project performance of ZILMP, total net payments for emission reductions were estimated to be around 45 million USD, out of which 31.5 million USD would be channeled to local communities (FNDS, 2019).[11]

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8 The FCPF is administered by the World Bank and supports REDD+ efforts in developing countries through two complementary funds: the FCPF Readiness Fund, which prepares countries to participate in REDD+, and the FCPF Carbon Fund, which provides results-based payments.

9 These projected emission reductions consider buffers for project risks and uncertainties of more than 6 million tCO2e, corresponding to the guidelines of the FCPF Carbon Fund (World Bank, 2018; FCPF, 2022b).

10 The implementation period started in 2018, prior to the signing of the Emissions Reductions Payment Agreement (ERPA) between the World Bank and the Government of Mozambique in 2019 (FCPF, 2019).

11 In the event of full performance of the ZILMP, after the final verification of the program, any remaining funds from the performance buffer will be allocated to the Gilé National Reserve, the districts, and the communities in accordance with the benefit sharing plan.

c. Implementation status of ZILMP

Table 1 displays the cumulative emission reductions and revenues through ZILMP relative to the overall ZILMP targets. It highlights the low level of achievements in the program's three main dimensions: the volume of emission reductions (tCO2e), disbursed gross payments by the FCPF fund for emission reductions (USD), and benefit sharing in line with the agreed benefit-sharing plan.

Table 1 Cumulative ZILMP emission reductions, gross payments, and shared benefits

Date	Emission reductions (tCO2e)	Reductions achievement (%)	Payments FCPF Fund (USD)	Payments achievement (%)	Benefits shared (USD)	Benefit-sharing achievement (%)
2020	0	0.0%	0	0.0%	0	0.0%
2021	1,286,049	12.9%	6,400,000	12.8%	0	0.0%
2022	1,286,049	12.9%	7,000,000	14.0%	580,873	1.2%
2023	1,769,806	17.7%	7,034,954	14.1%	1,580,873	3.3%
06/2024	2,524,633	25.2%	7,034,954	14.1%	1,580,873	3.3%

Notes: Own calculations based on implementation reports of the World Bank (2024). Achievement is relative to the overall ZILMP targets outlined by the FNDS (2019). The "Date" column refers to the date of the implementation status reports. "Emission Reductions" refer to reductions that have been verified by a third party.

Until 2020, no payments for emission reductions were recorded through ZILMP. In 2021, Mozambique became the first of 47 participating countries to receive payments from the FCPF fund, achieving close to 1.3 million tCO2e in verified emission reductions and obtaining 6.4 million USD (World Bank, 2021). However, these benefits were not shared with communities that year as the call for proposals for community initiatives was only launched in November 2021.

The delay in distributing benefits, coupled with the slow implementation of community proposals, raises concerns about the transparency and accountability of the benefit-sharing process. With notable payments received but minimal funds disbursed to the communities, there is an increased risk of funds being diverted or misused before reaching their intended beneficiaries. Such gaps in fund distribution, especially when large sums of money are involved and governance structures are weak, could also create opportunities for corruption. Strengthening oversight and ensuring the timely distribution of benefits are essential to minimize the risk of mismanagement and to ensure that the program fulfills its intended social and environmental objectives.

In 2022, the first payments totaling 583,873 USD were distributed to the Zambezia provincial government (116,175 USD), district governments (232,349 USD), and the Gilé National Park (232,349 USD) (FCPF, 2022a).[12] The call for matching grants for the private sector was only launched in 2022. 59 projects from the private sector were pre-selected and submitted their business plans for approval by the end of 2022.

By 2023, 133 community-based organizations were selected to receive payments through benefit sharing. Of these, 82 were legalized, and 22 had signed contracts with the FNDS, with payments approved. The project advanced the readiness of community-based organizations and private sector grants, disbursing 1 million USD to beneficiaries by November 2023.[13] Muhate (2023) points out that poorly established community land delimitations, legalization processes, and a lack of financial infrastructure like community bank accounts have contributed to delays in fund transfers.

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12 Accumulated operational costs up to the end of 2022 were estimated at approximately 841,000 USD (calculated as gross payments minus performance buffer minus net payments).

13 The World Bank implementation report from December 2023 lacks details about the distribution of these funds between communities and private sector initiatives.

For the 2018 reporting period, the emission reductions available for transfer to the Carbon Fund were approximately 2.04 million tCO2e (FCPF, 2021). For the 2019-2020 reporting period, transferable emission reductions amounted to 0.48 million tCO2e. This was solely due to reductions achieved in 2019, because in 2020 emissions exceeded the reference period levels, resulting in no additional transferable reductions for that year (FCPF, 2022a). Similarly, no emission reductions were available for transfer to the Carbon Fund for the 2021-2022 reporting period (FCPF, 2023). Contrary to the program's objectives, increases in deforestation and related emissions have been observed each year from 2020 to 2022, with yearly emissions averaging more than 3 million tCO2e above reference levels during this period (FCPF, 2022a; FCPF, 2023). This increased deforestation resulted in no carbon payments for the 2021-2022 reporting period.

The World Bank (2024) implementation report states that there is a high risk of not disbursing funds to beneficiaries in full by the program's closure in December 2025. It also mentions that the current design and benefit-sharing mechanism do not effectively reduce or prevent large-scale deforestation in the nine participating districts. The report criticizes the slow selection and administration process, prompting the FNDS implementing unit to simplify and streamline procedures, as well as integrate environmental and social screening into the technical design of subprojects. The World Bank mission in November 2023 rated the project's overall implementation progress as "moderately unsatisfactory" due to delays in disbursing financing to local beneficiaries.

Given Mozambique's ongoing fiscal challenges, there is a heightened risk that funds intended for ZILMP beneficiaries could be diverted to cover other central government expenditures. Mozambique's growing levels of fiscal debt, along with slow and inefficient distribution processes, create vulnerabilities where these funds may be repurposed before reaching the communities they are meant to benefit. Strengthening oversight mechanisms and ensuring more transparent fund management are essential to safeguard these resources and ensure they contribute to local development as intended.

As a result of the increased emissions, Mozambique risks receiving reduced or zero payments for the remaining reporting period of 2023-2024. Unsustainable small-scale agriculture is considered the leading cause of deforestation in the ZILMP area. Charcoal production, resulting from agricultural expansion, and unsustainable timber exploitation have also contributed to deforestation. Attempts to mitigate risks from timber activities have been made through intensified law enforcement and land use delimitation and titling (FCPF, 2023).

According to the World Resource Institute's Global Forest Watch (2024), which uses satellite images to detect changes in tree cover (more than 30% tree canopy[14]), the total loss of natural forests in Mozambique between 2018 and 2023 corresponds to 541 million tCO2e. The tree loss in the province of Zambezia is estimated to be equivalent to 173 million tCO2e during this period, accounting for almost 32% of Mozambique's overall forest loss. Figure 1 shows that the annual tree cover loss in natural forests in Zambezia increased from around 42,600 ha in 2018 to 75,900 ha in 2023, representing a 78% increase. Among the ten districts with the highest tree cover loss in Zambezia between 2018 and 2023, six districts are part of ZILMP: Mocuba (53 kha tree cover loss), Alto Molucué (40 kha), Gilé (37 kha), Gurué (20 kha), Pebane (18 kha), and Maganja da Costa (16 kha). This substantial tree loss in ZILMP districts highlights serious concerns about the program's capability to effectively curb deforestation.

*Figure 1 Tree cover loss in natural forest in Zambezia (in 1000 hectares)*
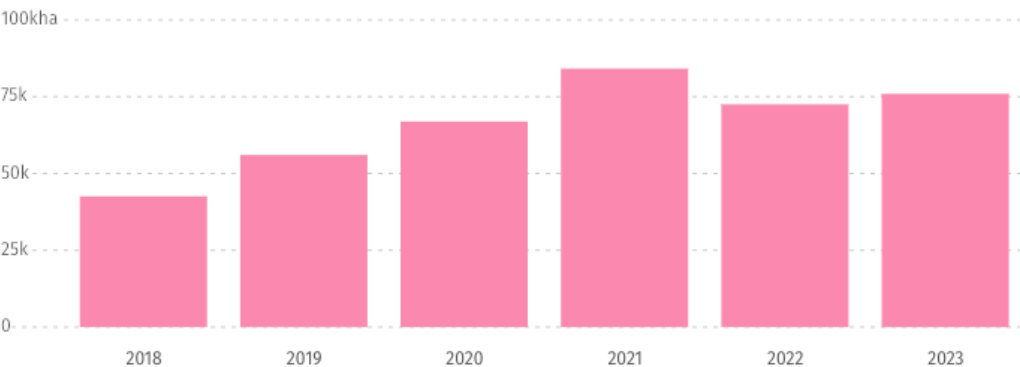
Source: Global Forest Watch (2024).

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14 According to the national REDD+ strategy, forests are defined as areas with a minimum of 1 hectare, a minimum tree height at maturity of 3 meters, and a minimum tree cover of 30% (República de Moçambique, 2016).

Table 1 and Figure 2 highlight that as of June 2024, only about 25% of the overall targeted emission reductions of ZILMP have been achieved. Furthermore, only about 7 million USD has been disbursed by the FCPF fund to the Government of Mozambique, corresponding to only about 14% of ZILMP's global gross payments target. This low level of achievement also represents a lost opportunity when compared to market trends, as the FCPF fund offers a payment of 5 USD per tCO2e for emission reductions, which is above the current market rates for nature-based projects.

Moreover, the benefits shared thus far amount to only 3.3% of the originally projected shared benefits over the ZILMP project lifecycle, as outlined in the benefit sharing plan of the FNDS (2019) under the full performance of emission reductions of 10 million tCO2e. These low disbursal levels to communities, districts, the private sector, provincial authorities, and the Gilé National Reserve could have contributed to the recent increase in deforestation.

Figure 2 Emission reductions, gross payments, and benefit sharing as a share of overall ZILMP targets
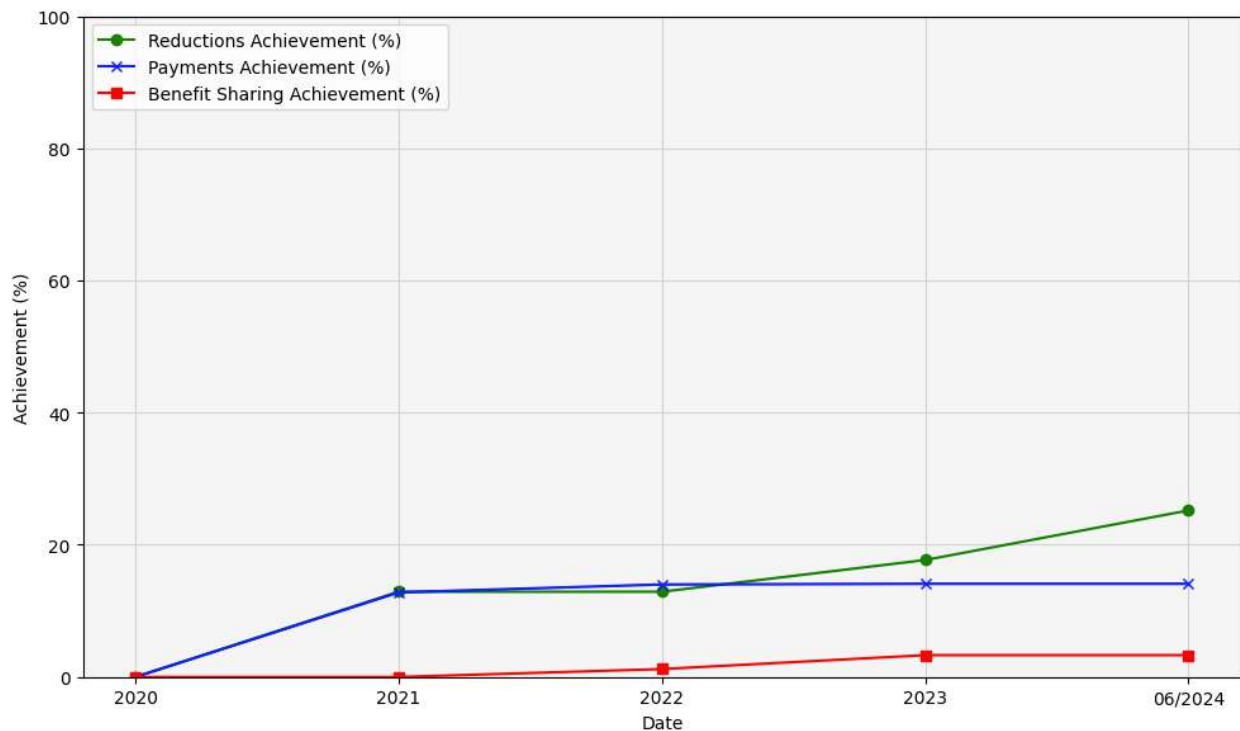
Notes: Own illustration based on implementation reports of the World Bank (2024). Achievement is relative to the overall ZILMP targets outlined by the FNDS (2019). "Date" refers to the date of the implementation status reports.

Consequently, the overall project risk rating increased from "moderate" in December 2023 to "high" according to the World Bank Mid-Term Review published in June 2024. The review recommended reducing the project's scope through restructuring, intensifying the implementation of the benefit sharing plan, developing more effective and coordinated responses to deforestation, and introducing activities to enhance the inclusion of marginalized communities and disadvantaged groups.

In short, ZILMP faces significant challenges, including increasing deforestation, slow administrative processes, and significant delays in disbursing funds to local communities and the private sector.

d. Methodological Concerns of REDD+ Projects

Accurate baseline emission levels are essential for measuring the effectiveness of REDD+ projects, but they are often significantly overestimated. West et al. (2024) criticize REDD+ methodologies for lacking robustness and consistency. Their study shows that deforestation baselines for REDD+ projects vary substantially due to the freedom project developers have in selecting methodologies, reference areas, and risk models, sometimes resulting in baselines that are 14 times higher than necessary.

Another study published in Science by West et al. (2023) concludes that carbon offset schemes significantly overestimate the levels of deforestation they prevent. Companies use these schemes to claim progress towards "net zero" while doing little to reduce greenhouse gases. The study found that REDD+ projects were used to offset almost three times more carbon than they have mitigated through forest preservation. Overestimations of forest preservation have inflated the number of carbon credits on the market, suppressing prices and allowing companies to meet net-zero targets cheaply.

West et al. argue that the booming trade in carbon credits may resemble a "lemons market," where buyers cannot distinguish quality, eventually leading to market collapse due to bad-quality products. They emphasize that historical references are often highly inaccurate, and projects may be placed where conservation would likely succeed anyway. The study indicates that calculations based on historical deforestation trends are often too simplistic and that 68% of retired carbon credits from their investigated REDD+ sites barely reduced deforestation.[15] Even the remaining 32% did not conserve forests to the claimed levels, with only 6% of total carbon credits linked to actual reductions in emissions. The researchers warn that deforestation predictions may be inflated to boost revenue from credit sales, driven by adverse incentives in an unregulated market. Watchdog agencies are being established, but many are connected to carbon credit certification bodies. The industry thus needs to close loopholes, develop more sophisticated and transparent methods to quantify preserved forests, and create trusted marketplaces (University of Cambridge, 2023).

International research also reveals that emission leakage—deforestation shifting to areas outside the project boundaries— is systematically underestimated in REDD+ projects (Research from the University of California, Berkeley, funded by Carbon Market Watch, 2023). Furthermore, the risk of future tree loss in REDD+ projects due to natural events like forest fires or pests is underestimated by a factor of ten, exploiting methodological flexibilities. Carbon Market Watch (2023) concludes that REDD+ projects do not generate high-quality carbon credits, often lack integrity, and their credits should not be traded or used by countries to fulfill their nationally determined contributions under Article 6 of the Paris Agreement.

e. Greenwashing by oil and gas companies

The multinational oil and gas corporations Shell and Chevron are among the largest historical CO_2 emitters, significantly contributing to global warming.[16] Between 2020 and 2022, Shell was the largest buyer of carbon offset credits globally, purchasing 9.9 million credits, including 8.8 million from REDD+ projects. Volkswagen followed with 9.6 million credits, 5.7 million of which were from REDD+ projects. Other significant buyers included Chevron with 6.1 million credits (2 million from REDD+) and PetroChina with 2 million credits (1 million from REDD+). TotalEnergies, which operates the Mozambique LNG project in Cabo Delgado, bought 0.9 million carbon credits, including 0.2 million from REDD+ projects. Overall, fossil fuel companies are estimated to account for half of the carbon offsets purchased (Carbon Brief, 2023).

In light of this, Eni's new REDD+ initiative in Mozambique, announced in June 2024, warrants careful monitoring (Eni, 2024). The Great Limpopo project, the largest forest preservation effort in Mozambique to date, aims to protect up to 4 million hectares across the provinces of Manica, Sofala, Inhambane, and Gaza. While Eni plans to achieve carbon neutrality by 2050 by offsetting 5% of its emissions through a mix of nature and technology-based projects, the history of fossil fuel companies purchasing relatively inexpensive carbon credits and the performance issues of the REDD+ project in Zambezia raise questions about the true impact of such initiatives. Therefore, this project should be scrutinized in the context of past overestimations of emission reductions and the risk of greenwashing by fossil fuel companies.

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15 West et al. (2023) examined REDD+ projects in Tanzania, the Democratic Republic of Congo, Cambodia, Peru, and Colombia. While 26 REDD+ project sites were investigated, only 18 had sufficient baseline deforestation data available for meaningful comparative analysis.
16 Between 1854 and 2022, it is estimated that Chevron emitted almost 3% of all CO_2 emissions from global fossil fuel and cement emissions, while Shell's estimated share is more than 2% (Carbon Majors, 2024).

3. Revenue potential and volatility in carbon markets

Voluntary carbon credits come in various types, including nature-based credits from projects that conserve or restore ecosystems, avoidance credits from activities such as deforestation prevention or energy efficiency improvements, and removal credits from projects that actively remove carbon dioxide from the atmosphere, such as direct air capture.[17] REDD+ projects fall into the nature-based avoidance category because they aim to prevent the release of carbon dioxide that occurs when trees are cut down.

Carbon credit prices vary significantly across categories and are influenced by factors such as the credit issuer, issuing standards, geographical location, and co-benefits. Even within the same project type, price differences exist. For example, household device projects like clean cookstoves in low-income countries command higher prices than similar projects in other regions.

Average prices of standardized carbon credit contracts for nature-based credits dropped significantly from more than 15 USD in 2022 to less than 5 USD per tCO2e in 2023, based on S&P Global Platts data. The World Bank (2023b) attributes this price drop partly to the growing use of standardized contracts. These contracts have the potential to increase market liquidity and facilitate investments by making trading more straightforward. However, they can also lead to a "least common denominator" effect, where the unique attributes and higher value of the highest quality projects are not fully recognized. Consequently, sellers of higher-value credits have increasingly opted to sell through bilateral deals rather than on exchanges to ensure they receive a better price for their credits (World Bank, 2023b).

Substantial price fluctuations have marked the carbon credit market recently, with further significant price declines in 2023 and 2024. Figure 3 highlights that the price of carbon credits futures for nature-based offsets dropped to as low as 1 USD per tCO2e in June 2024.[18] The Ecosystem Marketplace (2024), which provides a comprehensive overview of global voluntary carbon credit supply and demand, highlights a 56% decline in the transaction volume of voluntary carbon markets from 2022 to 2023, with the market contracting for the second consecutive year from its 2021 peak. Negative media coverage about voluntary carbon credit projects and a pause in purchases as buyers awaited clearer standards and regulations contributed to this downturn. The number of market participants also decreased, as some entities temporarily halted credit sales awaiting stronger quality norms and potentially higher prices. REDD+ credits, the most popular project type, lost 62% of their value, and the average price of these credits fell by 23%. Despite the overall market decline, projects delivering co-benefits for nature and communities grew, accounting for 28% of transactions. Feedback from buyers indicated a stronger preference for community-focused projects offering additional environmental and social benefits alongside emissions reductions.

Figure 3 Nature based global emissions offset futures (in USD per ton)

Source: Carbon credits (7 June 2024)

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17 Other types of voluntary carbon credits include those from renewable energy projects like solar, the aviation industry's offsetting and reduction scheme (CORSIA), waste management, and agricultural practices.
18 These future contracts are comprised of projects from the Verra registry that fall under the Agriculture, Forestry, or Other Land Use (AFOLU) categories.

BloombergNEF (2024) suggests in its Carbon Market Outlook 2024 that the prices of voluntary carbon offsets will largely depend on the standards agreed upon.[19] It predicts that by 2030, carbon credits could trade at just 13 USD per tCO2e in voluntary markets if the carbon credit markets lack rigorous standards and integrity concerns drive companies away. However, if more robust, universal high-quality standards for voluntary carbon markets can be established, BloombergNEF predicts that credit prices could trade at 20 USD per tCO2e by the end of the decade.[20]

According to the MEF (2023), Mozambique has the potential to generate 80 to 90 million carbon credits annually, representing about 4% of Africa's total potential. As of 2023, 64 carbon projects are implemented in Mozambique, with only 32 of these projects having certified carbon credits (USAID, 2023).[21] Muhate (2023) estimates the potential annual revenue from the current REDD+ projects to be around 27.9 million USD.[22] Including 17 new REDD+ projects currently in the licensing process, the estimated revenue could increase to 46.5 million USD annually. Using substantially higher prices of 20 USD per carbon credit, the MEF (2023) suggests that the annual revenue potential is between 200 and 500 million USD if Mozambique produces between 10 and 25 million carbon credits.

In Table 2, we provide rough estimates of Mozambique's annual revenue potential under varying carbon price scenarios, highlighting significant variations due to price uncertainties. Estimated revenues for 15 million retired carbon credits could range from 15 million USD at low carbon prices (based on the June 2024 nature-based carbon offsets futures) to 300 million USD annually if prices reach 20 USD per ton (based on the high-quality scenario of Bloomberg NEF for 2030).[23] Under a price of 5 USD per tCO2e (based on the ZILMP prices), 15 million retired carbon credits have the potential to generate 75 million USD annually.

Table 2 Gross revenues from carbon credits under different carbon prices (in million USD)

Retired Carbon credits	Low Price 1 USD/tCO2e	Base Price 5 USD/tCO2e	Price Trajectory 13 USD/tCO2e	High Price 20 USD/tCO2e
10 million	10	50	130	200
15 million	15	75	195	300
25 million	25	125	325	500

Comparing these figures with the MEF's (2023) revenue estimations of up to 500 million USD annually highlights that such high revenues critically depend on sustained high carbon prices, as well as sufficient demand and local supply of verified carbon credits. Besides, carbon offset prices could drop due to global factors, such as an increased supply of offset projects in other countries, a damaged reputation of voluntary carbon credit projects leading to lower market confidence, and a structural shift in demand from nature-based to technology-based projects like direct air capture. The recent drop in carbon prices has demonstrated that it remains unclear if and whether carbon credits from deforestation and forest degradation projects will achieve prices at or above 20 USD per tCO2e over sustained periods, at least in the upcoming years.

Price fluctuations in the voluntary carbon market pose significant challenges for both financial and environmental sustainability. This high volatility undermines the financial stability needed to support long-term conservation and emission reduction projects, potentially jeopardizing their environmental goals. For Mozambique, these fluctuations can lead to unpredictable and reduced revenues, especially if market participants exploit price variations. This complicates the planning and implementation of effective climate action strategies. Setting realistic expectations for local communities and adequately considering their multidimensional opportunity costs, such as the potential loss of agricultural production in project areas, remains crucial.

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19 BloombergNEF is a research provider focused on global commodity markets and the transition to low carbon economies.

20 In comparison, BloombergNEF (2024) projects the carbon prices restricted to carbon removals, such as from direct air capture technology that pulls CO2 out of the atmosphere, could rise substantially to 146 USD per tCO2e by 2030. Similarly, carbon prices of the EU compliance market, the Emission Trading System (ETS), are expected to reach 149 USD per tCO2e in 2030.

21 The carbon projects are currently implemented by 21 private sector entities and by the Government of Mozambique.

22 The estimations are based on carbon prices of 2.26 USD per tCO2e for Energy and 8.81 USD per tCO2e for Agriculture, Forests, and Other Land Uses (AFOLU), plus project risk buffers.

23 To interpret our scenarios, it is important to note that the revenue estimates are based on retired carbon credits (i.e., achieved and verified emission reductions) per year, not on emission reduction potentials before accounting for risk and uncertainty buffers.

4. Conclusion

Mozambique's implementation of REDD+ and voluntary carbon markets underscores both the potential benefits and significant challenges of using carbon finance for climate change mitigation and sustainable development. Despite Mozambique's vulnerability to climate impacts and its commitments under the Paris Agreement, several practical hurdles have hindered progress.

The annual tree cover loss in natural forests in Zambezia has increased in recent years, raising concerns about the effectiveness of the REDD+ program. As of June 2024, only about 25% of ZILMP's overall emission reduction target and 14% of the overall revenue target from carbon credits have been achieved, while the implementation period of the project is nearing its end in December 2024. To date, the benefits shared with communities, the private sector, district and provincial authorities, and the Gilé National Reserve amount to only about 3% of the originally estimated shared benefits. Current carbon finance initiatives thus fail to deliver sufficient social and environmental benefits, particularly for rural communities.

Additionally, carbon markets are subject to significant price volatility, leading to uncertain revenues and complicating long-term planning for conservation and emission reduction projects. While carbon pricing promotes cost-effective emissions reductions, it may discourage more structural and sustainable measures that are more costly. Furthermore, offsetting emissions can reduce the ambition of mitigation in other sectors and potentially lead to a lock-in of carbon-intensive activities.

There is currently no value-added tax (VAT) on carbon credit transactions in Mozambique. For comparison, the United Kingdom will introduce VAT on voluntary carbon credits starting in September 2024. This policy change acknowledges the emergence of secondary trading markets and the integration of carbon credits into product offerings, such as products marketed as carbon neutral.[24] Implementing a VAT on carbon credits in Mozambique could generate additional revenues for the government and strengthen the price signal for carbon, encouraging cleaner technologies.

From a climate justice perspective, it is critical to address the inequities highlighted by ZILMP's outcomes. While it is important to protect forests and reduce deforestation, the increase in subsistence agriculture—a primary driver of deforestation—also reflects the necessity for local communities to secure their livelihoods.

This stands in stark contrast to the practices of the world's largest CO2 emitters and multinational oil and gas companies, which continue to emit greenhouse gases on a large scale while using carbon credits for greenwashing. This raises ethical concerns about the equitable distribution of responsibilities and benefits in global climate mitigation efforts. Using carbon storage in forests to offset fossil fuel emissions is problematic due to the high risk of overestimating emission reductions and the possibility of cheap carbon credits exploiting price fluctuations, which do not adequately compensate for the negative externalities of the fossil fuel industry. Therefore, for carbon finance to be truly effective and just, it must be coupled with robust measures that ensure transparency, accountability, and equitable distribution of benefits, prioritizing the needs and rights of vulnerable communities directly impacted by climate change.

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24 Activities remaining outside the scope of VAT in the United Kingdom include the initial issuance of credits by public authorities, holding credits as an investment without economic activity, donations to carbon credit projects, and sales from unverified or self-assessed projects (HRMC, 2024).

ANNEX: Article 6 of the Paris Agreement

Article 6 of the Paris Agreement outlines a framework for countries to collaborate voluntarily to achieve their climate targets, thereby facilitating international cooperation and unlocking financing for developing nations. This framework allows for the transfer of carbon credits earned from the reduction of greenhouse gas emissions, enabling countries to meet their climate targets more efficiently. The carbon crediting mechanism under the Paris Agreement is designed to improve cooperation among countries (UNFCC, 2024b).

Article 6.2 of the agreement establishes the basis for trading greenhouse gas emissions reductions through voluntary cooperation between governments. This provision also allows countries to transfer carbon credits to help meet their climate targets. For instance, if Country A reduces its emissions by less than its target, it can purchase carbon credits from Country B, which has exceeded its own reduction targets. This system enables both countries to achieve their overall climate goals.

Article 6.4 establishes a mechanism for negotiating GHG emission reductions under the supervision of the UNFCCC. This mechanism allows for the direct involvement of private sector entities authorized by their national governments, providing a structured approach to international carbon crediting.

An illustrative example of how these mechanisms work can be seen in a scenario where both Country A and Country B aim to reduce their emissions from 100 million tCO2e to 70 million tCO2e. If Country A manages to reduce its emissions to only 90 million tCO2e, it needs to find an additional 20 million tCO2e in emission reductions to meet its target. Meanwhile, if Country B reduces its emissions to 50 million tCO2e, it exceeds its target by 20 million tCO2e. Country A can then purchase these surplus credits from Country B, allowing both countries to achieve their emission targets of 70 million tCO2e through the trade of carbon credits.

This approach under Article 6 aims to facilitate compliance with climate goals and can serves as a source of climate finance for developing nations. A share of the proceeds from these carbon credit transactions could help countries to build resilience against the impacts of climate change.

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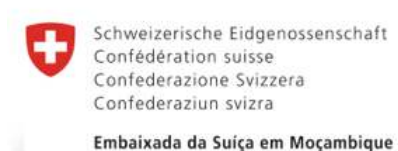
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