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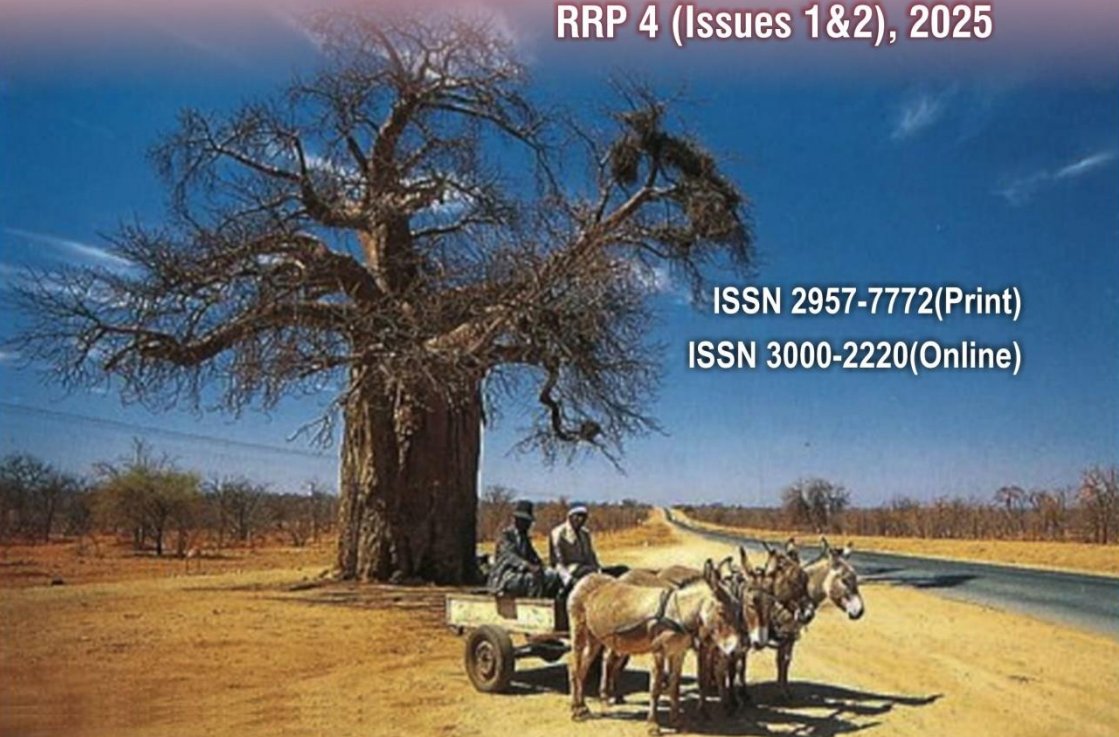

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About the Journal

JOURNAL PURPOSE

The purpose of the *Review of Rural Resilience Praxis is* to provide a forum for disaster risk mitigation, adaptation and preparedness.

CONTRIBUTION AND READERSHIP

Sociologists, demographers, psychologists, development experts, planners, social workers, social engineers, economists, among others whose focus is that of rural resilience.

JOURNAL SPECIFICATIONS

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SCOPE AND FOCUS

As much as the urban territory is increasing by each day, the rural economy, especially in many developing countries, still retains a great proportion of the extractive and accommodation industry. Retaining some space as rural remains critical given the sectors role in providing ecosystem services to both wildlife and humanity. In this light, rural resilience as practice beckons for critical studies especially in the face of the ever-threatening extreme weather events and climate change that then impact on the livelihoods and lifestyles of the rural communities. Review of Rural Resilience Praxis (RRRP) comes in as a platform for critical engagement by scholars, practitioners and leaders as they seek to debate and proffer solutions of the rural sector and trying to champion the philosophy of the right to be rural. The issue of conviviality between the different constituencies of the sectors, compiled with the competing challenges of improving rural spaces while also making the conservation and preservation debates matter is the hallmark of this platform of criticality. The journal is produced bi-annually.

Guidelines for Authors for the Review of Rural Resilience Praxis

Articles must be original contributions, not previously published and should not be under consideration for publishing elsewhere.

Manuscript Submission: Articles submitted to the *Review of Rural Resilience Praxis* are reviewed using the double-blind peer review system. The author's name(s) must not be included in the main text or running heads and footers.

A total number of words: 5000-7000 words and set in 12-point font size width with 1.5 line spacing.
Language: British/UK English
Title: must capture the gist and scope of the article
Names of authors: beginning with the first name and ending with the surname
Affiliation of authors: must be footnoted, showing the department and institution or organisation.
Abstract: must be 200 words
Keywords: must be five or six containing words that are not in the title
Body: Where the authors are more than three, use *et al.,*
Italicise *et al.*, *ibid.,* words that are not English, not names of people or organisations, etc. When you use several authors confirming the same point, state the point and bracket them in one bracket and in ascending order of dates and alphabetically separated by semi-colon e.g. (Falkenmark, 1989, 1990; Reddy, 2002; Dagdeviren and Robertson, 2011; Jacobsen *et al.*, 2012).

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Rural Development through Carbon Credits: Reflections on the Alternative of Carbon Capture in Developing Countries

NESBERT MASHINGAIDZE[1]

Abstract

The development of communities through nature-based solutions to environmental challenges has been seen as instrumental in promoting rural livelihoods and sustainable development. The facets of development, that is, social economic, political and environmental, have been successful in an area endowed with natural resources, such as forests. However, environmental challenges, such as climate change, have threatened the facets of development through its many and varied challenges. In trying to mitigate the challenges of climate change, innovative measures of reducing and removing atmospheric greenhouse gases (GHG) and at the same time improving people's livelihoods, such as carbon crediting, are gaining momentum, especially in developing countries. Rural communities can now develop through nature-based solutions and this has been viewed as a sustainable way of improving the community's livelihoods and mitigating climate change. The central argument of this article is that rural areas can be developed through alternative forms of carbon capturing which provide stocks of reduced or removed atmospheric carbon. Stocks of carbon can be sold by individuals or the community on the carbon market. The study is based on qualitative research that relies more on secondary than primary data. Secondary data was obtained through an extensive review of literature, whilst informant interviews, using interview guides, were used to obtain primary data.

Keywords: *greenhouse gas, community, voluntary, sustainability, livelihoods*

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INTRODUCTION

The Government of Zimbabwe places climate actions as a central issue in its economic development, protection of the people and environmental sustainability. Therefore, environmental maintenance and preservation are crucial to economic growth (Government of Zimbabwe, 2023). Some rural areas in Zimbabwe, and Africa at large, are endowed with vast potential forests with the potential for carbon crediting; some are community forests with potential for carbon crediting. However, besides the endowment of forests, rural communities have other alternatives for capturing carbon with the potential for developing the community through carbon trading (Cisneros *et al.*, 2012; Leach *et al.*, 2015). The central argument of this article is that rural communities can be developed through alternative forms of carbon capturing that provide stocks of reduced or removed atmospheric carbon. The move by the Government of Zimbabwe to regulate carbon trading has ushered in a new dispensation in the development of rural communities.

The reduction of emissions in Zimbabwe through carbon trading activities is a novel approach that facilitates modalities for transparency in the regulation of the markets. Carbon is a natural asset for Zimbabwe and its international trade must principally benefit local communities. These sentiments have provided clarity and opened opportunities to various elements of the carbon credit framework which is aimed at facilitating carbon trading for climate, environmental and microeconomic reasons. Carbon crediting is viewed as a mechanism aiming to reduce the emission or removal of carbon in the atmosphere to mitigate climate change and increase community finance (Madiye, 2013; Mashingaidze, 2021).

The main goal of carbon trading is to ensure actions that trigger the carbon trade market are undertaken, contributing to the financial programmes aimed at reducing emissions. This entails the reduction of emissions through promoting clean technologies and ensuring transparency in the carbon trade business. It is a fact that climate change is real and wreaking havoc in rural communities. Mitigating climate change can turn around the economic fortunes of an area through income generated from carbon trading and investment in clean technologies, thereby developing the area.

Based on the extensive review of secondary data, this article argues that communities in developing countries have various alternatives for carbon capturing which can contribute to the socio-economic development of an area through revenue generation from carbon trading.

BACKGROUND OF THE STUDY

This section traces the background and gives international, regional and national experiences of how rural communities have been developed through alternative forms of carbon capture.

Developed countries have schemes of carbon trading or carbon markets, where harvested carbon or stored carbon (stocks) is sold. The source of this carbon is either from activities carried out in rural or urban areas, such as deforestation and burning of fossil fuels, respectively. Furthermore, the presence of carbon markets has been viewed as important to the development of a nation (Kreibich *et al.*, 2017; Ashraf *et al.*, 2024). Communities have been developed in different ways. However, the endowment of natural resources in an area is crucial for the development of a community (Alghanmi *et al.*, 2024). Carbon market availability presents an opportunity to tap into natural resources such as forests. Therefore, it can be observed that the endowment of an area with natural resources, such as forests, has multiple benefits, including the development of communities through the use of income generated from carbon trading, preservation of nature and climate change mitigation.

Carbon markets aim to reduce atmospheric GHGscost-effectively by setting limits on emissions and enabling the trading of emission units, instruments representing emission reductions (Carbon Trade Exchange, 2020). In developed countries, this concept of carbon trading is often used to describe the compliance market that exists when the government moves in and regulates carbon trading activities. These schemes involve the European Union Emission Trading Scheme (EU ETS) and California's GHG scheme or the Regional Greenhouse Gas Initiative (RGGI) in northeastern United States (*ibid.*0). In these schemes, participants receive an initial allocation of carbon credits free of charge or enter an auction to buy them. Moreover, the business

that subsequently reduces their emission can sell their excess carbon credits to other participants whose emissions have increased. This view has been seen as making carbon a commodity. Regional countries, especially in the southern Africa, such as South Africa and Zimbabwe, are more vulnerable to the risk of climate change. This calls for greater attention to innovative ways of mitigating climate change. South Africa is among the countries at greatest physical risk from climate change. This is exacerbated by its geographical conditions. South Africa is already a semi-arid country being affected by a global average temperature increase of 1,5˚C (Cherish *et al.*, 2018). This increase in temperature triggers a variation in rainfall patterns. In South Africa, it is noted that the Agriculture, Forestry and Other Land Use (AFOLU) sector is at significant climate risk, therefore compromising their food security, health and challenges in maintaining the socio-economic sectors. However, the socio-economic contribution requires the development of the climate-resilient AFOLU sector (Meadows *et al.*, 2003; Chersich *et al.*, 2018).

In Tanzania, tt has been observed that for millennia, traditional communities have been stewards of their land (Trupin *et al.*, 2018), making their efforts more acknowledged and valued tangibly. With this environmental stewardship, some communities, rural communities and indigenous tribes, were now able to sell high-integrity carbon credits in Tanzania, which is a testament to their ancestral dedication to safeguarding the forests and biodiversity of East Africa (Maraseni *et al.*, 2014).

The linkages between environmental stewardship, community and economy have created a virtuous cycle of community sustainability. This virtuous cycle simultaneously preserves biodiversity, enhances territorial security and bolsters the local economy (Trupin *et al.*, 2018). The use of ancient knowledge is crucial to community development (Kimambo *et al.*, 2018). This entails the sustainable use of land as an integral aspect of community life because of its deliverables. In Tanzania, the Hadza hunter-gatherers, for example, have inhabited the Yaeda Valley area for 40 000 years (*ibid.*). Their lifestyle represents one of the oldest forms of human existence on earth, dependent entirely on a healthy environment to sustain their ancient traditions.

This exemplifies their natural reliance on the ecosystem without depleting it (Kimambo *et al.,* 2019). This presents a substantial opportunity for the country to develop a new economic system rooted in a nature-positive future, while safeguarding the rights of traditional Tanzanian livelihoods (Turpin *et al.*, 2018; Kimambo *et al.*, 2019). Therefore, the community's participation in deciding how to use this revenue is crucial for the sustainability of their projects.

According to Zimbabwe's fourth National Committees to the United National Framework Convention on Climate Change (2023), the country's net GHG emission is dominated by the AFOLU and the energy sector, followed by Industrial Processes and Product Use (IPPU), and waste (GoZ, 2023). It is worrying to note that these GHG are projected to increase across all sectors through 2050. The physical impacts of climate change have resulted in significant losses in various socio-economic sectors and the need to upscale climate action is now urgent than before.

Therefore, this section concludes that emmissions from the AFOLU sector has greater implications to the socio-economic activities of the community. Therefore, this calls for ways of reducing these emissions in a way that promotes community development. It emerged that communites rely more on their natural endowment, and protection of these resource will sustain these communities.

CONCEPTUAL FRAMEWORK FOR RURAL DEVELOPMENT THROUGH CARBON TRADING

This section conceptualises how rural communities can be developed through carbon harvesting and climate change mitigation through nature -ased solutions. Rural development through nature-based solutions, such as carbon crediting, has been viewed as one of the sustainable measures in developing countries. Figure 1 shows how rural development, through nature-based solutions, hinges on climate change mitigation measures, carbon credits and the reduction or removal of atmospheric GHGs.

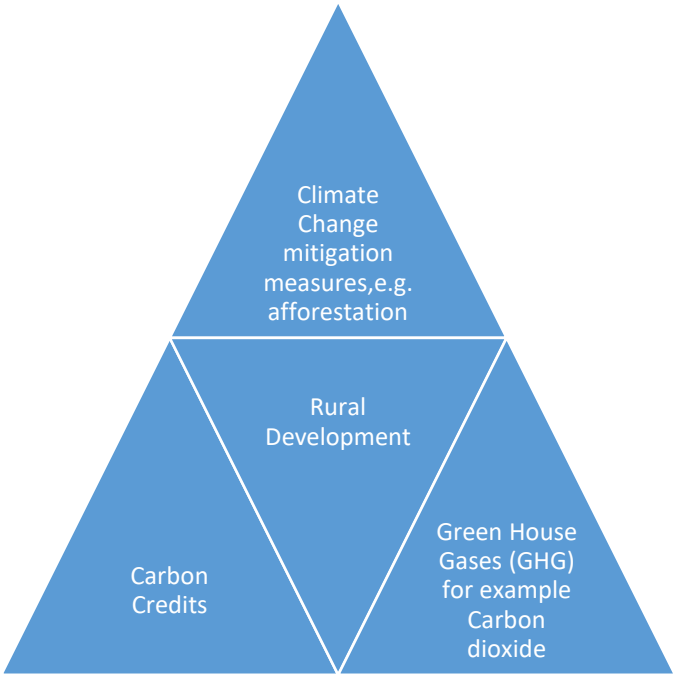

Figure 1: *Integrated components of rural development through carbon trading* (Mashingaidze, 2025)

A carbon credit is a tradable certificate representing one metric tonne of carbon dioxide equivalent that is either prevented from being emitted into the atmosphere or removed from the atmosphere as a result of climate change mitigation (Madiye, 2013; Gupta, 2018; GoZ, 2023). The credits generated are a financial instrument that is traded and or banked over a specified period. However, the generated credits need to be approved by a private or public registry linked to financial systems so that financial benefits are realised. Of paramount importance is that these carbon credits and carbon offsets from climate projects around the world, are aimed at reducing or eliminating GHG from the atmosphere. Therefore, each time a project must be verified to have reduced, avoided or captured one metric tonne of GHG, and that becomes one carbon credit created. Moreover, this can be either a voluntary or a compliance market. Both of the markets are crucial in rural development

through nature-based solutions. The compliance market is driven by government mandatory policies and measures. These measures seeks to reduce GHG emissions so as to achieve the Nationally Determined Contribution (NDC), carbon neutrality and net zero targets. The move by some governments to regulate carbon trading activities attracted more investors. These investors in turn further developed the areas through promoting nature conservation and climate change mitigation.

Carbon trading in Zimbabwe is guided by both international and national legal parameters that protect the government's national interest, investors and the local community (GoZ, 2023). This ensures that GHG emission reductions are met and society is protected from the negative impacts of climate change (*ibid.*). Therefore, all carbon trading activities must be done within the confines of the country's laws to promote fairness, efficiency and accountability.

The introduction of a carbon crediting framework in Zimbabwe has been received as a noble idea that brings order to carbon trading activities. In the past, some voluntary carbon credit projects have been criticised for lacking transparency in their measurement, verification and reporting and for limited community benefits.

Moreover, to strengthen the country's carbon trading governance structure, the Carbon Crediting Framework (CCF) advocates the setting of a committee with knowledgeable stakeholders which consists of climate change, carbon private markets, business stakeholders, the environment and legal experts.
Therefore, it can be concluded that rural development through carbon trading, revolves around the integration of climate change mitigation, reduction of GHG and climate change governance. This may require effective political decisions, coordination of efforts, massive investment and environmental education.

LITERATURE REVIEW

This section dwells much on review of relevant literature on rural development through carbon trading, focusing on evidence of researches done on development of communities through the conservation of nature.

Moreover, it gives a summary of empirical evidences of community practices aimed at mitigating climate change.

The 27th conference of parties of the United Nations Convention on Climate Change (UNFCCC) held in Sharon EI-Sheikh in Namibia, 2002, set a positive momentum on the use of carbon credit markets as a means of accelerating climate action, transforming people's livelihoods, generating investment which transforms economic action in African countries (African Union Commission, 2023). Statistics reveal that about 300 million carbon credits are produced annually in Africa (*ibid.*) which can turn the economic fortunes of different nations in Africa. Some of the recommendations from the conference are that there is need to bring together diverse stakeholders. These stakeholders include governments, private stakeholders and civil society. They facilitate investment in bankable projects that deliver meaningful climate action and generate high-integrity carbon credits for Africa.

It is important to know that carbon credit markets around the world are emerging as important platforms connecting commerce, climate change, emission reduction or removal, sustainability and ecosystem protection (ZELA, 2023). However, the presence of GHG in the atmosphere has plunged heads of state into loggerheads, thinking about the long-lasting solution to the climate change problem.

The inclusion of forest-related actions in national climate strategies and programmes impacted favorably on the achievement of international goals, such as Global Forest Goals, and enhancing carbon stocks (Agbogidi *et al.*, 2009). Moreover, Mckie (2021) asserts that carbon capture is vital to meeting climate goals. Environmental advocates further insist that storage of technology is not a costly mistake, but the best way for developed countries to cut emissions from heavy industries. Engineers and geologists from developed countries insist that schemes for carbon capture are vital weapons in the battle against global heating and warming (*ibid.*). Moreover, in developing countries, market mechanisms for mitigating climate change are put forward beyond the existing Clean Development Mechanisms (CDM). This is meant to encourage mitigation at the least possible cost and some of the proposals suggested by the UNFCCC are the introduction of new sector-based

mechanisms (Barron *et al.*, 2009). This will mitigate climate change and achieve economic development of communities.

It is only since the mid-20th century that deforestation has reached such proportions, as to constitute a major ecological and economic problem (Whitlow, 1980). Furthermore, Zvobgo *et al.* (2021) suggest that forests are being destroyed and are not being replacedand this is occurring particularly in areas where the concentration of population is high. Viewed differently, the remaining forest resources are not located in the areas where they are required (Mataruse *et al.*, 2023). This massive deforestation is providing a worrying situation, prompting rural communities to turn to other alternatives of carbon capture which can convert stored reduced or removed carbon into carbon credits.

The world will be better off everything possible was done to reduce emissions enough to keep the global temperature increase well below 2˚C. Mckie (2021) weighs in and argues that if countries have any hope of keeping global temperatures down 2˚C, then they desperately need to develop ways to capture and store carbon dioxide. Weng *et al* (2025) reveal that China is experiencing deteriorating air quality. This is because of the fast-growing transport sector, vehicle emissions having become one of the major sources of air pollution.
Therefore, the science behind carbon capture and storage is extremely good. It offers genuine solutions to some of the problems faced in trying to tackle the global increase in temperatures. The degraded forests present opportunities for carbon crediting. Forest endowment in an area presents vast opportunities for community development. It has been suggested that there are three forestry options available for verified carbon credits, and these are afforestation or reforestation, improved forest management and avoided conversion (Carbon Trade Exchange, 2020). These three forms of forests have climatic benefits through the reduction or removal of atmospheric carbon. The community can quantify the GHG removals generated by preventing the logging of forests that would have been carried out in the absence of purchasing the forestry carbon credit (*ibid.*).

The emission of GHG into the atmosphere has been caused largely by anthropological activities. Asner *et al.* (2005) assert that clearing and burning

tropical forests account for about 20% of global annual GHG, about as much as all of the fossil fuels burned in the United States every year and more than the world's transportation sectors. Furthermore, countries such as China and the USA are the world's number one and two emitters, but numbers three and four are Indonesia and Brazil, with 80% and 70% of their emission, respectively, from deforestation (*ibid.*).

Reducing overall emissions from deforestation in tropical nations can help avoid dangerous climate change. Most climate scientists think that greatly reducing or stopping tropical deforestation, while also substantially reducing emissions from developed and major developing countries' fossil fuels, will be necessary to keep warming under 2˚C by the end of the century (*ibid.*). Reducing emissions from deforestation in developing countries may reduce emission allowances or credits in carbon markets under post-2012 global cap and trade system.

To conclude, it is clearly evident that some rural communities are enjoying the fruits of conserving nature and their economies have flourished through investment in nature-based solutions. However, it emerged from the literature that keeping temperature warming under 2˚Cby 2050, requires coordinated efforts from all fronts, that is economic, political and social efforts.

RESEARCH METHODOLOGY

The study utilises the qualitative approach to obtain data on peoples views about carbon trading and rural development. The study adopts the case study and documentary review research designs. The case study design enabled the study to explore how rural communities have been developed through carbon credits in developing countries and alternative forms of carbon capturing, which are effective in reducing GHG emmissions. There are several rhetorical questions as to why developing countries have been chosen. This is because developing countries have both rural and urban settlements with some still having a large population in rural areas. Moreover, some of the contributing activities to global warming are in both rural and urban settlements, whilst activities for carbon capture and reducing GHGs through varied activities are more in rural than urban areas.

The research also used a documentary review, enabling the it to review relevant literature on carbon crediting activities in rural areas and carbon capture projects that aimed to reduce the emission of GHG and climate change mitigation. In terms of population and sampling, the population consisted of individuals who were randomly selected from rural communities, but with a special focus on rural areas where there were some projects for carbon crediting, such as Mutare and Chipinge in Zimbabwe. Moreover, key informants were drawn from government institutions including relevant ministeries, departments (like the Environmental Management Agency (EMA) and agencies. Rural district councils and selected environmental pressure groups were purposefully also selected to participate in key informant interviews.

Data obtained were on some forms of carbon capture in rural communities in Zimbabwe. The research also conducted five consultation meetings with academicians to discuss, test and refine some of the findings obtained through secondary research and validate the instruments used to collect primary data. These meetings included colleagues and some academicians.

Largely, an extensive desk review to obtain secondary data was conducted, this involving the review of literature on carbon crediting activities, issues surrounding good carbon crediting practices in rural areas and environment management reports produced by the Ministry of Environment, Wildlife and Climate Change (MECW). Reports by civic organisations into carbon trading and those by Intergovernmental Panel on Climate Change (IPCC) were also consulted. This allowed the study to gather data from a wide range of sources. During the desk review of literature, relevant policy documents on forest management approaches and environmental planning reports by organisations, academic journals and policy papers were reviewed.

FINDINGS

This section presents the findings of the study obtained from the collection of both qualitative and quantitative data. Both primary and secondary data were obtained using primary data collection methods and achival methods, respectively.

Zimbabwe is vulnerable to climate change shocks and impacts. These include recurrent droughts and Elnino-induced droughts characterised by mid-season dry spells that have an impact on some sectors such as agriculture and energy sectors and the people's livelihoods (Madiye, 2013; GoZ, 2023). Studies reveal that developing countries, such as Zimbabwe and Tanzania, have embarked on a paradigm shift from business as usual to more environmental alternatives for mitigating climate change. This is done through encouraging eco-friendly and socially responsible practices. Noted is the sectoral-based approach for sustainable practices and strategies by government. Some of these practices and strategies promote industrial growth and investment. Other strategies include a green economy strategy that aims to promote sustainable development, reduce emissions and increase the use of renewable energy, renewal energy policy that encourages investment in renewable energy sources like solar and wind power.

These methods, either technological or naturebased solutions, help to remove and reduce atmospheric GHGs, chief among them carbon dioxide. Removing or reducing carbon can create stocks of carbon that can be converted into carbon credits traded on carbon markets upon proper verification. These initiatives demonstrate the community's and government's commitment to sustainable industrial growth and investment, balancing economic development with environmental and social responsibilities.

The Africa Voluntary Carbon Credits Market Forum (2024) reveals that there are more than 147 methods of developing carbon credits in both rural and urban settlements in Africa and these methods are cross-cutting. They include many sectors, from energy, agriculture, biodiversity conservation (wildlife), wetlands conservation, plastic waste removal, afforestation and reforestation, methane capture, methane reduction in feed management for livestock, solid waste management for cities, water management systems to the transport sector.

The endowment of forests in rural areas, especially community forests, presents a great opportunity for carbon removal and mitigation of climate change in the long run. Communities in developing countries have embarked on afforestation and reforestation projects with the motive of carbon crediting.

This has also been enabled by the government through ministries and agencies, civil society organisations (CSOs) and private companies. It is important to note that trees take in atmospheric carbon through their leaves, store it through the stem and transfer it to the soil. This process alone reduces atmospheric carbon which can then be quantified and verified by registered carbon agents before it is converted to carbon credit.

Moreover, besides this sequestration role, the stored carbon can be traded in the form of carbon credits, whixh then provide the community with finance. To add on, agroforestry has been proven to be a panacea in environmental conservation and preservation of climate. This is relevant particularly in African countries, where the endowment of forests is high and carbon credit programmes are viewed as, and provide financial incentives for farmers who adopt agroforestry practices. These practices have been seen in countries such as Zimbabwe, Tanzania and Kenya. This initiative highly contributes to global efforts enshrined in the Paris Agreement and successive Cooperation of Parties (COPs) of reducing GHG emissions through nature-based activities.

In the context of agroforestry in Africa, these programmes offer a unique opportunity to incentivise farmers and land owners to adopt environmentally-friendly practices, while also generating additional income. Agroforestry projects in Africa can generate revenue by selling those credits to organisations or individuals seeking to offset their emissions. To further substantiate the view, Zimbabwe and Tanzania can be illustrated as a case study. Zimbabwe is trying all efforts on all fronts, both on the compliance and voluntary markets, despite a threat from anthropogenic activities such as urbanisation. Zimbabwe is endowed with both natural and private forests and some woodlands, though some have been destroyed by anthropogenic activities and eight internationally recognised wetlands which are threatened by unsustainable human activities such as the dvelopment of informal settlements.

This makes nature-based solutions which involve reforestation and ecosystem restoration such as wetlands preservation or mangrove restoration, more common in Zimbabwean rural areas. It is of paramount importance to note that the finance generated from crediting financials not only encourages the

expansion of agroforestry practices, but also contributes to the sustainable development of rural communities through the development of social amenities and infrastructure, such as roads and bridges. As argued before, the integration of agroforestry with carbon credit programmes provides an additional income stream through the sale of carbon credits, but trees have far more consequences in sequestering carbon dioxide and climate change mitigation.

In Tanzania, nature-based solutions have the potential to mitigate 41.44 Mt CO_2e per year through avoided forest conversion and an additional 0.95 Mt CO_2e per year through the sustainable management of grazing lands (Kimambo, 2019). This clearly indicates greater environmental benefits from nature-based solutions. This reduction is achieved from, eight village communities in the Ntakata Mountains that have committed to averting the felling of 1 250 000 trees each year (Trupin *et al*, 2018; Kimambo, 2019).

However, it is important to note that these community efforts are being acknowledged and valued tangibly. This is evidenced by rural communities and indigenous tribes who are now selling high-integrity carbon credits, a clear testament to their ancestral dedication to safeguarding the forests and biodiversity of East Africa. Moreover, despite the monetary value of carbon credits, the virtuous cycle simultaneously preserves biodiversity, enhances territorial security and bolsters the local economy. Currently, 60% of the revenue from carbon credits in Tanzania is directly managed by these communities, who reinvest these funds into health, education and local business development (Kimambo, 2019).

In 2023, Zimbabwe had the opportunity to develop a framework for carbon crediting. The framework for carbon crediting in Zimbabwe clearly states that this carbon trading expects the income generated to be distributed fairly between those investing in carbon trading activities, the community and the government, and a resource fund aiming to support local climate change adaptation and mitigation programmes, and expenses by government in administering frameworks, both at local and international level (GoZ, 2023). All these initiatives are aiming to develop Zimbawean rural communities.

However, in the long run, the diversification of income sources through agroforestry holds great promise for sustainable livelihoods and economic growth in Africa. Moreover, this not only contributes to climate change mitigation, but also enhances the adaptive capacity of local communities, making it a valuable strategy for sustainable development in the face of climate change. There are various ways in which the communities can achieve this. Landowners or communities can sell carbon credits by enrolling in reforestation or preservation projects such as the use of the Indigenous Knowledge System (IKS) and those projects which measure and pay for captured and stored carbon. Therefore, it is prudent that income from those credits fund community development projects, such as water provision, clinics, schools and crime reduction programmes. Despite this novel initiative and the regulatory details provided by Statutory Instrument 150 of 2023, some aspects require further clarity and analysis. This includes land ownership and the nature of communal land tenure systems may affect the willingness and attractiveness to buy credits from land without title deeds.

Besides nature-based solutions, another alternative available on the voluntary market for Zimbabwe is technology-based solutions. This also has been viewed as prudent as it increases industrial efficiency and promotes renewable energy projects, such as windmills or direct carbon capture. In an initiative to promote technology-based solutions, solar farms are dotted all over in Zimbabwe with the proposed Dema solar project in Mashonaland East Province. However, wind projects are not common in Zimbabwe because of its geographical nature. Being a land-locked country, wind farms are not suitable as they are more common in coastal locations and areas where the wind constantly blows. This makes technology-based solutions uncommon in Zimbabwean rural areas; therefore, communities can realistically engage in nature-based solutions such as reforestation, afforestation and tree canopy maintenance.

Studies on rural development also reveal that 32.7% of people in rural areas in Zimbabwe lack access to an improved water source, which contrasts starkly with the 97% coverage in urban areas (*The Standard*, 29 September 2024). The issue is compounded by economic problems faced by Zimbabwe in recent years, which have contributed to 75% of rural water points becoming

dysfunctional. It has been argued that in a country where the vast majority of rural people rely on buying solid fuels for their cooking needs and have no option but to boil water to make it safe, this constitutes a major source of carbon dioxide emissions.

In Mutare District, Zimbabwe, the role of civic society organisations has been very instrumental in reducing emissions and raising revenue for the community. This has been exemplified by CO2Balance, which works closely with the Diocese of Mutare Community Care Programme (DOMCCP), to rehabilitate broken-down boreholes in Chipinge and Mutare rural districts and to empower sustainable community-level structures to manage and maintain boreholes. These structures include Water Point Committees and Village Pump Minders responsible for the maintenance of these boreholes so that safe water is constantly supplied to the community, thereby reducing the need for solid fuels for boiling water. This saves thousands of tonnes of firewood per year and reduces CO_2 emissions. Statistically, the CO2 Balance and DOMCCP partnership has led to 120 boreholes being placed under the programme. The boreholes in CO2 Balance's Zimbabwe projects ensure that thousands of people have access to sufficient safe water, reducing the occurrence of water-borne diseases and removing the need to boil the water as a treatment method that exposes households to household air pollution (*ibid.*).

Moreover, the provision of safe water sources in communities removes the need to collect firewood for boiling and reduces the time spent collecting water, a burden that disproportionately falls on women and children. However, this joint partnership of two organisations yielded results, by offsetting the need of communities such as the use of wood to boil water in villages such as Muchisi. From this project, CO2 Balance was able to produce 174 324 carbon credits. Statistics by the leading carbon credits database, the American Based Voluntary Registry Offsets Database, shows that 81 491 credits have been retired, leaving just 92 833 active from 16 borehole projects in Chipinge and Mutare. German online statistics platform, Statista, reports that the average price of the Voluntary Carbon Market (VCM) credits was US$6,53 early this year, making CO2 Balance achieve credits worth over US$600 000. This money is then used by CO2 Balance to fund its initiative

with DOMCCP and raise finances for its other programme uses. However, from this project, there has been a remarkable decrease in the amount of firewood being used for boiling water for consumption at home, and that decline in the use of firewood will reduce the carbon footprint.

DISCUSSION

Anthropogenic pressures quickly alter nature, requiring protected area planning and management (Hoffman *et al.,* 2021). Therefore, alternatives to carbon capture in rural areas must be people-centred and inclusive. Various authorities argue that environmental problems are people's problems and, therefore, require solutions from people. This has been seen in some developed countries such as the United States of America where they launched a carbon offset programme which would allow corporations to fund renewable energy projects in developing countries.

Regardless of how the noble idea is, the determination of GHG emission caps for different industries needs to be considered. For the project to be sustainable, transparency and accountability must lead the way, especially in considering the potential for a project for carbon crediting. For instance, power companies such as HwangeColliery, a well-known emitter might be different from those companies at plantations such as Tanganda Tea that generates tea plantations. Therefore, a sectoral-based approach is crucial in considering the potential of a project for carbon crediting. Chuma *et al.* (2021) asset that countries such as Zimbabwe and Tanzania need a well-developed structure for the carbon market.

Furthermore, it is suggeted that if there is a well-structured carbon market strategy, a built necessary capacity and effective participation in global carbon markets and agriculture, it would be important for a country to succeed in carbon projects. However, the issue goes back to how creative and innovative a country is. As argued above, there are more than 147 projects for carbon crediting in Zimbabwe, so only further research is needed. In some countries, partnerships are being organised to ensure that carbon projects are a success. A case in point is Tanzania, which can be used to augment this view. In Tanzania, specifically in the Datooga Community, they have the Yaeda-Eyas

Landscape Project, a programme designed to prevent the annual felling of over 170 000 trees in the Yaeda Valley region (Trupin *et al.*, 2018).

This has seen results in the Ntakata Mountains, where eight village communities have committed to averting the felling of 1 250 000 trees each year (Kimambo, 2019). This programme is in partnership with Carbon Tanzania, an organisation aiding 12 communities to generate verified forest carbon offsets sold on the voluntary market, This is done through the protection of forests through patrols and implementation of village laws. Chuma *et. al* (2021) argue that countries must focus on projects for sustainable land use such as forestry and agriculture, renewable energy (solar, wind, hydro), energy efficiency, water conservation, blue carbon, community-based projects, waste management and disaster risk reduction.

Africa accounted for 11% of total carbon credits issued between 2016 and 2021. However, the region is currently generating 2% of its potential annual output. This means that the region is still performing below its potential. Statistically, the African carbon market can potentially be worth approximately US$1.3 trillion. Assuming a conservative value of 2-5% as Zimbabwe's share, the country's carbon market can potentially be worth between US$25.99-US$64.98 billion by 2033, based on the country's natural endowments and landscape (*ibid.*).

Besides revenue generation, it is the obligation of the government, through the Ministry of Environment, Water and Climate, Climate Change Management, to reduce its emissions of GHGs by 40% per capita by 2030.

CONCLUSIONS AND RECOMMENDATIONS

It is concluded that developing countries have vast alternatives for carbon capture, ranging from energy, agriculture, forestry and other land uses. The stored or captured carbon can be converted into credits at a carbon market, either voluntarily or in compliance with market regulations. Carbon credits are designed to reduce GHG emissions, thereby mitigating climate change. In Zimbabwe, the general public can realistically participate through nature-based solutions like reforestation, afforestation and avoidance. Communities have realised the benefits of carbon trading through partnerships. For instance,

partnerships like the one between CO2 Balance and DOMCCP made subsistence farmers in the Mutare district to look forward to more secure, sustainable livelihoods, with gardens, which are symbols of hope and resilience, blossoming amid the challenges of climate change.

It is noted that in previous years, several carbon credit projects started without adequate attention to community needs and respect for environmental concerns or land tenure rights. Therefore, there is need for clarification on land tenure systems as this is crucial for supporting carbon credit trading because no one would want to trade in carbon from land whose ownership is not known, especially in rural areas. To increase efficiency and accountability in carbon trading, a stocktake of all the projects contributing to emission reductions in the country must be done because without taking stock of all activities from the industry, including its waste sector, energy sector, forestry, agriculture and so forth, would be very difficult to manage and to meet obligations, To earn carbon credits from planting trees in developing countries such as Nigeria, there must be projects, carbon standards, carbon markets and regulations backed by legislation.

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