Kingdom of the Netherlands

Making Carbon Markets Work for Smallholder Farmers

Opportunities and challenges in Nigeria

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Ministry of Foreign Affairs of the Netherlands

Executive summary

This report is exploring the potential of carbon credits to benefit smallholder farmers, food and nutrition security, and sustainable land use in Nigeria. First, we briefly introduce the history of carbon markets, the types of carbon credits, the typical market actors as well as the most prevalent critique and risks associated with carbon offsets. Before identifying potential ways of collaboration for making carbon markets work for smallholder farmers between Nigeria and the Netherlands, we provide an overview of the most relevant policies and trends in both countries.

Carbon financing can be one tool contributing to the transition to renewable energy and clean fuels, an undoubtedly important step for any country in face of the climate crisis. However, carbon programs in agriculture have a higher potential for positive direct impact for smallholder farmers. The right regenerative, climate-resilient agriculture practices can not only sequester carbon, but also improve soil quality and increase smallholder resilience among other benefits. However, it is crucial to note that for such impacts to materialize, complex stakeholder networks, as well as natural systems need to work together to enable positive outcomes for farmers. The potential of carbon credits can only be assessed within the complexity of their context.

The report presents several opportunities which may enable carbon markets to contribute to the transition towards more sustainable food systems in Nigeria. Essential ingredients mentioned by key stakeholders are: education and capacity building on climate resilient, regenerative agriculture and about carbon credits for smallholders; improved access to quality seedlings and nurseries; leveraging outgrower schemes and government-led carbon programs. Importantly, program developers need to ensure informed consent of smallholder farmers as well as their strong influence and clear understanding on the use of carbon credit revenues.

To enable increased adoption of renewables and clean (cooking) fuels by (smallholder) households through carbon credits, a first step could be raising awareness and technical assistance for SMEs in these sectors about carbon credit markets, followed by supporting groups of SMEs to pilot a group-based carbon program. Besides, supporting the enabling infrastructure (for example pay-as-you-go and digital inclusion) is needed for easier roll-out and adoption of initiatives in this space. Cross-sector investment opportunities include co-investment in program setup, certification and monitoring, development and testing of cost-effective carbon measurement methods and enabling connections and exchange across focus sectors.

In order to make the regulatory and voluntary markets work for smallholders and climate impact, key contributions include: support in the development of a national voluntary carbon market platform in line with the Africa Carbon Markets Initiative targets, multi-stakeholder consultation on tensions between voluntary and obligatory markets, exploring opportunities for financial solutions for other ecosystem services (e.g. biodiversity and water), and improving the enabling environment for private sector participation through transparency on policy directions and through easy access to market information.

I. Carbon markets: an introduction

1. A short background

Background of this report

The Embassy of the Kingdom of the Netherlands (EKN) is interested in exploring the potential and relevance of carbon credits as a means for smallholder farmers to increase their incomes, improve food & nutrition security and contribute to a higher number of hectares of sustainably used farmland. The interest is in line with the ambition of the Nigerian government to establish a policy infrastructure around carbon markets, and the Dutch government seeks to explore ways of contributing to the development of such markets on various levels, ranging from providing bi-lateral support to the Nigerian government, but also for instance supporting in-country developments through development programs and economic collaboration.

The research was conducted by a collaboration between Dutch and Nigerian-based consultants from Bopinc and EERC respectively. Both sides have leveraged their existing expertises and conducted desk research and semi-structured expert interviews with public and private stakeholders from the Netherlands and Nigeria.

Putting a price on emissions - a brief history

In 2021, global carbon dioxide (CO2) emissions rose by 6 percent to 36.3 billion tonnes, representing the highest level ever in history in absolute terms[1], but also in line with general trends. This further contributes to the rise in global temperatures, which in turn affects the living conditions of the earth's inhabitants. The major emitters are usually not the victims. In fact, harmful implications are more likely to occur for less wealthy populations in the world, whereas the wealthier parts of the world are contributing to its growing occurrence the most.[2] With many historical attempts to curb the rising greenhouse gas (GHG) emissions failing, in recent years more and more institutions have turned towards putting a price on the emissions and creating a market that incentivizes greener adjustments. The IPCC (Intergovernmental Panel on Climate Change) observed the following rationale behind putting a price on emissions:

> *Policies that provide a real or implicit price of carbon could create incentives for producers and consumers to significantly invest in low-GHG products, technologies and processes. Such policies could include economic instruments, government funding and regulation.*[3]

The mechanism behind carbon credits was formalized in the Kyoto Protocol, an international agreement among more than 170 countries, and the market mechanisms were agreed through the subsequent Marrakesh Accords. Then, in 2014, article 6 of the Paris Agreements brought the market one step further, by allowing the official establishment of *international*

[1] IEA. 2022. Global CO2 Emissions Rebounded to their Highest Level in History in 2021

[2] Climate Trade 2021. Which Countries are the World's Biggest Carbon Polluters? Newsletter, May 17.

[3] IPPC 2007. Working Group III: contribution to the Intergovernmental Panel on Climate Change

compliance carbon markets where countries can trade carbon credits amongst each other. Article 6.4 specifically enables a company in one country to reduce emissions in that country, and have those reductions credited so that it can sell them to another company in another country. That second company may use them for complying with its own emission reduction obligations or to help it meet net-zero[4]. Most of the transactions are actually not performed by national governments directly, but by operators who serve as an intermediary and have set quotas by their country. This structure provided the basis for the first carbon (compliance) market, which was later on accompanied by the fast growing voluntary carbon market.

Compliance market

The compliance market for carbon can also be called Emission Trading Systems (ETS), referring more explicitly to the (inter)governmental infrastructure that sets the rules for these regulatory markets. The first ETS was established in the EU and it is dependent on national, regional, and international regulations and the European Union itself as validating institution. Currently, there are several more Emission Trading Systems in the world and these include the European Union's Emissions Trading System (EU ETS), the California Global Warming Solutions Act (USA), and the Chinese National Emission Trading Systems (China). However, ETS currently covers roughly 23 percent of the global emissions with an increase of 164 percent in the traded value of the CO2 permits in 2021, reaching a total market value of US$851 Billion[5]. The global market also remains unstable due to changing climate goals, policies, inflation, and uncertainty, with an average price ranging from less than US$10 per ton to more than US$100 per tCO2e. A contributor to insecurities is that countries are constantly making strategic choices between committing to compliance markets, or going for voluntary markets only. Since CO2 emissions can only be traded in one market (officially) a country like India for instance, has recently decided to focus on voluntary markets only[6].

Voluntary market

Besides the compliance markets that are driven by institutional adherence to a quota, there is also a voluntary market whereby the purchasing or selling of carbon credits happens on a voluntary basis. Companies can participate in the voluntary carbon market either individually or as part of an industry-wide scheme (e.g. the Carbon Offsetting and Reduction Scheme for International Aviation) and set their own commitments and quotas. While compliance markets are currently limited to specific regions (see above), voluntary carbon credits are more unrestrained by political or governmental institutions and can be applicable to every type of industry. Because of these lower restrictions, the prices of voluntary market carbon credits are therefore often lower than their counterparts within the compliance markets. The voluntary market has been frequently hailed as one of the fastest growing markets of the future. Whereas the market has recently reached the US$2 Billion mark in 2022, it was expected by McKinsey to grow towards $50 Billion in 2030.[7] Credits from independent crediting mechanisms clearly dominate the carbon market, driven by corporate commitments. Compliance demand for carbon credits remains more limited, though new rules for international carbon markets under Article 6 of the Paris Agreement provide clarity

[4] UNCC 2022. Article 6.4 Mechanism
[5] Carbon Credits 2022. A Guide to Compliance Carbon Credit Markets
[6] BloombergNEF 2022. The untapped power of carbon credits
[7] Blaufelder et al. 2021. A Blueprint for Scaling Voluntary Carbon Markets to Meet the Climate Challenge.

that may enable future growth. Nature-based credits are in especially high demand: forestry and land use transactions more than doubled between 2020 and 2021. Increasing demand for carbon removals has resulted in price increases for these credits.[8]

Insetting

Finally, next to compliance (regulatory) markets and voluntary markets, value chain insetting should also be mentioned. Insetting refers to a company compensating its emissions through a carbon offset project within its own value chain. In contrast to a typical carbon offset project, emissions are avoided, reduced or sequestered upstream or downstream within the company's own value chain.[9] Whenever products are considered CO2 neutral, their entire supply chain needs to be carbon neutral, according to GHG protocol accounting standards[10], contributing to the rise of value chain insetting projects.

2. Carbon offset strategies

Trading 'carbon credits' and 'carbon offsetting' (see glossary) are frequently used and relate to a multitude of carbon reduction and removal and methods, as illustrated by the graph below. A carbon offset can be either a reduction or removal of emissions of carbon dioxide or other greenhouse gasses made in order to compensate for emissions made elsewhere. The differentiation between 'reduction' or 'removal' credits is probably the most significant differentiator. This has to do with the current GHG levels in the air: they are already too high to keep a stable climate, that is projected to stay within the 1.5 degrees marker, that was agreed during the Paris accords[11]. As the names suggest, reduction or avoidance methods focus on avoiding the addition of more CO2 to the air either now or in the future, whereas removal methods are about actually removing CO2 that are already in the air.

[8] World Bank 2022. State and Trends of Carbon Pricing.
[9] My Climate 2022. What is Carbon Insetting?
[10] FAO and Rabobank 2022. Global System for Carbon Farming: A Holistic Climate Change Solution
[11] UNCC 2021. Climate Commitments Not On Track to Meet Paris Agreement Goals. February 26, 2021

The diverse types of carbon credit
Source: [The Ecosystem Marketplace: The State of the Voluntary Carbon Markets Q3 2022]

Carbon reduction vs. Carbon removal

Carbon reduction or avoidance

Examples of carbon reduction are the replacement of fossil fuel based energy with energy coming from renewable sources (e.g. wind and solar). Clean cooking, referring to people using cleaner fuels and more energy efficient stoves, are another example that reduces CO2 emissions. Another option is to protect natural ecosystems such as forests, ocean systems or mangroves. These ecosystems can be used as carbon sinks and can actively remove carbon from the air, if they are healthy.[12] However, it is important to note that *protecting* an ecosystem is different from *restoring* a degraded ecosystem. Whereas the first is about avoiding any further loss of carbon sinks, the latter is about expanding the natural carbon sink potential. Whereas protecting ecosystems is part of carbon reduction methods, restoring would therefore fall under the header of carbon removal, like described in the next paragraph.

Carbon removal

Cabron removal is about actively trying to remove more carbon from the air (and store it in

[12] UNEP 2022. Five Ecosystems where Nature-based Solutions can Deliver huge Benefits

carbon sinks) than current processes allow for. These methods can be split into two categories: nature-based solutions and technological solutions. Nature-based solutions are mostly related to reforestation and carbon farming. See an overview of carbon farming methods (agroforestry, soil organic carbon, biochar, manure management, biofertilizer and compost) in the visual below.

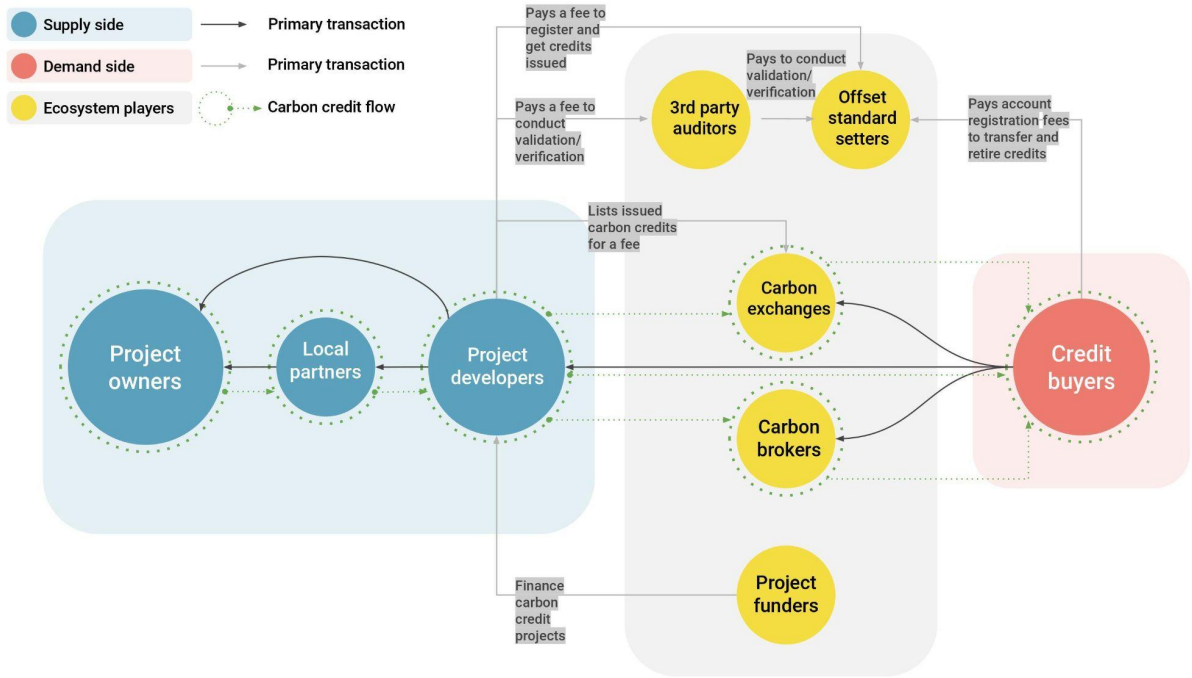
Visual overview of carbon farming methods and their potential, adapted from:
FAO, Rabobank, 2022. Global system for carbon farming

Next to natural carbon removal strategies, there are also high-tech strategies like direct air capture and enhanced mineralization. These strategies are often also referred to as CCS (Carbon Capture and Storage). There is also a lot of critique on them. First, technological carbon removal uses a lot of energy and does nothing to restore natural balance of CO2 management. Secondly, although the actual removal of CO2 from the air is possible, the storage of the CO2 seems to be highly ineffective (with less than 0.5% actually being successfully stored). Nonetheless, these strategies are being promoted as a necessity because restoring GHG levels with just natural strategies is likely to be unachievable.

Lastly, there are also hybrid strategies, whereby natural processes are enhanced by technological interventions. These strategies can include enhanced root crops (able to store more CO2 in the soils), bioenergy with carbon capture and storage, and ocean-based carbon removal. Although many of these techniques are not completely developed yet for scale, some could provide interesting opportunities in the future.

3. Market actors

The value chain for carbon credits encompassess different types of stakeholders, ranging from *buyers* of the carbon credits, to the *exchanges, marketplaces* and *brokers* of carbon credits where the buyers can buy them, to the *project developers* which can be considered the producers of carbon credits because they organize carbon reduction and removal projects, to the actual *suppliers* of carbon capture or avoidance activities. This last group of suppliers can be a variety of types, it can for instance be about companies that leverage or produce renewable energy, agencies or institutions that protect forests, but also farmers who switch to more regenerative practices. In any case, these suppliers are the ones' that actually execute the activities that are reducing or removing carbon emissions.
To enable the supply chain, a range of enabling parties are involved. Typical actor involved is a *third-party auditor*, validating and verifying a project's baseline and its projected emission reductions. *Offset standard setters* define rules and criteria for voluntary carbon credits (in the absence of national or international registration). Besides, consultants may be involved at any point in the process to support *suppliers* or *project developers* in the program setup.



Visual overview of typical carbon market actors and transactions, adapted from:
[Paia Consulting, 2021. Carbon Offsets and Credits, Explained]

4. Critique and risks

The carbon credit market is under a lot of scrutiny. From calling out low-quality, greenwashing credits[13] [14] and the risk of big emitters abusing offsets to get away with current practices[15], to technical concerns over the efficiency or the actual CO2 impact of carbon projects[16]. The critique is diverse and widely communicated. Below is a list of some of the most common risks and disadvantages of carbon credits to be considered.

There is no silver bullet
Carbon credits are not a substitute for massive, comprehensive reductions in emissions. If used as a “license to emit”, carbon credits become counterproductive.

Measurement accuracy versus cost-effectiveness
For transactions to take place, the potential and the actual carbon reduction or removal need to be verified. The more rigorous measurement, the better the quality of credits, and the lower the risk of greenwashing. However, more rigorous measurement also comes with more transactional costs, meaning investment which needs to be spent not on the actual carbon impact, but on auditors and consultants providing validation and verification services.

Price volatility
Although there are good reasons to assume price increase[17]. Currently there are a lot of low-quality credits on the market which hinder trust of stakeholders and can affect prices negatively. Although most actors seem to count on price increase, there is uncertainty associated with price volatility.

Carbon tunnel vision
Carbon credits reinforce this trend, ignoring other impacts of the different methods - e.g. while there is a lot of evidence on biodiversity and soil regeneration impact of agroforestry, its impact is “reduced” somewhat to its carbon removal potential through carbon accounting.
There is a longstanding social-science critique of the "a ton is a ton" approach[18], in the realms of carbon accounting. This outlines that a ton of carbon emissions which is released in the atmosphere, is accounted for with the same value as a ton of carbon emissions which is removed from the atmosphere. While the simplification is useful in carbon accounting and for the creation of carbon budgets, it can be highly critical to global carbon emission reduction.

Equity and dependency
Under the Clean Development Mechanism (see the Glossary), more developed countries could gain credits by providing funding for projects in developing countries. This sets up an economic hierarchy and creates new dependencies. The concern is the reinforcement of the

[13] Carbon Credits Scam, from the BBC Series You’ve been scammed
[14] GRAIN 2021.Corporate Greenwashing: "Net Zero" and "Nature-based Solutions" Are a Deadly Fraud
[15] Aljazeera 2022, Why We Can’t Offset Our Way Out of Climate Change
[16] Song and Temple 2021. "The Climate Solution Actually Adding Millions of Tons of CO2 Into the Atmosphere".
[17] World Bank. 2022. State and Trends of Carbon Pricing.
[18] MacKenzie D. 2009. Making Things the Same: Gases, Emission Rights and the Politics of Carbon Markets.

existing global North–South discourse in the environmental and development arena, where countries in the global North are seen as benevolent aides providing a guiding hand to the poor and unsustainable global South. It is also related to the risk of exploitation (of, for example, benefiting from carbon credits created through smallholder farmers who may not be aware of the value of credits) and the critique of neo-colonialism and carbon colonialism[19].

Key quality considerations

The following are the key quality considerations (and risks), to be considered when it comes to carbon credits[20].

Additionality	Additionality is about ensuring that the project and its associated emission reductions would not have happened if carbon credits were not issued (in other words, there is a need for carbon financing to be mobilized).
Leakage	Leakage occurs if a project designed to reduce CO2 emissions leads to the shifting of the emitting activity elsewhere.
Permanence	This criterion is a problem for forestry in particular, because if the trees should perish after a number of years, then the CO2 that is sequestered in those trees will eventually be released into the atmosphere again. These is one of the main reasons why forestry projects have initially been very difficult to certify. Since then, several large certification bodies (Gold Standard, Verra, Plan Vivo) and other private carbon brokers have developed and certified methodologies for forestry. The Rabobank Acorn framework for example refers to “durability” instead of permanence. Durability is defined as the twenty year retention of the level of sequestered CO2 that was sold as a carbon removal unit (CRU).
Double-counting	The criterion of no-double counting refers to the principle that carbon credit can only be used, or retired, by one party, meaning that carbon credits need to be strictly administered in a database. However, administration in a registry may not be enough to avoid double-counting, due to the parallel spheres of carbon credit accounting (in the regulatory market, the voluntary market ,and through insetting). For example, if a corporate in IT partners with a project developer to set up a carbon farming project in another country to offset their emissions (on the voluntary market), the national government may still count the same removal towards it NDC (regulatory market), while the direct offtaker of the farmers may also count the same removals to offset their emissions (insetting).[21]

[19] Lyons W. 2014. Carbon Colonialism and the New Land Grab: Plantation Forestry in Uganda And its Livelihood Impacts

[20] KIT, 2011. Demystifying Carbon Markets

[21] FAO and Rabobank 2022. Global System for Carbon Farming: A Holistic Climate Change Change Solution

Adverse impacts	Carbon programs should have no significant adverse environmental or social impacts. For example, tree-planting projects can cause conflicts with indigenous people who are displaced or otherwise find their use of forest resources curtailed. A potential negative environmental impact is due to plantation of fast-growing invasive species that may end up damaging native forests and reducing biodiversity.
Compliance	Compliance is about ensuring that carbon program comply with local rules and regulations.

II. The Netherlands and the carbon market

1. Dutch policy focal points

Strategy for foreign trade & development collaboration

More focus on trade and development priorities
Whilst recognizing the Dutch wealth is dependent on earnings that are happening outside its own borders, in its 2022 policy brief there is a clear emphasis on repositioning the Netherlands in a shifting global environment. Whilst at the same time increasing economic diplomacy overall, themes like economical resilience, an equal playing field and the reduction of strategic dependencies are the principles that guide a centering of priority markets around fewer countries (25) and gearing it towards topics where the Netherlands expect a clear added value. [22]

Combining foreign trade with development
Dutch knowledge and skills should help provide innovative solutions for the most urgent problems of our time, such as climate change. By actively contributing to sustainable economic development worldwide, the Netherlands will enable developing countries to grow more rapidly into trade partners. Which should result in benefits for both sides. The government specifically mentions developing a more finely tuned bilateral relationship with some countries – Senegal, Nigeria, Ghana and Morocco, among others by focusing on a combination of trade and development cooperation.

Sustainability and digital are expected to be key themes that guide a transition into a resilient and connected future
In line with the push for more focus, the Dutch government wants to bring a more long-term perspective to both development strategies, as well as foreign trade strategies. Especially the topics of 'sustainability' and 'digitalization' are regarded as essential themes that will affect the economies of the future. This is backed by additional development investments that the

[22] Ministry of Foreign Affairs Policy document 2022, 'Doen waar Nederland Goed in is

government makes into renewable energy, food, climate finance and digitalization, focussed on 25 countries, including Nigeria.

Public-Private collaboration essential to Dutch export and innovation
The Netherlands is emphasizing the importance of Public-Private-Partnerships (PPS) in the Dutch export- and innovation policies, which in its turn will be connected more strongly. The Dutch economic diplomacy will commit more to connecting companies to international opportunities.[23]

Climate policy overview

Mitigation - an international endeavor
The Dutch government places greenhouse gasses (GHG's) at the heart of its mitigation policy, recognizing that the Dutch lifestyle has a relatively large footprint, with approximately 40% of emissions lying outside of its borders. The Netherlands is committed to reducing emissions and achieving carbon neutrality and emphasizes these goals should be achieved by strongly reducing the international footprint.

Adaptation - focusing on agrifood and flood risk
The Netherlands is suspected to have most added value in the agriculture and land use and flood risk management sectors, as well as through humanitarian aid. Through multilateral channels and in partner countries, the government is committed to climate-smart agriculture and food systems, and to sustainable agricultural raw materials, among other things.

Financing - committing to Paris Agreements and focus on building resilience
The Netherlands seems to recognize in its policy document that in order to achieve the mitigation and adaptation goals of the Paris Agreement, much more and larger investments are required worldwide from a multitude of sources and channels, and by various donors. The government, therefore, emphasizes the importance of Article 2.1c of the Paris Agreement to bring all funding flows into line with the Paris Agreement (Paris Alignment). The government considers compliance with the commitment made by developed countries at the COP15 climate summit in 2009 to mobilize USD 100 billion annually from 2020 to 2025 for climate action in developing countries to be of great importance for global cooperation under the Paris Agreement. In the years ahead, the Netherlands states it will invest considerably more in international climate policy. Extra funds will also be made available to tackle the major food shortages caused by geopolitical conflict and climate change.

How the Netherlands currently provides support to other countries
The Netherlands sees three main areas where it can support other countries. The first area is about providing *'Funding, knowledge and expertise'*, which relates mostly to topics like water security, climate-resilient agriculture, sustainable energy and the circular economy. The

[23] Ministerie van Buitenlandse Zaken Beleidsnotitie 2022. Doen waar Nederland goed is

second area is about supporting the adoption of *'clean, sustainable energy'*. The third area is about *'combating deforestation'* aimed at conserving valuable forests. [24]

2. Examples of Dutch private sector players on the international carbon market

A big demand for carbon credits in the Dutch private sector

Because of its large footprint, the Dutch economy brings forth a big demand for carbon reductions. Although there is also a push to actually reduce carbon emissions within Dutch companies and organizations themselves, many are also already heavily active in the voluntary and compliance markets for carbon offsets. In 2015 alone the Netherlands transacted 4.4 million carbon offsets (Ecosystem Marketplace and EcoStar Natural Talents, 2017). Big buyers of carbon credits come from the energy sector (such as Vattenfall and Greenchoice), the dairy industry (Interfood, Hoogwegt), the banking industry and tech companies.

Carbon offsetting in the Netherlands

Most of the carbon offsets are happening abroad in developing countries (e.g. protecting forests in Africa), therefore a lot of money is moving towards other countries. In 2017-2018 the Dutch government launched a GreenDeal, encouraging companies to shrink their carbon footprints by supporting voluntary carbon projects exclusively within the Netherlands. Although there might be opportunities for the relatively highly skilled chemical/industrial sector, energy sector or renewable energy sector in the Netherlands to create new means to reduce future CO2 emissions, with only limited geographical space and relatively high costs of (agricultural) land it is unlikely that local nature-based-solutions will be a big contributor to removing carbon from the air under current global economic conditions. Therefore the removal of CO2 through nature based solutions will likely continue to happen abroad.

Carbon offsetting is spurring a new Dutch service industry

With a relatively big demand for carbon credits from businesses that work within or with the Netherlands, a new service industry is developing itself; the industry of carbon credit intermediaries. A well-known example comes from the Dutch international bank Rabobank and the liaised Acorn platform to develop carbon projects and sell carbon removal units (CRUs) to a variety of multinationals (like Microsoft and others) looking to reduce their carbon footprint. Another example is the Rotterdam-based start-up called Carble, focusing on 'insetting'. The start-up compensates farmers in coffee value chains for loss of revenues in order to prevent deforestation (and thus loss of carbon capture mechanisms) with cash transfers. The cash transfers depend on volumes of carbon capture that coffee brands are looking for in order to reduce their carbon footprint. In order to validate the carbon capture both manual field measurements and earth observation data are being used. The buyer's quest for transparency and validation around actual carbon capture is also creating local oriented platforms such as Nieuw Groen, which focuses on local capture. Instead of focussing on international value chains, Nieuw Groen focuses on Dutch farmers to change their

[24] Government of Netherlands. Dutch Development Cooperation Policy on Climate Change

practices and remove carbon from the air. This way Nieuw Groen offers a more localized solution for Dutch credit buyers that can be both companies, as well as consumers.

III. Nigeria and the carbon market

1. Market overview

Nigeria is the largest country in Africa, with over 211 million population as of 2021[25]. The country has a land area of 923,768 square kilometers (km2) and 853 km of coastline[26]. Nigeria is endowed with different biodiversity (freshwater swamp forest, mangroves and coastal vegetation, lowland forest, derived savannah, guinea savannah, Sudan/Sahel savannah, and montane ecosystems) that are suitable for supporting various natured-based solutions for climatic adaption and mitigation[27]. Nearly 78 percent of the total Nigeria land mass, representing 70.8 million hectares are under agricultural cultivation: with about 34 million hectares of arable land and about 6.5 million hectares under permanent agricultural purposes[28].

Agriculture contributes 23.6 percent to the Gross Domestic Product, while farming remains the main source of livelihood for over 70 percent (about 148 million) of the Nigerian population, with the majority (88 percent) being smallholder farmers, cultivating an average of 0.5 hectares[29]. Generally, in Nigeria, farm households mostly rely on rain-fed agriculture, traditional methods (slash and burn), and increasingly chemical-dependent farming systems for their farm operations, which are the key drivers of rising deforestation, land degradation, desertification, and loss of ecosystem health as well as greenhouse gas (GHG) emissions. Additionally, farmers often have little knowledge of climate change, or potential benefits from environmental conservation and carbon markets.

The 2020 Nigeria 3rd national communication to the United Nations Framework Convention on Climate Change (UNFCCC) indicates that the total GHGs from agriculture, forestry, and other land uses activities (AFOLU) stands at 366,734 Gg CO2-eq, representing about 60 percent of the total national net GHG emissions[30], which makes a strong case for more efforts in agriculture to lower emissions. The remaining percentage comes from oil and gas, transportation, waste, and other sectors.
Lowering emissions from agriculture, forestry, and other land use sector also has a large, so far mostly untapped potential for income generation from carbon markets. According to the Climate Action Platform for Africa, Nigeria has a carbon sequestration potential of 13.97 to 95.44 MTCO2eq per year, with about 10.161 MTCO2eq of soil carbon. Additionally, the country has the potential to generate revenue ranging from $139.69 million to $11.45 billion revenue

[25] World Bank 2022. The World Bank Data Indicator for Nigeria
[26] World Bank 2021. Nigeria Climate Risk Country Profile. World Bank Group, Washington DC
[27] FGN. 2015. National Biodiversity Strategy and Action Plan: 2016 - 2022
[28] Okorie D.I and Lin B. 2022. Emissions in Agricultural-based Developing Economies: A Case of Nigeria. Journal of Cleaner Production. Vol 337: 130570. February. 2022.
[29] FAO 2021. The Federal Republic of Nigeria Resilience Strategy 2021 - 2023.
[30] 2050 Long Term Vision for Nigeria (LTV - 2050): Federal Ministry of Environment. 2022.

from carbon credits, at $10 per tonne of carbon[31]. Recently, the Federal Ministry of Environment confirmed that Nigeria has the capacity to generate over 250 metric tons of CO2eq annually valued at about 3 billion USD[32].

2. Nigerian policy focal points

Nigeria is one of the signatories to the Paris Agreement, and the country recognizes the need for transition to low-emission development for achieving sustainable economic growth through pathways that yield multiple benefits such as social, environmental, and economic growth, especially through carbon credits. Additionally, the Long-term Low Emission Development Strategies (LT-LEDS) aims at Nigeria becoming a low-carbon, climate-resilient, and high-growth circular economy that reduces its current level of emissions by 50 percent towards achieving net-zero emissions across all sectors by the year 2060[33].

The Emission Trading Scheme

The Nigeria Climate Change Act of 2021 provided a framework for mainstreaming climate change action, carbon budgeting, and establishing the **National Council on Climate Change (NCCC)**. The NCC is required to provide the enabling platform for all stakeholders to support the realization of the recently launched Emission Trading Scheme (ETS). The council is still working on the national framework to finalize the best workable approach to the country's ETS, through active engagement with relevant stakeholders. The ETS is expected to provide policy recommendations that will guide the national transition to a green economy, as a way of achieving the country's **Nationally Determined Contributions (NDCs)**, as well as promoting income generation from carbon credits.

It should be noted however, that while the ETS aims at all sectors, emphasis is still on the energy sector, especially oil and gas, besides the transport and construction sector with little consideration for agriculture. One of the factors responsible is the ease of establishing a feasible emission tax policy in the energy sector, which is especially challenging in agriculture, particularly at the production side of which is mostly dominated by smallholder farmers . In addition, lack of accurate data on emissions alongside poor coordination of activities from the agricultural sector contributes to the country accounting mostly for the energy sector. It is easier for Nigeria to determine the amount of crude oil produced per period, since the oil and gas constitute the major sector of the economy.

The Africa Carbon Markets Initiative

Africa has been identified as a continent with high potential for the voluntary carbon market. While the market is growing, the transaction activity still falls short of its potential (22 MTCO2eq retired in 2021)[34] with just a few countries responsible for the volume carbon credits so far. The gap spawned the formation of the Africa carbon Markets Initiative (ACMI). The initiative is led by Nigeria in its quest to becoming the climate action leader in Africa,

[31] Climate Action Platform Africa, 2022

[32] Nigeria Emission Trading Scheme 2022. Climate Change Department, Federal Ministry of Environment

[33] 2050 Long Term Vision for Nigeria (LTV - 2050): Federal Ministry of Environment, 2022.

[34] McKinsey Vivid Economics Carbon Credit Database, drawing on Verra, Gold Standard, ACR, CAR, Plan Vivo (2022)

following a recent declaration at COP 27 to pioneer the initiative alongside 12 other African countries. ACMI's ambition is the growth of African voluntary carbon markets to:

- Produce 300 million carbon credits annually by 2030, and 1.5 billion credits annually by 2050
- Unlock 6 billion in revenue by 2030 and over 120 billion by 2050
- Support 30 million jobs by 2030 and over 110 million jobs by 2050[35]

Through the ACMI, Nigeria aims to ensure increased participation in voluntary carbon markets with an estimated total of between 25 and 30 million tons of carbon credits annually by 2030, generating over $500 million annually at $20 per tonne.

3. Carbon schemes: current stage of development

The Nigeria Emission Trading Scheme is still under development

The ETS is still in process, with the possibility of undergoing several reviews and approvals, prior to its actual implementation. Some key issues are still under debate, such as: carbon measurement and verification approach, regulatory and voluntary trading mechanisms and implementation strategies. Additionally, the Federal government through the Ministry of Environment is currently working on the development of a carbon framework alongside the development of the national carbon registry through support from the British government, UNDP (United Nations Development Program), EU (European Union), West Africa Alliance on Carbon Market, and Climate Finance. The framework is expected to be completed by early 2023. It will help establish mechanisms for carbon trading while the registry will provide a platform for transparent information on emission reduction projects and carbon credits in Nigeria. It however important to note that the NCCC is headed by the incumbent President as the Chairman of the Council. This suggests that the plan may likely experience some delays, following the transition in power in early 2023.

Need for capacity building

Findings from the series of interactions with some of the Nigerian stakeholders revealed that most stakeholders are either not familiar with or have limited knowledge of carbon credit market mechanisms. While most government officials are aware of the intention of the government to embark on the carbon credits, there is a lack of thorough understanding of the concept, and of current projects and initiatives in Nigeria. All of the interviewed stakeholders equally affirmed the need for awareness and advocacy ensuring the country's participation in carbon markets. In response to some of the existing issues in the ETS, the Food and Agriculture Organization (FAO) is embarking on capacity building for government officials on emission measurement reporting and validation using the EX-ACT tool, particularly for stakeholders in the agricultural sector. EX-ACT is a land-based accounting system, estimating carbon stock changes (i.e. emissions or sinks of CO2) as well as GHG emissions per unit of land, expressed in equivalent tonnes of CO2 per hectare and year[36]. The agency identified this as the first step in promoting awareness of the carbon market among stakeholders in the sector. Although the tool comes with a number of assumptions and

[35] Climate Champion, 2022. Africa Carbon Markets Initiative launched to Dramatically Expand Africa's Participation in Voluntary Carbon Market.
[36] FAO 2022. The EX-Ante Carbon-balance Tool (EX-ACT)

limitations, it is considered a cost-effective way for measuring emission levels in agriculture following its approval by the UNFCCC. Its feasibility in the agriculture sector could also support the progress on acting on gaps and opportunities for emissions reduction in agriculture.

The Great Green Wall Initiative in Nigeria

The Great Green Wall Initiative (GGW) is a Pan-Africa program for the Sahara and Sahel to address the issues of desertification and land degradation, biodiversity loss, promote climate change resilience by ecosystems and communities, and improve food security in 21 countries in Africa, including Nigeria. In 2015, Nigeria established the **National Agency for Great Green Wall (NAGGW)**, with the mission to halt and reverse 22,500Km2 of land degradation; prevent depletion of biological diversity, and ensure that by 2025, ecosystems are resilient to climate change; continue to provide essential services that would contribute to human welfare; and ensure poverty eradication by improving the livelihood of 25 million people by 2030[37]. Nigeria is currently the leader of the initiative in Africa with its implementation covering 11 states (Adamawa, Bauchi, Borno, Gombe, Jigawa, Kano, Katsina, Kebbi, Sokoto, Yobe, and Zamfara), representing about 35 percent of the country's land areas. While the initiative was primarily designed for the restoration of degraded land and ecosystem services, the potential and the level of achievements recorded across Africa have dawned on the need to leverage the gains for carbon credits across the participating countries.

The NCCC is expected to liaise with the National Agency on Great Green Wall (NAGGW) to jointly coordinate on carbon credit activities under the GGW. Currently, several firms (e.g. Stratus Consult Limited, Atmosphere, etc.) have indicated interest to engage in carbon credits with Nigeria while a few have succeeded in signing a Memorandum of Understanding (MoU) with the NAGGW. The NAGGW however prefers to engage with firms that are localized in Nigeria as a way of avoiding the long approval process and bureaucracy involved in signing MoU with foreign firms. This is especially challenging because under the GGW in Nigeria, the government has been responsible for the provision of incentives for farmers (such as tree seedlings, farm inputs). This investment approach therefore suggests the possibility of the government taking the lead on the sales of carbon.
Some of the challenges of leveraging carbon credits under the GGW include: lack of consensus on the appropriate method for verification and validation; the need for alignment with the central GGW Pan-Africa office in Mauritania, the inability of the government to release funds for environmental projects[38] [39], the land tenure system and land donations, the limited rainy season on arid lands and the rising incidences of insurgency and banditry.

Upcoming initiatives

Nigeria is becoming a viable country for carbon credits with the emergence of several projects including, for example, renewable energy, clean cooking, and mangrove restoration.

[37] GLOBE 2022. The Great Green Experience in Nigeria. Global Legislator Organization for a Balanced Environment
[38] UNCCD 2022. United Nations Convention to Combat Desertification: The Green Great Wall Initiative
[39] GLOBE 2022. The Great Green Experience in Nigeria. Global Legislator Organization for a Balanced Environment

Project implementers, especially in land use-related projects include: Stratus Consult Ltd., ITOCO, Everi GmbH, the Global Evergreening Alliance, and Rabobank Acorn[40].
Both Stratus and ITOCO are partnering with the NAGGW on the transformation of dry, arid, and semi-arid land in the northern region while Everi GmbH is the implementer of a Niger Delta mangrove project (see box below). Currently, there is an increasing intervention on mangroves in the Niger Delta region, following the FAO intervention in restoration of mangroves in Cross River, with support from the Foreign Commonwealth Development Office (FCDO), United Kingdom Embassy in Nigeria.

Niger Delta Mangrove Project

The Niger Delta is Africa's largest wetland. It is home to more than 20 million people, and has one of the highest concentrations of biodiversity on our planet.

However, its biodiversity has been interrupted by illegal logging activities, which harm the ecosystem and put local livelihoods at risk. The Niger Delta carbon credit project aims at restoring 1920 hectares of mangrove by planting 1 million red mangroves annually, with the ambition to contribute to biodiversity, income generation, and food security for smallholder farmers.

It is the first blue carbon project with an estimated annual emission reduction of 79,406 tCO2eq over a 40-year period (2021 - 2061)[41]. The project is currently open to investors with the expected verification period scheduled for January 2024.

Other sectors are also recording demand for carbon credits, especially the energy sector. In 2021, Nigeria had its first carbon credit revenues of one million euros from the petroleum industry, through the Nigeria Petroleum Investment Management Services (NAPIMS)[42]. The agency partnered with Total Energies through its parent company (Nigerian National Petroleum Corporation). The aim of the partnership is to lower production emissions from the oil and gas sector, increasing efficiency (not a transition to renewables). One of the upcoming stakeholders in the sector is Oando clean energy. Currently, Nigeria's carbon market has a limited number of actors with a growing interest from different parties from across Europe, especially from Portugal, Germany, France, and so on. Multilateral organizations such as the Food and Agriculture Organization (FAO), and the United Nations Development Program (UNDP) are working actively to support the Nigerian Government at varying level towards ensuring transition to net zero emission nation.

4. Impact potential for smallholders, food and nutrition security, and sustainable use of farmland

The Nigeria Energy Transition plan focuses on solar energy, and especially, on the transition of centralized energy (national grid) to solar. This is a very promising ambition in terms of

[40] Press Release: The Global Ever Greening Alliance and Acorn, A Rabobank Initiative, Are Developing A US$12.5 Million Land Restoration Programme for Nigeria
[41] Niger Delta Mangrove Project. CCB and VCS Project Description, Version 3, 2022
[42] FG Earns 1 million Euros from Sales of Carbon Credits. Vanguard News Paper, 9 June, 2021

emission reduction. If such centralized, large-scale transition projects materialize, they would make a significant impact on climate change mitigation, and would also serve as a good opportunity to tap into carbon credits. The scale and centralized control of such projects would make a good case of, for example, engaging on the regulatory carbon market.
However, the main objective of this report is to look at the potential benefits of carbon financing for smallholder farmers, food and nutrition, and the sustainable use of farmland. Thus, we focus on nature-based carbon removals, and in specific, on carbon farming methods, while assessing the impact potential of carbon credits for the target group.

Besides the focus on smallholders, deforestation is also one of the major challenges attributed to agriculture, as Nigeria is currently recording one of the highest levels of deforestation in the world, with less than 10 percent of the forest cover remaining[43]. This is why agroforestry has been identified as the best strategy for carbon sink in the sector alongside climate smart practices[44]. However, the issue of emission measurement and verification has been a challenge in the agricultural sector, as illustrated by the case below.

Dantata Foods - Failed validation of agricultural carbon credits
In 2021, Dantata Foods emerged as the first agricultural firm to launch carbon credits for smallholder farmers in Nigeria. The firm mobilized over 30,000 smallholder farmers across Jigawa, Kaduna, and Kano towards increased productivity and income generation from voluntary carbon credits through regenerative agriculture practices including minimum tillage, no chemical application, and crop-livestock integration. The innovation was led by LINKS-Nigeria and the Centre for Dryland Agriculture, Bayero University in Kano State.
The report of the experiment proved successful with a record of a 60 percent yield increase in rice production while the laboratory analysis of soil carbon sequestration ranged between 179,742 to 352,089 per kg/ha. Despite the positive outcome, the plan later failed following the inability of the firm to sell the carbon due to validation issues. This led to a major discouragement among farmers, who expected to generate additional income from carbon credits. According to LINKS-Nigeria, Dantata was reported to have eventually shut down its operations in Nigeria after the intervention. The outcome illustrates some of the risks involved in the market, especially when issues around validation are not addressed.

Despite the risks, there are numerous potential benefits of carbon farming projects. Many are, actually not related to carbon credits, but are resulting from other benefits of carbon farming methods, such as improved biodiversity and climate resilience. Such benefits of the main carbon farming methods are further detailed below.

Beyond carbon credits: impact potential of carbon farming

Increasing soil carbon

Soil carbon programs are gaining attention as means to driving multiple benefits for smallholder farmers. These programs promote sustainable soil management practices such

[43] World Bank 2021. Nigeria Climate Risk Country Profile. World Bank Group, Washington DC.
[44] 2050 Long Term Vision for Nigeria (LTV - 2050): Federal Ministry of Environment, 2022.

as reduced / no tillage, reduced inputs, cover crops, crop rotations, optimized grazing[45]. Increasing soil organic carbon contribute to climate change mitigation, improved nutrient cycles, soil biodiversity, improved water retention, improve food security, and reduces losses in agricultural production[46].

This practice is especially more relevant for farmers in an area where erosion is highly prevalent. Particularly in northern Nigeria, the issue of water retention in soil constitute a major challenge in farming.

Investment in soil carbon programs for carbon credits is growing in East Africa, with participation of a large number of farmers. See two examples in the box below.

Kenya Agricultural Carbon Project
Location: Western Kenya
Funder: World Bank BioCarbon Fund
The project facilitated a local carbon market for 30,000 smallholder farmers. It enabled many positive outcomes among which: 90% maize yield increase in 5 years resulting in increasing food security, increased income from crop yields and carbon credits, increased access to financial services, access to firewood, fruit and fodder from the trees and increased farmers' climate change knowledge[47].

ProSoil
Location: Western Kenya
Funder: GIZ
The program employs participatory planning, implementation, and monitoring aimed to enhance Soil Protection and Rehabilitation (SPR) measures. Instead of focussing on scattered farms, the holistic approach includes on-farm and off-farm soil protection measures. The program also combines physical soil protection and water retention measures with conservation agriculture (minimum tillage, agroforestry, mulching, mixed cropping and improved crop rotations)[48].

SLMP
Location: Ethiopia
Funder: EU
The EU Sustainable Land Management Practices (SLMP) project targets 33,000 households in rural Ethiopia.[49] FAO is currently working to drive the realization of this, by actively promoting climate-smart practices that could encourage soil carbon sequestration, alongside with the engagement with government stakeholders on measuring soil carbon using EX-ACT tool for modeling and monitoring.

[45] FAO, Rabobank, 2022. Global system for carbon farming
[46] Nyawire et al. 2022. Enhancing Soil Carbon in East Africa: The Biophysical Evidence, Socioeconomic Incentives and Policy Implications. Alliance Biodiversity International
[47] World Bank: Kenya Agricultural Carbon Project
[48] GFA Consulting Group, 2020. Successful Start of GIZ Project ProSoil in Western Kenya.
[49] GIZ, KFW. EU support to SLMP.

While soil carbon sequestration has a great potential in terms of measurement and verification, it is more challenging to implement a scalable, cost-effective method, than to above-ground biomass (trees). While above-ground biomass can be monitored through satellite imagery, this is not the case for soil carbon. The feasibility of large-scale, cost-effective monitoring is one of the main reasons why, for example, Rabobank Acorn started with focusing on agroforestry.

Agroforestry

Agroforestry is one of the most attractive farming practices, with multiple benefits for smallholder farmers. Apart from the food security needs of rural households, agroforestry can raise carbon stocks of agricultural systems, and such increases can potentially be sold as CO2 emission offsets[50]. Besides the carbon sequestration potential, agroforestry has several other ecosystem benefits, such as: improving soil health, increasing climate and weather resilience, diversification and quality improvement of nutrients, improved yields and afforestation. Besides, integrating different crops, trees and animals on the farm results in the diversification of income streams for farmers.[51]

Agrosilviculture	Combining crops and trees, e.g. coffee with citrus trees
Silvopasture	Combining trees and animals, e.g. cattle grazing in coconut groves
Agrosilvipastoral	Combining crops, trees and animals, e.g. woody hedges grown for fodder

Types of agroforestry systems[6]

While agrisilvicuture appears the most common of agroforestry practices in Nigeria, most Nigerian farmers hardly engage in planting of trees on farmlands. Some farmers engage in light planting of trees, such as scattered tree planting, life fencing, alley cropping, shelterbelts, etc. Meanwhile, carbon program developers incentivize and encourage the planting of fast-growing trees and trees with more important carbon sequestration potential, e.g. under the Great Green Wall initiative.

Composting

Farmers could participate in emission reduction programs through conversion of agricultural waste (e.g. wet grasses, animal dung) into high-quality compost, or bio-fertilizer. This will promote sustainable farming practices by reducing emissions (especially N2O) from the use of chemicals and harsh fertilizers. The use of biofertilizers, when combined with good agricultural practices, is expected to increase crop yields by at least 40%, while lowering cost of production[52]. However, compared to agroforestry and soil carbon, its positive impacts on the ecosystem are more limited.

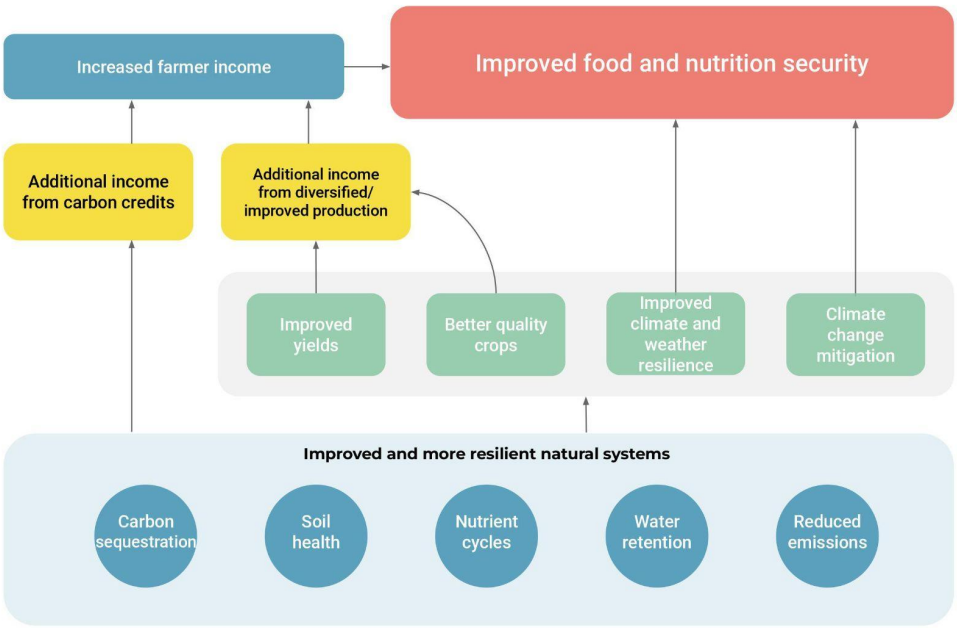
[50] Luedeling et al, 2011. Carbon Sequestration Potentials of Agroforestry in Africa: Opportunities and Challenges. Opportunities and Challenges. Dordrecht: Springer. p 61-84

[51] FAO and Rabobank 2022. Global System for Carbon Farming: A Holistic Climate Change Solution

[52] UNDP 2020. Compost Manure Ensures Food Security. UNDP-GEF Assisted Program in Benue State, Nigeria

A biofertilizer project is currently being supported in Benue state, under a UNDP-GEF assisted program, where farmers are trained on the utilization of community waste into bio-fertilizer. The farmers are now building elevated trenches and incorporating the use of bio-fertilizers in their production. The practice is expected to help farmers to contribute to emission reduction, biodiversity conservation, increased income and productivity, while ensuring food security.

Other carbon farming methods include biochar (partly burnt biomass added to soils, allowing nutrient retention while absorbing CO2) and manure management (feed additives and supplements that reduce methane and nitrogen emissions). These practices, while also beneficial for regeneration, have less diverse ecosystem benefits than agroforestry and soil carbon[53]. The following visual shows a simplified overview of the impact potential of the above discussed carbon farming methods towards contributing to food and nutrition security. It is crucial to note that for such impacts to materialize, complex stakeholder networks, as well as natural systems need to work together to enable such positive outcomes for farmers.



Impact potential of adopting carbon farming methods

Carbon farming for smallholders in Nigeria: the challenges

While agriculture constitutes one the major sectors with huge potentials for carbon credits in Nigeria, there has been limited intervention to promote smallholder farmer participation in the market. Some of the key factors responsible include:

[53] FAO and Rabobank 2022. Global System for Carbon Farming: A Holistic Climate Change Soultion

Limited awareness about regenerative agriculture and carbon credits

Farmers are becoming aware of the impact of climate change on their production activities, consequently becoming more responsive in adopting sustainable agricultural practices (so far, mostly without compensation from carbon financing). Most farmers however, are unaware of the accompanying benefits that could be realized from such practices. Cultural norms and habits may also discourage the farmers from adopting new practices. For example, integrating trees on the farm is "not in the culture" of farmers under the HortiNigeria program, as explained by the program manager. Besides practical challenges such as integrating trees without disrupting the canal structure connecting numerous small farms on a large flatland, farmers may face opposition from peers due to cultural norms.

Besides, there is very limited understanding about carbon credits among most stakeholders, especially smallholders. Anecdotes shared by interviewees such as where farmers have been asking whether the broker will come and take carbon from their trees illustrate this. Due to this limited understanding, farmers are vulnerable to carbon program developers who may not engage in awareness-raising, leading to the risk of lacking informed consent, and similar dynamics as described as a worst-case scenario in the previous section.

Trade-offs and uncertainties

Participation in carbon credit programs comes with some level of costs and uncertainties. For instance, growing of trees on farmland (agroforestry) has huge potential for both biomass and sustainable land use (soil carbon) but comes with limited land for production of food crops. Some designs have recommended planting of economic trees or fast growing trees to support multiple benefits. However, the waiting time for such trees to mature and the hindrances they create (by reducing exposure to sunlight) have been some of the major concerns for farmers. Besides, due to the criterion of permanence (or rather: durability) of carbon sequestration, farmers are required to commit to long-term (e.g. 20-years) plans when getting in a carbon project. Such a long-term commitment also comes with more uncertainties.

Land tenure right

Investment in carbon credit programs in smallholder farming is often influenced by land tenure right. The long term commitment to carbon credits (which is needed to ensure *permanence*) requires a secure land tenure for farmers. The challenge has contributed to limited achievement recorded in Malawi as well as under the Great Green Wall initiative, especially in Nigeria. .

Tension between rigorous measurement and cost-effectiveness

As mentioned before, among risks and critique of carbon credits in general, the amount of carbon sequestration capacity must be modeled (predicted), and monitored (verified). This comes at some level of costs. Such costs depend a lot on the carbon farming method and the monitoring method used in the program. For example, measuring soil carbon with traditional methodologies is very costly, as it requires manual sampling and measurement. There are actors, such as aESTI, developing and piloting scalable more tech-based methodologies, however these are still nascent. Monitoring above-ground carbon is already more affordable, as it is possible to use satellite data to monitor above-ground biomass - a method used by Acorn, verified by Plan Vivo.

Others have also developed monitoring methodologies with the restrictions of smallholder context in mind. One example is the Smallholder Agriculture Monitoring and Baseline Assessment (SHAMBA) tool, which is introduced on its website as a "a free and simple way to assess changes in greenhouse gasses from land use in tropical areas."[54] The tool has been reviewed and approved by the Plan Vivo Standard.
Another example is the The EX-Ante Carbon-balance Tool (EX-ACT) by FAO.

Unfortunately, making measurements more accessible and less costly comes with its trade-offs. Certification agencies are under scrutiny over potentially superficial measurements, e.g. too much reliance on practice-based predictions versus actual measurements of carbon sequestration. Due to increasing criticism on low-quality carbon credits, some are concerned that this results in certification agencies becoming very risk-averse and conservative about certifying innovative methods (which are much needed to make carbon credit verification feasible in the smallholder context).

Literacy and digital inclusion
For all the needed modeling, measurement and verification to be implemented, a certain level of (digital) literacy of the farmers is very useful. Access to mobile money accounts and/or bank accounts may also make participation and accounting easier, and the transfer of carbon credit revenues more transparent.
However, about half of smallholder farmers in Nigeria are illiterate[55] with limited knowledge of ICT or technology. The challenge thus suggests the need for an intermediary not only to aggregate smallholder farmers, but also to facilitate accounting and the transfer of revenues, while building capacity of farmers and ensuring informed consent.

Access to prefinancing
While revenues from carbon credits can provide an interesting financial incentive for farmers, they are often not the final solution to covering investment costs of implementing carbon farming practices. In general, project developers modeling the business case of carbon farming for smallholders are convinced about the positive return on investment, which comes as a result of increased yield, improved quality, lower fertilizer use, potential new revenue streams (e.g. from selling tree crops), and carbon credit revenue. However, agroforestry and regenerative agriculture come with significant investment costs, which varies based on context (production system, farm size, types of trees, etc.) and it takes several years for carbon revenues to materialize. Some stakeholders estimate that for smallholders participating in a carbon farming program, the financial benefits typically start to materialize from the third to fourth year, depending on the context.
In order to fill in this gap, other types of financing may be needed. This can be offered, for example, through blended finance, and the repayment of loans to farmers may be covered by carbon credit revenue.
This has two important consequences for smallholder participation in carbon projects. One is that carbon credits may not fully replace other financiers needed in the smallholder ecosystem. Although projected carbon credit revenue would make access to finance easier, it does not necessarily remove the challenge completely. It also means that relevant

[54] SHAMBA tool website
[55] CGAP, 2017. National Survey and Segmentation of Smallholder Farmers Households in Nigeria.

"traditional" financiers may need to be involved among the intermediaries / stakeholders in a carbon farming projects, increasing complexity and transaction costs. The second one is, that some part of the carbon credit revenue could be used for loan repayment. This is of course better than if repayment would need to be fully covered by increased produce revenues coming from their investments, but it is a factor to keep in mind, when calculating potential "free-use" cash revenue from carbon credits.
To tackle this challenge, Rabobank Acorn is planning to launch its Cooperative Carbon Finance Fund[56], enabling a financing mechanism where the farmers' investment in agroforestry is financed by future carbon removal unit (CRU) proceeds. After the CRUE generation, verification and sales to the buyer (facilitated by Acorn), the carbon proceeds flow directly from Acorn to the investor(s). No cash flows from local farmers to Acorn or the investor are required, mitigating currency risks. (A visual representation of the approach can be found here.)

The need for intermediaries
The need for monitoring and accounting combined with the limited capacities, and the lack of digital and financial inclusion of farmers constitute the main reasons why most carbon credits involving smallholder farmers requires several ecosystem players and intermediaries, who can:

- assess carbon sequestration capacity and the business case for a carbon project,
- prefinance investment in carbon farming practices,
- aggregate, organize, educate farmers,
- certify the program and issue carbon credits,
- monitor permanence / durability, leakage, potential adverse effects, etc.,
- facilitate contract with farmers and other stakeholders,
- ensure the transfer of benefits.

Intermediaries use certain percentage of the carbon credit revenue to cover their costs. The percentage varies widely depending on the setup. In some programs, smallholder farmers may only receive as little as 10% of the carbon credit revenue generated, while Rabobank Acorn is committed to delivering 80% of revenues benefiting the farmers and aESTI to 90%. Other brokers on the voluntary market such as Southpole or Indigo also typically take 10 -20% of the revenue generated[57]. Sharing revenues from trading credits, of course, is only possible, if the credits are traded. If carbon credits are generated as part of insetting, the initiating company may simply account for the carbon credits in their value chain reduction, without fairly compensating its suppliers (the farmers) for the price of the credits.

Besides, it's often intermediaries influencing and controlling the share and use of revenues. In a best-practice scenario, this is strongly influenced, if not driven, by the farmers themselves. In a worst-case scenario however, this could lead to farmers getting into arrangements without a thorough understanding or control, resulting in potential exploitation.
In summary, three important elements of concern in multi-stakeholder smallholder carbon programs are:

[56] Acorn, 2022. Cooperative carbon finance
[57] carboncredits.com, 2022. Carbon Credit Brokers Bring in More Revenues and Critics

- Ensuring informed consent by farmers,
- Ensuring strong smallholder influence in the decision over the use and transfer of carbon revenues,
- Ensuring farmers' influence and clarity on decisions over using revenues for in-kind or in-cash benefits.

IV. The way forward

Key areas for collaboration

Despite all the highlighted challenges, smallholder farmers' participation in carbon credit markets is still possible. Governments need to work closely with stakeholders to jointly establish mechanisms ensuring that smallholder farmers' benefits from emission trading. The following section discusses some of the investment opportunities, and approaches contributing to making emission trading work for smallholder farmers.

1. Investment opportunities

Leveraging carbon financing the transition to more resilient food production

In order to be able to leverage carbon financing for the transition to regenerative, climate resilient agriculture, a number of conditions must be met. Investment in the following points could provide a meaningful contribution to this objective.

Education and capacity building on climate resilient and regenerative agriculture for smallholders

The lack of awareness about such farming practices is one of the key challenges for carbon farming program development. In essence, potential carbon credit revenue is just an additional benefit for farmers from implementing such practices. Thus, awareness raising about the impacts and know-how of practices such as increasing soil organic carbon and agroforestry are much needed, as a first step towards more resilient food production.

Raising awareness about the carbon credit market among smallholders

Besides awareness about sustainable practices, education of carbon credits would help to mitigate the potential risk of exploiting carbon sequestration capacities of smallholders due to their lack of knowledge of the value of carbon credits. As earlier noted, some farmers are currently adopting sustainable practices that promote substantial amounts of carbon sequestration, without compensation. Education should include detailed information on the cost implications and potential risks, but also the expected benefits; cost of no action from farmers in terms of accrued losses in the long run; the rising impact of climate change, and so on. Such awareness raising is often among the many preparatory steps for setting up carbon farming programs.

Improved access to quality seedlings and nurseries

Access to quality inputs seems to be a prevalent challenge for smallholders in Nigeria. When it comes to carbon projects, access to quality tree seedling is especially relevant. In order to enable the setup of agroforestry and afforestation programs, facilitating access to quality seedlings through supporting nurseries can be very impactful, especially if such nurseries can also become education hubs, contributing to awareness-raising activities detailed above.

Leveraging outgrower schemes

In Nigeria, the outgrowth scheme is one of the most successful approaches to increasing farmers' income through linkages with large firms and export markets. Carbon program developers can leverage such schemes in engaging smallholder farmers' participation in carbon credit. Measures however need to be in place to regulate the amount of revenue that goes to smallholder farmers

A good example is the ongoing engagement of farm households by Stratus Consult Limited. The firm is engaging rural farmers under the Great Green Wall initiative in Northeast Nigeria, to plant economic trees that also have a high potential for carbon sequestration. Stratus is proposing an income share of 80:20 percent ratio of carbon credits with farmers. In addition, the firm is responsible for the provision of inputs, and are equally responsible for the processing and sales of the produce from the economic trees, excluding food crops planted by the farmers.

Involvement in government-led carbon programs (afforestation and reforestation)

Afforestation and reforestation are usually government-led carbon programs in Nigeria and often involve rural communities as human capital. In some cases, farmers are allowed to plant food crops for a certain period in the reforestation area, until the trees are established. Then, once the forest canopy is established, they are later denied access to forest areas. In addition, some permit harvesting of wildlife and tree branches for home cooking, but with no shared benefits from carbon credits. Example of such interventions in Nigeria is Reducing Emission from Deforestation and Degradation plus (REDD+) program in Cross River State.

Joint forest management and shared benefits should be encouraged in such programs, to promote farmers' participation and benefits. Farmers are more likely to sustainably reduce deforestation and or support afforestation if they benefit from the additional income. One starting point could be, to offer benefits for farmers who are already implementing regenerative practices, and this way encourage others to join, having a basis for building carbon programs for additional carbon farming.

Leveraging carbon financing to accelerate the transition towards renewable energy and clean cooking

As mentioned earlier, there is a huge potential for emission reduction in the transition to solar of the national grid, however, such programs are out of scope for this report, which aims to focus on the potential benefits for smallholder farmers. While large-scale renewable transition, on the mid- and long-term, clearly would benefit everyone, there is no clear direct benefit for smallholders. Thus, when it comes to the renewable energy sector, our focus is on potential linkages with ongoing and future Dutch-funded projects. These projects are often

focusing on the micro level, supporting SMEs to provide access to solar and clean cooking for households. Although we recognize the huge potential of macro-scale solar transition projects, our focus is on the potential linkages and challenges on the SME and household level.

On the micro-level of SMEs and households, carbon credits could play a role in:

- subsidizing the costs of reaching the last mile, thus improving access to clean cooking and renewables
- subsidizing the price of product and services, improving affordability for the lowest income customers, however, this comes with a risk of market disruption
- making the business case more attractive for aspiring entrepreneurs
- strengthen and contribute to the impact of carbon farming programs, e.g. by decreasing the use of firewood through clean cooking.

The investment in the following points could provide a meaningful contribution to supporting the carbon market participation of renewable and clean cooking companies in the Nigerian market.

Raising awareness and technical assistance for SMEs in renewables and clean cooking about carbon credit markets

Similarly to farmers, SMEs in these sectors have a limited understanding of the carbon credit market, and advisory on the topic is scarce and expensive. Thus, supporting education about carbon credits, as well as providing needs-based, tailored consultancy on the costs, benefits, needed actions for participation on the market would be an important first step.

Setting up and supporting groups of SMEs to pilot a group-based carbon program

As a next step, a group of SMEs with high potential could be assisted and organized for the setup of a carbon program, enabling access to carbon credits by creating scale through aggregation. Similarly to the farmer context, transaction costs would be too high and the carbon removal potential would be too low for individual, smaller enterprises to create a viable case for carbon credits. Bigger players, such as BURN [58]have the capacity to set up such schemes, but smaller players would benefit from umbrella programs.

Supporting infrastructure

When discussing the future of solar home and clean cooking solutions, we must recognize the infrastructural challenges beyond the infrastructure for accessing carbon credits. In the case of agriculture, access to seedlings and nurseries was highlighted. In the case of solar and clean cooking, the following points of attention were highlighted by interviewees:

- Digitalization: digital inclusion is especially important in these sectors, which often use pay-as-you-go technology to make products and services affordable.
- Liquefied Petroleum Gas (LPG) infrastructure: regulation on the LPG market is nascent in Nigeria, making the business case especially risky for clean cooking companies. Informal sales, price volatility, export to other countries (resulting in dependence on import despite local production) contribute to uncertainty.

[58] BURN: Carbon Credits.

- Biogas infrastructure: investments in biogas can also be co-financed by carbon credits, such as the Kenya Biogas Programme, certified by Gold Standard[59]. There is a strong case for using more bio-digesters in agriculture in Nigeria, however, the sector is nascent partly due to logistic challenges. Despite previous bans of open grazing due to its negative impacts, it remains a politically and culturally sensitive issue, and open grazing does not allow for the aggregation of cow dung needed for biodigester use.

Cross-sector investments

Regardless of, and across sectors, there is a need for investment to make carbon markets work for smallholder farmers, improving food & nutrition security and contributing to a higher number of hectares of sustainably used farmland. Below, we highlighted some of the key investment areas.

Development and testing of cost-effective carbon measurement methods
Across sectors, one of the main challenges of carbon programs is the cost of measurement. As described earlier, there is a difficult balance to find between cost-effectiveness, feasibility in the smallholder context and rigor. This need on the market also presents an opportunity for the Dutch and the Nigerian private sector to come up with innovative approaches and technologies. An example for this is aESTI, currently piloting their technology in Kenya, in a program funded by GiZ. To tackle the double challenge of measuring soil carbon and participation of smallholders in carbon programs, aEsti is working on an "economical and effortless capturing of soil organic carbon through satellite data and digital machine learning"[60]. This methodology is currently being tested under the program with GiZ.

Co-investment in program setup, certification and monitoring
As described earlier, access to finance for investment in carbon farming practices, as well as financing for baseline, modeling, certification and monitoring is a challenge. Blended finance, including both public and private funds, can offer a relevant solution covering these needs, to enable the setup of new carbon credit programs in Nigeria.

Enabling connections across focus sectors
There are several synergies to explore between regenerative and climate resilient agriculture, renewable energy and clean cooking. Companies and programs in these sectors could explore, for example, service bundling for smallholder households between clean cooking, renewable energy, and agricultural inputs. Baobab+ is already running a project in Nigeria, under RVO's Results-Based Financing portfolio, where they leverage the pay-as-you-go model to offer clean cooking and solar home solutions to households. Once a network of customers and a history of repayment is established, through, for example, clean cookstoves, then further products and services (also including agricultural inputs) could be distributed, leveraging the same networks. This could make transaction costs lower for the different suppliers and for carbon program developers.
Such collaboration could also facilitate lower emissions and mitigate the risk of leakage. For example, integrating clean cooking initiatives with agroforestry initiatives could mitigate the

[59] Circular Ecology: Gold Standard Carbon Offsets - African Biogas Digesters and Cookstoves
[60] GiZ, 20222. Satellite-based Soil-Carbon Monitoring

risk of cutting trees and thus risking permanence, as well as the risk of increased deforestation next to the program area, through increased shift to clean fuels from firewood. Ecosystem actors, such as the EKN in Nigeria could support the creation of such synergies by bringing actors together from these focus sectors.

2. Making ecosystem trading schemes work for smallholders and climate impact

Nigeria is one of the leading economies in Africa, with high potential for a carbon market, but the country is yet to finalize its plan to support the realization of its potentials. Nigeria is one of the African countries that is committed to piloting the African Carbon Market Initiative, with the ambition to retire 300 megatons of African credits annually by 2030, a target that is 19 times that of 2020 targets[61].

The plan requires a lot of interventions and support in different areas, including, but not limited to the development of relevant policies across the high emission sectors. Besides, the Climate Act of 2021 also require significant effort for its operationalization. The UNDP is currently providing support on climate strategy through the Federal Ministry of Environment. Some of the priority areas, based on Nigeria's updated NDC report (2021)[62] and other sources, are the following.

Assisting the development of national voluntary carbon market platform in line with the ACMI targets for African countries

One of the problems highlighted in the ACMI Roadmap Report is that African countries do not have carbon registries. As mentioned earlier, Nigeria is already working with partners on setting up a national registry, a great step towards enabling transparency and mitigating the risk of double-counting. The next step would be setting up a national trading platform, which enables buyers to find a seller and vica versa.

Consulting on tensions between voluntary and obligatory markets

At the policy level, countries face a dilemma of focusing on regulatory markets, versus focusing on voluntary markets. Since carbon credits should not be double-counted, meaning that a certain carbon offset should only be accounted on one market and sold to one buyer, carbon program developers need to choose which market to trade on. On the one hand, the voluntary market provides an interesting potential for attracting private investment, because there is a high demand for high-quality carbon credits from companies. On the other hand, if all carbon offsets are accounted for on the voluntary market, countries may risk not meeting their NDC ambitions. Bringing key stakeholders on both the regulatory and the voluntary market and aligning on strategies can enable a coordinated effort towards desired impacts.

Explore opportunities for financial solutions for other ecosystem services

While the carbon credit market is in a nascent stage, there are other crucial ecosystem services, for which markets are likely to be set up in the future. Biodiversity and water services may be the next ones to play a more important role: there are already existing biodiversity

[61] Africa Carbon Markets Initiative (ACMI): Roadmap Report Harnessing carbon markets for Africa, 2022
[62] Nigeria's First nationally Determined Contribution, 2021 Update. Federal Ministry of Environment, Abuja.

credit[63] and water credit[64] pilots and schemes. Exploring ecosystem services beyond carbon is also relevant in the smallholder context, as sustainable farming practices contribute significantly to biodiversity and water retention, as well as carbon sequestration.

Support in the providing of enabling environment for private sector participation

- **Enabling investment through transparency**
  Given the challenges and uncertainties on the carbon market, Nigeria could contribute a lot to attracting carbon financing by facilitating transparency about rules, regulations, policy ambitions, reporting, priority impact areas which fit the Nigerian context (e.g. mangrove projects), access to key stakeholders, and guidance on carbon program development for smallholder and climate impact. Easy access to information on these topics decreases risks and complexity for market actors, in particular for carbon program developers, investors and funders.
  Technology transfer could also be one way to contribute to transparent reporting of carbon credits. This could be done in close collaboration with the National Office for Technology Acquisition and Promotion (NOTAP) - a national agency established for effective and efficient transfer of technology beneficial to deal with climate change in the future.
- **Carbon credit knowledge exchange**
  Findings revealed that there is a lot of need for capacity building and awareness programs for all relevant stakeholders, in order to achieve Nigeria's ambitions on the carbon market. Knowledge hubs, matchmaking, a "one-stop-shop" for program developers, immersion activities, study tours could all be tools to explore to engage, connect and mobilize stakeholders. The intervention could also include explaining the credit systems opportunities to Dutch private sector actors.

3. Conclusion

Supporting the right regenerative, climate-resilient agriculture practices can have a huge potential to improve smallholder resilience, food and nutrition security, and increase the hectares of sustainable used farmland in Nigeria. One way to support the transition is through carbon financing. Carbon come with a long list of risks and concerns, but the ambition of Nigeria and the international carbon market actors is clearly aimed at promoting and growing the carbon market. In the process of credits maturing this currently nascent market, ecosystem actors need to prioritize the investment in mechanisms and activities that can safeguard actual positive climate impact and ensure fair compensation of smallholder farmers.

[63] NSW Environment and Heritage: What Are Biodiversity Credits?
[64] ISRIC.org: Green Water Credits

Annex

1. Glossary

See sources in the footnote.[65] [66] [67] [68] [69]

Carbon compensation	Reduction or removal of CO2 emissions or other greenhouse gasses made in one location in order to compensate for emissions made elsewhere
Carbon credit	A carbon credit is a unit of measure generated from a specific project activity that destroys, sequesters or avoids greenhouse gas (GHG) emissions. One credit is equivalent to 1 Mt (metric tonne) of greenhouse gas emissions.
Kyoto Protocol	The United Nations protocol ratified in 1997 that established carbon emission reduction targets for participating nations.
Joint Implementation (JI)	One of the 3 mechanisms on the regulatory market. A developed country with relatively high costs of domestic greenhouse reduction would set up a project in another developed country.
Clean Development Mechanism (CDM)	A developed country can 'sponsor' a greenhouse gas reduction project in a developing country where the cost of greenhouse gas reduction project activities is usually much lower, but the atmospheric effect is globally equivalent. The developed country would be given credits for meeting its emission reduction targets, while the developing country would receive the capital investment and clean technology or beneficial change in land use.
International Emissions Trading (IET)	One of the 3 mechanisms on the regulatory market. countries can trade in the international carbon credit market to cover their shortfall in Assigned amount units. Countries with surplus units can sell them to countries that are exceeding their emission targets under Annex B of the Kyoto Protocol.
Registry	Is a third-party program to verify, account for, measure, and collect data for GHG, or greenhouse gas, emissions to be traded on the carbon market.
Validation	At the beginning stages, validation is a process of having a qualified accredited third-party audit of a carbon project. This assures that the project meets the GHG, or greenhouse gas, program criteria.

[65] UNFCC 2022. Mechanism Under the Kyotol Protocol
[66] Carbon Credit Glossary 2022.
[67] WRI 2010. Bottom Line on Offsets. World Resources Institute, North America, August 1, 2010
[68] UNFCC 2022. What is REDD+?
[69] KIT, 2011. Demystifying Carbon Markets

Verification	A process of having a qualified, accredited third-party audit of a carbon project after it has generated carbon credits. This assures that the carbon credits are genuine and bonafide.
REDD+	REDD+ is a framework created by the UNFCCC Conference of the Parties (COP) to guide activities in the forest sector that reduces emissions from deforestation and forest degradation, as well as the sustainable management of forests and the conservation and enhancement of forest carbon stocks in developing countries. It aims at the implementation of activities by national governments to reduce human pressure on forests that result in greenhouse gas emissions at the national level, but as an interim measure also recognizes subnational implementation. The implementation of REDD+ activities is voluntary and depends on the national circumstances, capacities and capabilities of each developing country and the level of support received.
Ex-post credit	The credit is sold after the credit has been produced and issued by the certification body.
Ex-ante credit	The credit is issued by the certification body before the emission reduction has actually occurred. First, the project as a whole needs to be certified by an independent auditor, who also verifies the conservative calculation of the credits that will be generated within a future time frame. The certification body then issues ex-ante credits, which can then be entered into a registry and sold. Periodically, an independent auditor needs to verify whether the credits have indeed been produced. Ex-ante is sometimes also referred to as 'up-front'.
Emission Reduction Purchase Agreement (ERPA)	An ERPA is a legally binding contract that allows one party to deliver verified carbon credits to another. Certain conditions govern the exchange and activities, and prices are negotiated before an ERPA is signed: all parties must agree on the volume of GHG emissions to be reduced during the contract period and by what means, the financing amount, and the results metric that triggers payments.
Forward Emission Reduction Purchase Agreement	This is an agreement in which a producer and buyer agree to the sale of a certain number of credits before they are produced and issued. The actual handover and payment of the credits happens when the emission reductions have been verified and the credits issued. Often this type of agreement spans multiple years, where the buyer agrees to purchase a certain amount of credits each year for a number of years to come. There are different mechanisms for agreeing the price. For example, a fixed price for all credits to be sold in the contract, a flexible price that follows an index of the market price, or a combination of both.
Prepaid Forward Emission Reduction Purchase Agreement	Same as above, with the exception that the credit is actually paid for before it is produced and issued.

2. Overview of smallholder data in Nigeria

SOCIO ECONOMICS OF SMALLHOLDER FARMS IN NIGERIA		SMALL FARMERS	OTHER FARMERS
Farm aspects	Average farm size (ha)	0.53	3.14
	% of smallholders on total farmers	88.4	11.6
	% female-headed households	12.7	1.3
Income and poverty	Household income (const. 2009 Int.$)	9 815	7 095
	% of income from crop production	49	56
	% of income from on-farm income	55	60
	% of income from agricultural wage labour	1	1
	% of income from non-agricultural wages and self-employment	43	37
	Smallholder poverty rate	73	80
Labour	Family labour days supplied on the farm over a day period (person days)	0.41	0.49
	Family labour days supplied off-farm over a day period (person days)	0.68	0.78
Production	Value of crop production (const. 2009 Int. $)	1 354	2 886
	Amount of food produced (const. 2009 Int. $)	1 181	2 165
	Value of food production per ha (const. 2009 Int. $)	3 157	817
Capital and inputs	Livestock (TLU)	7.3	7.7
	% of households using motorized equipment	16.2	8.3
	% of households using fertilizer	44.5	52
	Fertilizer per hectare (kg)	347	47
	Seed per hectare (kg)	1 040	117
	Irrigation (% of land)	2	2

Source: FAO. 2018. Smallholders data portrait (available at www.fao.org/family-farming/data-sources/dataportrait/farm-size/en).

3. Carbon projects in Nigeria from the Verra registry

To date, there are four projects in the registry of Verra in Nigeria.

Agroforestry: Niger Delta mangrove project
The project is aimed at enhancing biodiversity management capability through education and awareness among communities restoring degraded portions as well as ensuring sustainable use of the Niger Delta mangroves for ecological, environmental and socio-economic (livelihoods) benefits. The main objective is to plant 1,000,000 red mangroves per year. Job creation (10 full-time and 50 part-time). Everi-climate (project developer of high-quality carbon emission reduction projects and programs) in partnership with Nigeria State Forestry Department, UN Yield and Swovuge (Society for Women and Vulnerable Group Empowerment to reduce inequalities and help involved local women become financially independent). Open to investors. Current investors are oil & gas companies, Government of Nigeria, Federal Ministry of Environment, Ecological Fund.

Renewable energy: Solar home systems in Lagos
The installation of 5MW of grouped Solar Home Systems across Nigeria, in order to provide cheap and clean renewable electricity to approximately 3,500 residential households and SMEs. Solar Home Systems will avoid the release of 17,761 tonnes of Co2 emissions into the environment. Project investor is Solynta Energy Limited. Project crediting period: from 2020 to 2027.

Renewable energy: Starsight Energy
Starsight Power Utility Limited plans to implement 1. the replacement of carbon-intensive diesel-based captive power and/or grid electricity by solar rooftop photovoltaic (PV) energy in electricity distribution on off-grid at a single or a group of buildings, and 2. the replacement of inefficient air conditioners by efficient inverter air conditioners in off-grid and grid-connected residential, commercial or institutional buildings.

Clean cooking: UpEnergy social and climate impact programme
UpEnergy Group will work with micro-entrepreneurs, NGOs, financial institutions, local distribution partners, etc. to provide residential/institution users with clean cooking technologies. UpEnergy would ensure the last-mile distribution and installation of about 475,000 improved cooking stoves to the beneficiaries. To quantify carbon savings, the project rigorously track and verify how the products fight climate change. Additionally, third parties conservatively audit the work to ensure the integrity of the emissions reductions.Crediting period term: April 2022 to March 2029