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SMALLHOLDER FARMERS AND THE VOLUNTARY CARBON MARKET: A BALANCING ACT

Navigating Pricing, Co-Benefits, and Challenges

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ABSTRACT

Smallholder farmers are key players in global climate action, yet their participation in the Voluntary Carbon Market (VCM) remains constrained by financial, structural, and governance challenges. This report provides an in-depth examination of the VCM's structure, key stakeholders, and pricing mechanisms, highlighting smallholders' opportunities and barriers in accessing this market. Through two case studies—the Jinotega & Matagalpa Project in Nicaragua and the Quilombolas Social Carbon Project in Brazil—the report illustrates different value chain models and governance structures that influence benefit generation and distribution for smallholder farmers. Findings suggest that tailored governance mechanisms, transparent pricing, and equitable value-sharing models are essential for enhancing smallholder participation. The report concludes with recommendations on optimizing compensation, improving governance, and ensuring long-term sustainability for farmers engaged in carbon-offsetting projects.

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List of Acronyms

ACR	American Carbon Registry
AENOR	Spanish Association for Standardization and Certification
AMORQUIC	Associação dos Moradores Remanescentes Quilombolas da Comunidade Curralinho
APA	Área de Proteção Ambiental
ARR	Afforestation, Reforestation, and Revegetation
BCR	BioCarbon Registry
CAR	Climate Action Reserve
CCB	Community & Biodiversity Standards
CCM	Compliance Carbon Market
CCS	Carbon Capture and storage
CDM	Clean Development Mechanism
CO_2	Carbon dioxide
CRU	Carbon removal unit
CSA	Climate-smart Agricultural
CSOs	Civil Society Organizations
ECAM	Equipe de Conservacao da Amazonia
ERPA	Emission Reductions Purchase Agreement
GHG	Greenhouse Gas
GMO	Genetically Modified Organism
GVC	Governance in global value chains
ICVCM	Integrity Council for the Voluntary Carbon Market
IFM	Improved Forest Management
IPCC	Intergovernmental Panel on Climate Change
MoU	Memorandum of Understanding
NbS	Nature-based Solutions
NGOs	Non-Governmental Organizations
NIO	Nicaraguan Córdoba
OTC	Over-the-counter
QAS	Quality Assurance Standard
REDD	Reducing Emissions from Deforestation and Forest Degradation in Developing Countries
SFSC	Smallholder Farmer Social Carbon
tCO2e	Ton of Carbon Dioxide Equivalent
TSVCM	Taskforce on Scaling Voluntary Carbon Markets
UK	United Kingdom
US	United States
USD	United States Dollar
VCM	Voluntary Carbon Market
VCMI	Voluntary Carbon Markets Integrity Initiative
VCS	Verified Carbon Standard
VVBs	Validation and Verification Bodies

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Sincerely,

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1. The Voluntary Carbon Market

The voluntary carbon market (VCM) is a market-driven mechanism designed to contribute to reductions in global greenhouse gas (GHG) emissions. Operating through an over-the-counter (OTC) system, the VCM enables companies and organizations to purchase carbon credits outside of government-mandated emissions reduction schemes. These credits are generated by projects, such as renewable energy and reforestation initiatives, aimed at mitigating GHG emissions.

Although regulatory frameworks for the VCM remain underdeveloped, corporate actors are increasingly taking the lead in advancing climate action through voluntary commitments that often surpass compliance market mandates (Miltenberger et al., 2021). The integrity of the carbon credits in the VCM is maintained through rigorous verification processes conducted by registries, such as the Verified Carbon Standard (Verra) and the Gold Standard. A key principle is additionality, ensuring that offsets represent emissions reductions beyond business-as-usual scenarios (Dyck et al., 2023).

Each carbon credit corresponds to one metric ton of CO_2 or equivalent GHG emissions reduced or removed from the atmosphere. Project developers generate these credits and sell them primarily to companies voluntarily seeking to offset their emissions. The revenue generated often fuels reinvestments in further emissions reduction activities (Nowak, 2022).

1.1 Distinction between Carbon Markets

There are two main types of carbon markets: compliance carbon market (CCM) and voluntary carbon market (VCM). While both facilitate the trading of carbon credits or offsets, the VCM operates independently of the CCM, which is regulated to fulfill mandatory emissions reduction obligations.

The CCM, primarily designed to meet legally binding targets such as those established under the Kyoto Protocol and the Paris Agreement, enforces emissions limits through cap-and-trade mechanisms. Credits traded within the CCM address compliance requirements and support governmental entities in achieving regulatory goals (Battocletti et al., 2024).

In contrast, the VCM is project-based, relying on voluntary participation. Companies engage in the VCM for various reasons, including corporate social responsibility, shareholder expectations, and public relations strategies. Unlike the CCM, which is bound by legal mandates, the VCM provides flexibility for companies to demonstrate leadership in environmental stewardship. Here, credits – also referred to as offsets in this report—are often directly traded between project developers and companies that aim to compensate for their environmental impact (Battocletti et al., 2024).

1.2 Drivers of the Voluntary Carbon Market

The voluntary carbon market (VCM) is instrumental in advancing the transition to a low-carbon future (Spilker & Nugent, 2022). It arose in response to insufficient governmental action on climate change and the growing public demand for companies to take greater responsibility for managing their emissions (Streck, 2021). Since its inception in the 1990s, the VCM has expanded significantly, both in the volume of transactions and the variety of credits and participants involved. Governments aiming to meet their commitments under the Paris Agreement have strategically encouraged VCM activities to complement national climate plans (Dyck et al., 2023). Over recent years, the VCM has doubled in size, channeling substantial investments into climate change mitigation efforts.

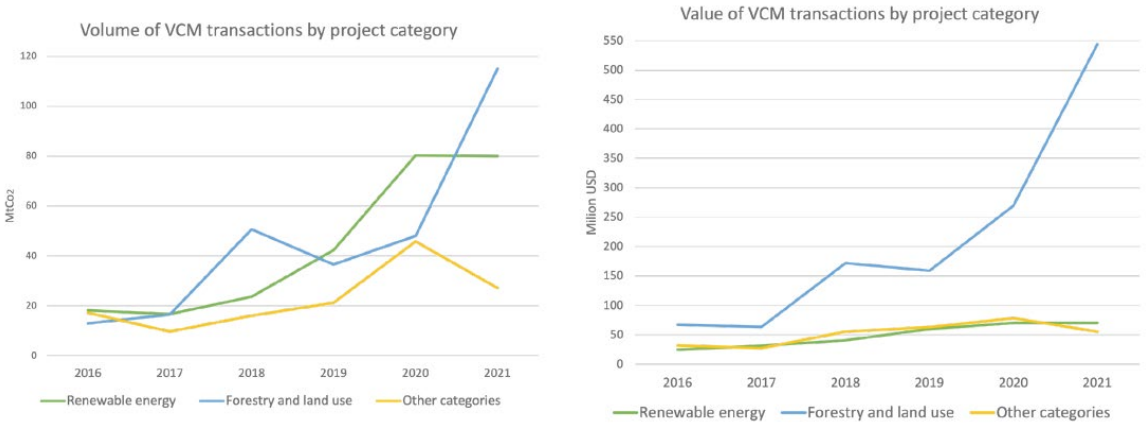
The growing demand for carbon credits from voluntary buyers, particularly multinational corporations, has been a major factor driving this expansion. As Fearnehough et al. (2020) highlight, the private sector accounts for a significant share of transactions in the VCM, reflecting heightened awareness of climate challenges and an increased sense of accountability for immediate action.

Carbon credits within the VCM are generated through a diverse range of projects aimed at reducing emissions or sequestering carbon. These projects include renewable energy development, afforestation and reforestation, methane capture, energy efficiency improvements, geologic CO_2 storage, and carbon farming. They also encompass recycling and waste reduction initiatives, biofuels development, public transportation infrastructure enhancements, conservation efforts, direct air capture technologies, and sustainable water management projects (McLaughlin et al., 2023).

Forestry and land use projects are particularly prominent within the VCM. These initiatives have been a mainstay of voluntary carbon markets and are among the most sought-after mitigation projects (see Figure 1). Between January and August 2021, nearly half of the total transacted CO_2 volumes originated from forestry and land use activities.

Notably, credits generated from these projects are also among the highest priced in the market, underscoring their value and importance in combating climate change (United Nations Development Programme, 2021).

Figure 1. Popularity of credits from forestry and land use projects in the VCM



Source: United Nations Development Programme, 2021.

Although the VCM is a significant complementary mechanism in the global effort to reduce carbon emissions and combat climate change, it operates outside the framework of legally mandated compliance instruments (Macquarie, 2023). Unlike projects under the Clean Development Mechanism (CDM)[1], certifications are not mandatory for carbon credits generated through VCM projects.

This lack of regulatory oversight is often seen as a double-edged sword. On the one hand, critics argue that the absence of strict regulations undermines the credibility of the VCM. On the other hand, proponents view it as an advantage, as the lower entry barriers allow a broader range of projects to participate. This inclusivity makes the VCM more scalable, enabling it to address climate mitigation and adaptation challenges on a larger scale (Lovell, 2010).

By fostering participation across diverse sectors, the VCM holds the potential to accelerate progress towards achieving a net-zero economy. Realizing this potential requires a focus on innovation, effective governance, and the establishment of robust infrastructure. Such measures are essential to ensure transparency around emissions reductions and the developmental impacts of VCM projects (Macquarie, 2023).

[1] The Clean Development Mechanism (CDM) is one of three market mechanisms created by the 1997 Kyoto Protocol that allows for international trade in carbon credits. It enables industrialized countries to invest in emission-reduction projects in developing countries (Thomas et al., 2010).

1.3 Structure of the Voluntary Carbon Market

Like other markets, the price of offsets traded in the voluntary carbon market (VCM) is determined by supply and demand dynamics. A clear understanding of the major stakeholders on each side helps illustrate how their behaviors shape the market price of carbon credits.

1.3.1 Supply Side Actors

The supply side of the VCM is composed of the sellers of carbon offsets, encompassing a diverse range of actors. A primary group includes project owners and developers who identify, develop, and implement GHG emissions reduction projects to produce carbon credits. These project developers may represent private firms, non-governmental organizations, financial intermediaries, individuals, or social groups. Their efforts include carbon reduction initiatives such as large-scale afforestation projects, carbon capture and storage (CCS) technologies, and small-scale clean cookstove projects in rural communities (Zhang & Van der Vleuten, 2023).

The overarching goal of these developers is to design and manage projects that not only reduce greenhouse gas emissions but also deliver sustainable co-benefits, such as job creation, biodiversity conservation, and environmental protection. In doing so, they can contribute significantly to global climate action.

Brokers also play a vital role on the supply side, acting as intermediaries who purchase carbon credits from project developers and sell them to end buyers. They may create financial derivatives or form partnerships with project developers to jointly sell carbon offsets from co-developed projects.

1.3.2 Demand Side Actors

On the demand side, any entity—firms, governments, non-governmental organizations, or individuals—can purchase carbon credits from the VCM to offset their emissions. Companies aiming for net-zero emissions through offsetting represent a substantial group of buyers. These organizations procure carbon credits to compensate for emissions resulting from their operations, products, and services. Such participation demonstrates their commitment to environmental sustainability, enhances corporate reputation, and provides a competitive advantage by attracting environmentally conscious customers and investors.

Societal and political pressures to decarbonize have driven companies from various sectors, including fossil fuel producers, automotive manufacturers, and technology firms, to participate in the VCM. Prominent users of carbon credits include Shell, Volkswagen, and Chevron (Gabbatiss, 2023).

1.3.3 Other Key Actors

In addition to demand and supply stakeholders, other actors influence the structure and dynamics of the VCM through their roles and interactions.

Standard Setters, Certifiers, and Verifiers

Asymmetry in knowledge between carbon offset providers and buyers poses a risk of market failure. This gap has led to the emergence of third-party organizations that set standards, audit projects, and verify claims regarding the quality and quantity of offsets (Conte & Kotchen, 2010).

Historically, credits in carbon markets were generated via the Clean Development Mechanism (CDM) under the Kyoto Protocol, which required meeting specific standards and obtaining certification from accredited bodies. Today, many VCM project developers choose to certify their projects to ensure the quality of carbon offsets and signal their reliability to buyers. Four key certifiers currently dominate the voluntary carbon market: the Voluntary Carbon Standard, the Gold Standard established by WWF, the Climate Action Reserve (CAR) initiated by the State of California, and the American Carbon Registry (ACR), the world's first carbon registry, operating solely in the US.

Alongside certifiers, new standard-setting institutions have emerged to develop or refine methodologies and norms for carbon offsets. For instance, the Integrity Council for the Voluntary Carbon Market (ICVCM) introduced the 10 Core Carbon Principles, which provide a framework for assessing mitigation projects. While certifiers are responsible for issuing qualifications, verification is carried out independently by third-party organizations. These entities play a crucial role in ensuring transparency and accountability, acting as gatekeepers to maintain trust and credibility in the VCM.

Regulators

While regulation contrasts with the voluntary nature of the VCM, some governments are attempting to introduce structure into it. For instance, the European Union is exploring the development of its own certification standards. This trend mirrors past developments in the UK and the US, where governments implemented standards for compliance markets. In 2009, the UK government accredited compliance credits meeting the Quality Assurance Standard (QAS) standard, whose rules were set by the government and administered by a private contractor (Lovell, 2010). Similarly, California's CAR registry, originally established by the state government, now operates as a non-profit organization certifying projects in both compliance and voluntary markets.

Regulatory oversight might extend across multiple jurisdictions, as carbon reduction projects are often implemented in one country but traded in another. For example, carbon offsets sold in the Netherlands may originate from agroforestry projects in Uganda. Local governments influence project implementation through rules on land ownership and project types, while financial regulators in the marketplace oversee offset transactions.

1.4 Carbon Credit Pricing Mechanism

The price of carbon credits remains relatively low in many regions. In 2022, the prices fell below $10 per ton of carbon dioxide equivalent (tCO_2e). For the VCM to become more financially sustainable, a price increase is needed. Carbon credit prices are influenced by several factors, including the sector or activity generating the credits (e.g., forestry, land use, agriculture, renewable energy), the crediting standard applied (e.g., VCS or GS), and the quality of the credits (Dyck et al., 2023). These elements directly affect the pricing mechanisms within the VCM.

1.4.1 Project Characteristics

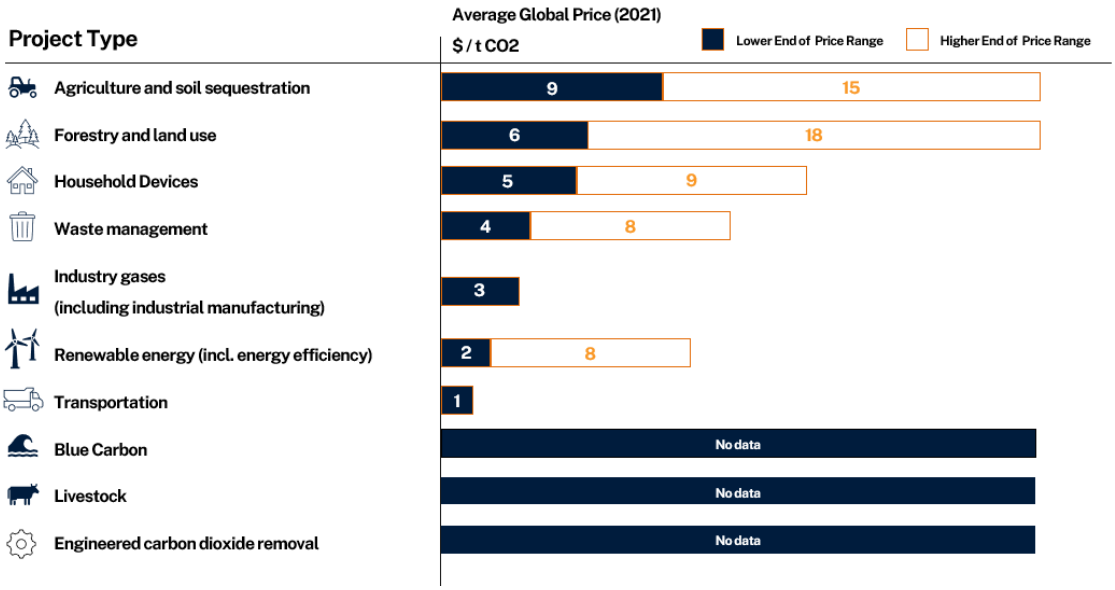
Project activities: The type of project and its activities dictate the price range of the carbon credits. Figure 2 illustrates this price range in 2021. For instance, according to Dyck et al. (2023), most nature-based solutions (NbS)[2] carbon credits in the VCM are generated by forestry activities, with the largest supply of credits coming from REDD+[3] initiatives. Other nature-based solutions (NbS) include Afforestation, Reforestation, and Revegetation (ARR), Improved Forest Management (IFM), regenerative agriculture practices (e.g., no-tillage and cover crop rotation), agroforestry[4], and livestock and fertilizer management.

Co-benefits: Many climate mitigation projects offer additional societal benefits (e.g., women's empowerment, capacity building, and biodiversity conservation) alongside their immediate environmental impacts. These co-benefits vary in form and are highly valued by buyers. Additionally, projects with co-benefit-oriented carbon standards tend to be more popular and are more likely to be transacted than projects without such benefits. Although the study does not focus on pricing, it suggests that all other factors are equal, and projects with higher demand could potentially command higher prices (Lee et al., 2018).

Project Location- According to Conte and Kotchen (2010), the location of both providers and projects has a significant effect on offset prices. They further assert that carbon credits generated from forestry projects in developing and least-developed countries tend to be priced higher than those from industrialized nations. This price difference may be attributed to the co-benefits that projects in developing countries often offer, which may appeal to consumers of carbon credits who value these additional benefits.

[2] Nature-based solutions (NbS) refer to the use of natural ecosystems and processes to tackle various socio-environmental challenges. These challenges include climate change mitigation and adaptation, human security concerns like water and food security, and disaster risk reduction.
[3] REDD+: Reducing Emissions from Deforestation and Degradation Plus Conservation, Sustainable Management, and Enhancement of Forest Stocks
[4] Agroforestry is the intentional integration of trees and shrubs into crop and/or animal farming systems.

Figure 2. Price range of credits by project type



Source: Ecosystem Marketplace and S&P Global Platts, Nori.com, and Indigoag.com, 2021.

1.4.2 Carbon Credit Quality

It is crucial for market players to have accurate and up-to-date information on carbon credit prices. Typically, the terms of carbon transactions are formalized through an Emission Reductions Purchase Agreement (ERPA). Every VCM activity and its corresponding price per carbon credit are documented in the ERPA records. Unlike compliance markets, where pricing tends to follow more standardized rules, carbon credit prices in the VCM are subject to negotiation. However, it is generally accepted that the quality of carbon credits significantly impacts their pricing.

Currently, some initiatives are working toward improving the VCM's transparency, efficiency, and effectiveness, such as the Taskforce on Scaling Voluntary Carbon Markets (TSVCM) and the Voluntary Carbon Markets Integrity Initiative (VCMI). Both initiatives define credit quality based on the Core Carbon Principles established by the Integrity Council for the Voluntary Carbon Market (ICVCM). These principles are detailed in Box 1.

In conclusion, the primary factors influencing carbon credit prices include the types of VCM projects, the demand from corporate buyers for credits generated by specific activities, negotiating power, and the overall quality of the credits, which encompasses their certifications and associated risks. Despite an understanding of these factors, the pricing structure within the VCM remains opaque, as no standardized mechanism exists to establish prices or ensure transparency in the market.

Box 1. The 10 Core Carbon Principles of Offset Quality

The ICVCM report (2024) outlined the 10 Core Carbon Principles alongside a comprehensive assessment framework. These principles serve as a global benchmark for identifying high-integrity carbon credits that generate accurate and verifiable climate impacts. The principles establish strict criteria for disclosure and sustainable development. Several existing international certification programs have adopted elements of these principles:

1. **Effective Governance:** A program should be transparent, accountable, and subject to continuous improvement.
2. **Traceability:** A registry is essential to ensure that a project is uniquely identified and its impacts are traceable.
3. **Transparency:** Information about mitigation activities should be publicly available in an accessible electronic format for non-experts.
4. **Robustness:** A program must be able to withstand independent third-party validation and verification.
5. **Additionality:** Mitigation activities should result in reductions or removals that would not have occurred in the absence of the project.
6. **Permanence:** Reductions or removals should be permanent. Risks of reversal should be measured and compensated.
7. **Quantifiability:** Reductions or removals should be quantified using conservative approaches based on scientific methods.
8. **No Double Counting:** Projects should only count once toward mitigation. Credits must be free from double issuance, double claiming, and double use and should be retired once purchased.
9. **Safeguards:** Projects should adhere to industry best practices in social and environmental safeguards.
10. **No Lock-in:** Projects should avoid locking in emissions, technologies, or carbon-intensive practices.

1.4.3 Indirect Factors Affecting Offset Prices and Value Distribution

Given the significance of forestry-based projects in the VCM, this section examines some indirect factors that may influence the offset prices and the value distribution within a specific project.

Land Tenure & Communal Land Ownership- The insecurity of land tenure, an issue in many developing and least-developed countries, can significantly affect the distributional equity of a project and undermine its permanence, a crucial quality criterion for carbon offsets and, thus, their prices. In some Indigenous cultures, tenure rights may not be clearly defined, and even if they are, corruption and weak legal enforcement can hinder land users from benefiting from a project. For example, titleholders may not be recognized as owners of natural resource rights, including trees and hence the carbon sequestered (Sunderlin et al., 2014). This can challenge farmers' entitlement to income generated from a project such as agroforestry.

Additionally, attention must be paid to the length of land tenure. Certification is often required, but it can take several years from the project's commencement to verification (Finley-Brook, 2016), and this timeline does not guarantee that carbon credits will eventually be transacted in the VCM. In the context of REDD, participants are typically compensated only after emissions reductions are verified (Finley-Brook, 2016). This practice has two key implications:

1. If the duration of land tenure is short, projects on that land may not meet permanence requirements, reducing carbon offsets' prices and the ability to sell them in the market.

2. The lengthy verification process, which can take one and a half to six years (Battocletti et al., 2024), requires farmers to make a significant initial investment before receiving income. The discounted returns can be relatively low, particularly for smallholder farmers who own or lease small plots of land, which generate limited carbon units and make certification more challenging (Arup & Zhang, 2015).

In some regions, communities collectively own land (Corbera & Brown, 2008). Gaining consensus among all stakeholders can be difficult, creating ambiguity regarding whether individual farmers have the right to join a project or sign a contract, how benefits are distributed among community members, and how inputs from individual farmers would be compensated. In addition, the income-generating potential of climate mitigation projects can erode traditional common property structures in certain Indigenous territories (Finley-Brook, 2016).

Carbon Rights- Another related issue affecting offset prices and value distribution is carbon rights. In China, for example, some forestland ownership and contracted management rights are separate. Forest carbon sink rights are typically attached to the ownership of trees (Xu, 2024). When local communities or the state collectively own natural resources, transfers often involve just the management rights rather than ownership of the carbon rights. In some cases, carbon rights cannot be transferred, or they must be explicitly contracted. Ownership of trees and land may also be separated. Given the relative novelty of nature-based solutions (NbS), there may be no clear rules regarding carbon sink rights, which can lead to legal disputes.

In many developing countries, there may be no laws governing such contracts, leading to substantial uncertainties for project owners and local farmers, preventing broader participation. Even if local authorities can manage disputes, agroforestry projects could be delayed or jeopardized due to unfavorable court decisions. These risks significantly increase transaction costs, which local farmers may partially bear, thus reducing the benefits they can derive from participating in a forestry-based climate mitigation project.

Local Policies- Forest carbon projects often have a long duration, as certification requires permanence. Some carbon sequestration projects must be implemented for at least 20 years to be credible (Gutiérrez, 2011). In developing countries, environmental conservation, food security concerns, and rapid urbanization may lead to changes in land use policies. Such spatial plans have a substantial impact on project sites and, consequently, on carbon offset prices (Boer, 2018)

Some governments provide tax credits, financial subsidies, and loan interest discounts to offset buyers or project developers. However, these policies are unlikely to remain in place over the long term. Policy volatility introduces another layer of uncertainty for project developers and, indirectly, for local populations. This uncertainty is particularly pronounced in less-developed countries with unstable macroeconomic environments. Furthermore, uncertainties related to the natural environment, such as climate, water supply, and natural disasters (e.g., floods and fires), can affect the natural growth rate of trees and their carbon sequestration capacity. These uncertainties pose risks to the longevity of projects, the quality (e.g., permanence) of carbon offsets, and their prices.

Some of these uncertainties can be mitigated or insured against, for instance, through carbon sink value discounting (Radke et al., 2020) or the creation of reserved forest. Under the Chicago Climate Exchange, forest owners are required to reserve 20% of their forest to manage potential reductions in offsets due to forest damage. In New Zealand, forest farms can introduce insurance to protect against climate hazards such as floods, droughts, and winds (Xu, 2024). These strategies reduce project risks, increase project value, and may offer some protection to farmers' shares in a project.

2. The Voluntary Carbon Market and Smallholder Farmers

This report focuses on carbon offset activities involving smallholder farmers[5]. Smallholder farmers participate in the VCM by engaging in various carbon offset activities, with agroforestry and nature conservation being two significant segments. These activities contribute to biological carbon sequestration by using photosynthesis in forests, grasslands, and wetlands to absorb CO_2 and store it in plants and soil.

- **Agroforestry-based** activities integrate trees into agricultural landscapes, enhancing both carbon sequestration and agricultural productivity.
- **Nature-conservation-based** activities aim to preserve and restore natural ecosystems, mainly forests.

The primary incentive for farming communities to participate in the VCM is the payments received for the carbon credits generated by their offset activities (Barbato & Strong, 2023; Buck & Palumbo-Compton, 2022). These payments provide an additional income stream, increasing financial stability and resilience. Beyond direct monetary compensation, farmers may also benefit from access to enhanced ecosystem services and training on improved land-use practices, leading to greater resilience to climate change and more sustainable livelihoods.
VCM projects thus deliver both **direct monetary payments** and **non-monetary benefits**, such as improved soil health, better water retention, and enhanced crop yields. Farmers may also receive training and technical assistance to adopt climate-smart agricultural (CSA) practices. This dual impact helps mitigate and adapt to climate change, supports local livelihoods, and promotes sustainable land management practices.

[5] According to the Fair & Smart Data definition (2023), "Smallholders are a vulnerable group of people cultivating small fields of land (usually between 2 to 5 hectares, depending on the region) to feed their families and earn an income. They mostly live in rural areas of the Global South with limited access to financial resources and essential infrastructure."

Despite the VCM's growth, there is a limited understanding of its appeal to smallholder farmers and how to improve their participation in the VCM from their perspective.

This report addresses the following research questions:

1. **Does the VCM provide a window of opportunity for smallholders in the Global South?**
    - Assessing the potential benefits for smallholders, including financial compensation and additional benefits.
    - Evaluating the short- and long-term opportunities for enhancing smallholder livelihoods within the VCM.
2. **How does the VCM governance affect the nature and extent of farmer benefits?**
    - Exploring the complexities of VCM governance, where multiple intermediaries connect carbon offset suppliers (smallholder farmers) with buyers (e.g., corporations).
    - Examining how stakeholders—farmers, project developers, certification bodies, and carbon credit buyers—influence pricing, benefit creation, and distribution.
3. **How can the VCM governance be improved to maximize farmer benefits?**
    - Identifying ways to optimize benefit distribution based on the existent VCM governance.
    - Formulating recommendations for enhancing farmer benefits and fostering equitable participation in the VCM.

2.1 Insights from Literature

The existing literature offers very limited insights into the questions and topics outlined in the previous section. Specifically, the academic literature on smallholder farmers participating in the VCM is almost non-existent. A search in Scopus for the terms "voluntary carbon markets" and "smallholder farmers" returned only two documents, both of which are over 10 years old (Shames et al., 2013; Tennigkeit et al., 2013) and are hidden behind paywalls. However, a broader body of literature on carbon markets does provide indirect insights relevant to our questions. Appendix 8.1 provides key terms from the literature used in this report.

Projects that involve local communities, such as those focused on household energy technologies like improved cookstoves, biogas digesters, and ceramic water purifiers, are often justified by their local co-benefits. These include improved health, increased incomes, and market opportunities, in addition to global emissions reductions. However, when considering VCM's projects involving the adoption of carbon-reducing technologies, such as clean cookstoves replacing firewood, Karhunmaa (2016) questions whether the "stories" of local development impacts that are shared with buyers of offsets resonate with the actual experiences of the users of the technology. She finds that the response to this question is negative. While the buyers of offsets tend to focus on creating sustainable local markets, technology users primarily highlight health benefits.

In the context of bio-sequestration schemes, such as those in Australia, Torabi and Bekessy (2015) demonstrate that private landowners can benefit from participation in ecosystem service markets, particularly if they sell credits in multiple markets simultaneously. "Stacking credits" refers to generating multiple credits from one piece of land, which can be sold separately in the relevant markets, such as biodiversity credits and carbon credits.

In renewable energy and forestry, carbon projects are often characterized by a lack of clarity in governance structures and concerns about fairness. Issues of fairness typically arise around the allocation of payments, with some projects prioritizing cost-effectiveness over equity (Narloch et al., 2013). In forestry, voluntary standards for carbon credits frequently focus on emissions reduction but fail to adequately address socio-economic challenges, such as the distribution of benefits to smallholders (Pan et al., 2022). Most directly related to our study, Howard and colleagues have shown that projects under schemes like Fairtrade International and Gold Standard aim to incorporate "fair carbon" principles, which focus on equity and justice in terms of access to benefits. Despite these efforts, challenges persist, including ensuring the participation of local communities in decision-making processes and addressing power imbalances in carbon projects (Howard et al., 2015, 2016).

2.2 Global Value Chains of the VCM

This report draws on the conceptual framework of global value chains (GVCs) to guide our analysis and address the outlined research questions. By applying a GVC lens, we view the VCM as the full range of interconnected activities required to produce and use a carbon credit. These activities often span multiple continents and involve countries at varying income levels, necessitating a high degree of coordination among buyers, intermediaries, and suppliers. The core proposition is that the nature and dynamics of final demand significantly influence the benefits accruing to suppliers. Box 2 provides information on the interconnectedness within global value chains in the VCM and its governance structures.

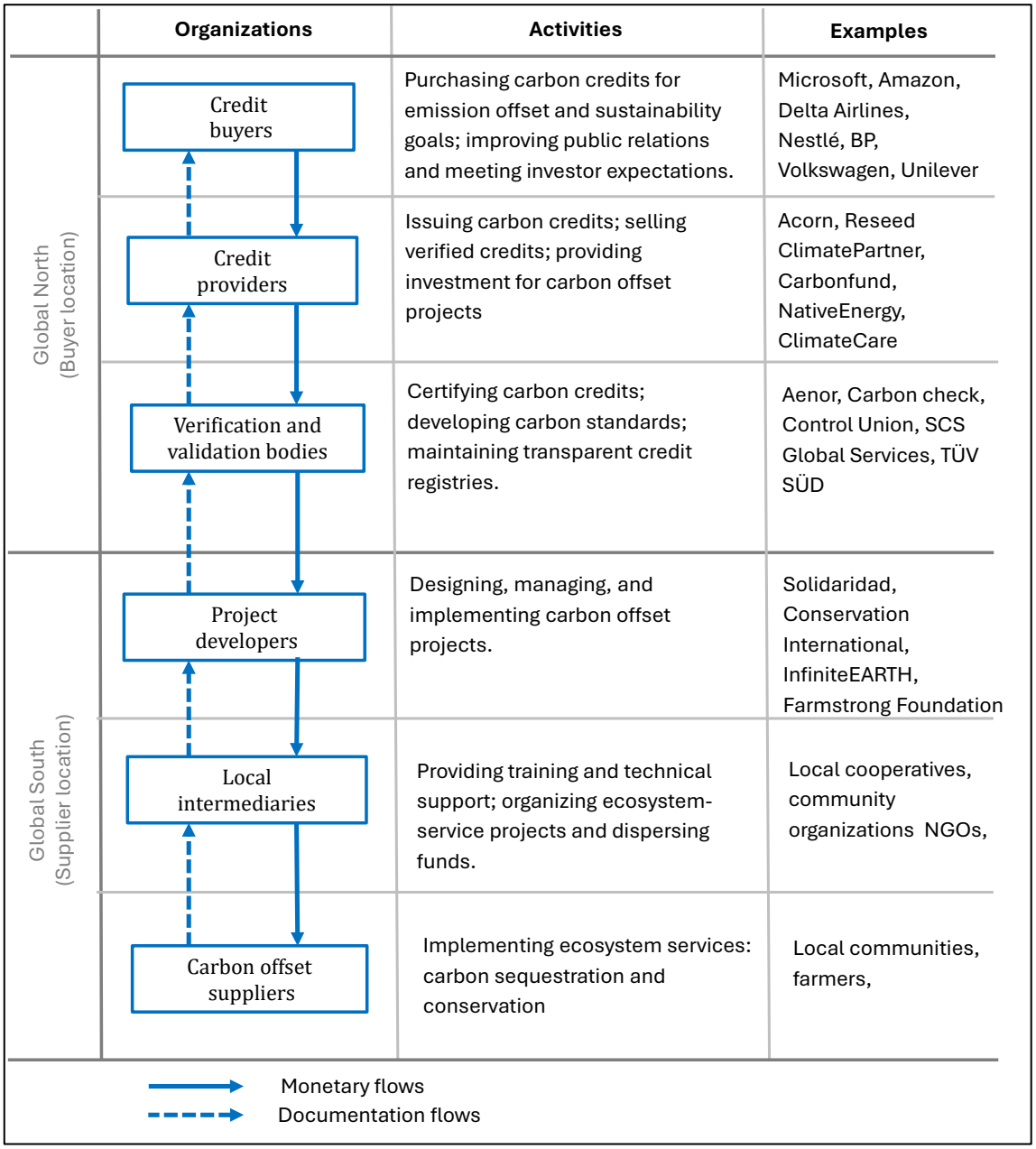
Box 2. Global Value Chains of the VCM

The global value chains (GVCs) of the VCM encompass a full spectrum of interconnected activities, from producing and certifying to commercializing carbon credits. These activities span multiple geographic regions and involve diverse stakeholders, including smallholder farmers, project developers, certification bodies, intermediaries, and carbon credit buyers—typically corporations seeking to offset emissions.

Governance structures within these GVCs dictate key aspects such as access to international markets, certification processes, and carbon credit pricing. Intermediaries often hold significant control in these areas, shaping the terms under which smallholders participate. The power asymmetries inherent in these relationships can substantially impact the extent to which smallholders derive financial and non-financial benefits from their engagement in carbon markets, underscoring the need for equitable governance mechanisms to enhance their share of value.

The key actors in the VCM value chains include credit buyers, credit providers, standard-setting organizations, project developers, local intermediaries, and carbon offset suppliers (such as smallholder farmers in the Global South). Figure 3 summarizes these relationships and activities.

Figure 3. Typical organizations and activities in the VCM value chains



Note: This figure illustrates a simplified version of the VCM value chains and offers terminology for the following sections of the report. In practice, the roles of various actors and organizations and their interactions may overlap and occur in a non-sequential manner. Additionally, standard-setting organizations may be directly involved in this chain.

- **Credit Buyers:** These end-users of carbon credits include multinational corporations, small and medium enterprises, and supply chain partners from various industries aiming to offset emissions to meet sustainability goals. Buyers are motivated by factors such as regulatory compliance, corporate sustainability commitments, public relations benefits, investor expectations, and personal or organizational dedication to environmental stewardship.

- **Credit Providers:** Credit providers sell carbon credits directly to businesses or individuals seeking to offset emissions. They include:
    - Financial institutions investing in carbon offset projects as part of sustainable investment strategies.
    - Companies that aggregate carbon credits from multiple smaller projects, enabling buyers to purchase offsets in bulk.
    - Specialized firms that manage voluntary carbon value chains, ensuring accounting and verification to maintain the credibility and transparency of sold carbon credits.

- **Standard-Setting Organizations:** These entities establish frameworks and criteria to ensure the integrity, credibility, and effectiveness of carbon offset projects. They develop standards and methodologies, issue carbon credits, maintain registries for transparency, and enforce monitoring and reporting requirements. Their role ensures both environmental and social benefits and builds trust in the market. Box 3 provides an overview of the main standards.

- **Validation and Verification Bodies (VVBs):** Third-party assessment consultancy firms that validate and certify project results. VVBs verify and certify carbon credits, ensuring they are credible and well-documented as 'real' offsets through rigorous processes.

- **Project Developers:** These entities design, implement, and manage carbon offset projects. They can include:
    - **Specialized companies** that focus exclusively on carbon offset project creation, leveraging expertise across sectors like forestry and agriculture.
    - **Non-Governmental Organizations (NGOs)** that integrate carbon offset projects into broader conservation and development missions. These organizations often collaborate closely with local communities to implement sustainable practices, such as reforestation, ecosystem restoration, and agroforestry.

  Both specialized companies and NGOs play critical roles in ensuring projects are scientifically credible, environmentally sound, and beneficial to local communities.

- **Local Intermediaries:** Cooperatives and local organizations play a pivotal role as intermediaries in the VCM by facilitating the implementation of carbon projects within local communities, particularly among smallholder farmers. Their responsibilities include:
    - Distributing funds from carbon credit buyers.
    - Organizing training sessions on carbon sequestration practices.
    - Managing the practical aspects of project execution.
    - Monitoring progress to ensure compliance with carbon market standards.
    - Providing technical support to farmers.

  These intermediaries enable smallholders to effectively participate in the VCM, bridging the gap between local communities and the broader carbon market ecosystem while ensuring that farmers can access financial benefits from carbon credits.

- **Carbon Offset Suppliers:** Smallholder farmers and local communities serve as the backbone of carbon offset activities by implementing carbon sequestration and conservation practices. These activities include:
    - **Carbon sequestration projects:** Reforestation, agroforestry, and sustainable land management.
    - **Conservation initiatives:** Rainforest protection and ecosystem management.

  By engaging in these efforts, smallholders generate carbon credits that are sold to the final buyers. They collaborate with NGOs, project developers, and certification bodies to ensure their credits comply with established standards. Farmers and communities often organize into cooperatives or partner with local entities, which facilitates their integration into the VCM value chain and help amplify their financial and non-financial benefits.

Box 3. The Key Standards of the VCM

- **Gold Standard:** One of the most globally recognized standards, it ensures that carbon reduction projects meet rigorous environmental and social criteria. It is widely applied in forestry and development projects.
- **Verra – Verified Carbon Standard (VCS):** The most widely used standard for carbon reduction projects globally, VCS focuses on land use, REDD+, and forestry initiatives, particularly those involving smallholder farmers.
- **Plan Vivo Carbon Standard (PV Climate):** A certification standard and framework supporting projects that promote sustainable land use and community development, especially in developing countries. It focuses on reforestation, afforestation, agroforestry, and sustainable agriculture practices.
- **Climate Action Reserve (CAR):** A carbon offset program and registry specific to the voluntary carbon market in North America. CAR issues, registers, and monitors carbon offset credits but does not sell them directly.
- **Verra – Community & Biodiversity Standards (CCB):** Often used alongside VCS, the CCB Standards ensure that projects deliver climate, biodiversity, and social benefits. This is particularly relevant for land-based projects involving smallholder farmers and local communities.
- **BioCarbon Registry (BCR):** A voluntary public registry for GHG emission reduction and removal projects that adhere to the BCR standard and methodology. BCR allows projects to issue verified carbon credits across various sectors, emphasizing social and environmental co-benefits.
- **Social Carbon Standard:** This standard, recognized for its focus on sustainable development, promotes carbon offset projects benefiting local communities and Indigenous populations.
- **FoodChain ID:** This standard is primarily focused on transparency and traceability. It uses blockchain technology to ensure that smallholders receive benefits from carbon credits. It places significant emphasis on supply chain integrity and utilizes the Smallholder Farmer Social Carbon (SFSC) framework developed by ReSeed.

Note: These are the primary VCM standard-setting organizations engaged in ecosystem service projects involving smallholder farmers and local communities in the Global South.

2.3 Ecosystem Services and their Compensation

In the VCM, carbon credits represent the emission reduction achieved through specific mitigation activities. In the context of this report, the commodity produced by smallholder farmers is a certified climate change mitigation activity, which is an ecosystem service quantified as a carbon credit. These credits belong to the category of credits connected to nature-based solutions, distinct from those linked to technology-based solutions.

As mentioned previously, it is important to note that credits linked to different types of ecosystem services vary in their price ranges. For instance, credits derived from reforestation, agroforestry, or other natural processes often have distinct pricing mechanisms due to factors like scale, verification costs, and regional differences. Table 1 summarizes the specific price ranges for different types of ecosystem service credits.

Table 1. Ecosystem services and price ranges in the VCM

Ecosystem Service (Project type)	Price Range (USD/ton CO_2)	Project Activities
Agroforestry	$7-$11	Integrating trees into agricultural landscapes to improve carbon sequestration
Blue Carbon (Coastal Wetlands, Mangroves)	$8–$12	Restoration and conservation of coastal ecosystems like mangroves and wetlands that store significant carbon
Deforestation Prevention (Conservation)	$8–$16	Preventing deforestation and forest degradation, primarily in tropical areas, to avoid CO_2 emissions

Source: Ecosystem Marketplace, 2023 and 2024; S&P Global Commodity Insights, 2024.
Note: The figures in the table are rounded.

Upgrading in the VCM Global Value Chains

In the literature of Global Value Chain (GVC), the term "upgrading" refers to the process by which suppliers enhance their position within a value chain, thereby capturing a greater share of economic benefits. For smallholders participating in the VCM, upgrading can translate into an increase in "value appropriation," meaning they receive a larger proportion of the final price paid by credit buyers.

Carbon credits that include certified co-benefits command a price premium and are increasingly sought by buyers, who often view them as essential. For instance, in 2022, credits from projects with at least one co-benefit certification were priced more than 75% higher than those without such certification (Ecosystem Marketplace, 2024). Thus, upgrading in this context may not only signify achieving higher prices but also generating co-benefits that contribute to the accumulation of assets and capabilities, fostering long-term income growth and livelihood sustainability for smallholders.

Nevertheless, participation in the VCM is not without costs. Smallholders face direct monetary costs, such as purchasing inputs for sequestration activities (e.g., seedlings and fertilizers), and longer-term costs, including potential reductions in crop yields and the opportunity cost of forgoing alternative income-generating activities. The literature on sustainability-driven GVCs highlights the dual possibilities: while sustainability requirements can lead to increased net benefits, they can also result in a "supplier squeeze," where the costs of compliance are transferred to suppliers without adequate compensation.

To analyze these dynamics in the VCM, the report employs the terminology and concepts summarized in Table 2. This framework helps evaluate the extent to which smallholders can achieve upgrading while balancing associated costs and benefits.

Table 2. Costs and benefits for smallholder farmers participating in the VCM

Ecosystem Service (Project type)	Monetary (direct)	Non-monetary (in-direct)
Benefits	• Direct financial benefit compensation/carbon credit payments • Diversified income	• Increased crop yields in the long term due to improved soil health. • Premiums on land use or on sustainably produced agricultural products.
Costs	• Operational costs associated with VCM participation. • Investment in new skills	• Potential land-use changes or reduced crop yields • Investments in time • Opportunity costs with respect to alternative land use • Upgrading of skills

3. Two Value Chain Cases

This chapter presents two case studies analyzed during the research: The Jinotega & Matagalpa Project in Nicaragua and the Quilombolas Social Carbon Project in Brazil. The information is based on documentation from various organizations and interviews with representatives of Nicaraguan farmers, the Quilombola community in Brazil, and other key actors within the value chains. The two main data collection methods for both cases were desk research and interviews. For more information about the data collection methods, the list of interviewees, and the analyzed documents, see appendices 8.2, 8.3, and 8.4.

3.1 The Jinotega & Matagalpa Project in Nicaragua

3.1.1 Project Overview and Value Proposition

Jinotega and Matagalpa are cities located in the north-central region of Nicaragua, within the Central American Atlantic Moist Forests ecoregion (see the map in Figure 4). These areas benefit from rich volcanic soils, high altitudes, and a tropical climate, providing ideal conditions for cultivating Arabica coffee beans. The Jinotega region alone produces 80% of Nicaragua's coffee, with most of the production exported to markets in the United States, Russia, Canada, and Europe. Coffee culture is deeply ingrained in this region, playing a critical role in the Nicaraguan economy. The coffee sector supports over 200,000 jobs, particularly in rural areas, making it essential for the livelihoods of smallholder farmers.

However, the Nicaraguan coffee industry faces significant challenges, particularly in relation to climate change and price volatility in the global coffee market. Rising production costs, high labor expenses, and the removal of previous tax exemptions on agricultural inputs further constrain farmers' profits.

Figure 4. Location of the Jinotega & Matagalpa Project

Source: Rabobank, "Solidaridad Nicaragua Jinotega & Matagalpa," 2022.

Historically, coffee farming in Nicaragua has relied on agroforestry systems, although these systems are poorly managed. Tall trees provide inadequate shade, and there are few additional plantings. Moreover, farmers have limited access to technical support from the government, and there is a low level of innovation in adopting practices that could improve crop yields (P9, Project Developer; P10, Carbon Offset Supplier).

In response to these challenges, the NGO Solidaridad launched the project "From Climate Victims to Climate Heroes" in 2017. This initiative aimed to help farmers build resilience to climate change and protect their crops by implementing improved agroforestry practices. The integration of trees into coffee plantations is expected to enhance biodiversity, protect crops and topsoil from extreme weather conditions, and provide a financial and environmental safety net for farmers facing pest outbreaks or climate-related disasters. The project also seeks to connect farmers with the carbon market (Solidaridad & Acorn, 2022).

> *"I'm a third-generation coffee farmer, and we've always used shade in the plantation, but it was about 15-20%. With the project and the technical support, we learned to manage 30% and even 40% shade. We introduced different types of trees, and we changed the types of fertilizers, which helped us reduce emissions in the plantation"* (P10, Carbon Offset Supplier).

The carbon project in Nicaragua initially involved 1,700 smallholder coffee farmers in Jinotega and Matagalpa, covering 2,500 hectares of coffee land transitioning to agroforestry. The ecosystem service provided by this project is carbon sequestration. Farmers plant new trees in their coffee plots at their own expense, and once the trees grow and CO_2 removal is detected using satellite technology, farmers are compensated based on the sale of Carbon Removal Units (CRUs). The process of detecting and verifying carbon sequestration can take three to five years (P8, Project Developer).

As of September 2024, the project has expanded to include 8,957 coffee farmers, supporting the capture of 36,433 tons of CO_2 across 20,679 hectares of land (Acorn, 2024a).

3.1.2 The Role of Acorn

Rabobank launched Acorn in 2020 as a platform to address the growing demand in the VCM for nature-based carbon credits, specifically from agroforestry. Rabobank describes it as "a holistic system that can benefit not only the environment but can also empower farmers over the long term" (Acorn, 2024b). Acorn's portfolio focuses exclusively on carbon removal rather than prevention or reduction of carbon emissions. The CRUs offered by Acorn are measured ex-post using remote sensing technologies and digital tools, which allow for large-scale tracing of carbon sequestration.

The collaboration between Acorn and Solidaridad Nicaragua began in 2020 to provide carbon finance as an incentive for farmers to improve their agroforestry systems. Acorn's role in this project is to serve as the platform where CRUs are traded in the carbon market. Additionally, Acorn developed the methodology for measuring and calculating CRUs, which was created in collaboration with the Plan Vivo Foundation and approved by both the Spanish Association for Standardization and Certification (AENOR) and SCS Global Services, an international third-party certifier specializing in sustainability standards. The use of remote sensing technology and Acorn's methodology allows the project to scale effectively while maintaining low costs, making carbon markets accessible to smallholder farmers through its partnership with Solidaridad.

To collect and manage data on participating farmers, Acorn has developed a digital tool in which the information is registered and maintained by the local partner. Before using this tool, both a Data-Sharing Consent and a Participant Agreement must be signed. The Participant Agreement outlines the responsibilities of the local partner, the farmer, and Acorn. For farmers, it specifies the eligibility criteria for joining the program and the rules they must follow once enrolled, such as prohibiting excessive pruning and deforestation. For local partners, the agreement details payment procedures and how farmers may receive seedlings. The process and instructions are available on Acorn's website under the section "The Participant Agreement and Data-Sharing Consent" (Acorn Rabobank, 2024).

3.1.3 The Role of Solidaridad

Solidaridad is an international NGO with a long-standing history of implementing projects aimed at enhancing community resilience and fostering sustainable supply chains. Before working with coffee farmers in Nicaragua on this project, Solidaridad developed initiatives to improve sustainability in the palm oil value chain and livestock farming in the region.

In the Jinotega & Matagalpa project, Solidaridad serves as the lead organization, coordinating efforts among all stakeholders within the value chain. The organization provides essential training and technical assistance to enhance the management of agroforestry systems and facilitates farmers' connection to carbon markets.

> *"For the farmer to be able to 'produce carbon certificates,' it is necessary to strengthen their capacities. The role of Solidaridad is to provide training and technical assistance. But we do not do it directly. Our strategy is to develop the capacities of local partners. They can be a cooperative, producer association, or trader with a group of producers within its supply chain. So, we work with these partners, strengthening capacities, that is, training their technicians, training the managers, supporting the organizations"* (P9, Project Developer).

In this project, Solidaridad collaborated with CISA Exportadora, part of the Mercon Coffee Group, a global company with extensive experience in coffee production, sourcing, and trade. CISA Exportadora played a crucial role in providing technical support and maintaining direct contact with the farmers. However, in December 2023, CISA abruptly declared bankruptcy and ceased operations. As CISA had maintained business relationships with the farmers for over 20 years, the sudden closure created challenges for coffee sales in the region, as other local buyers lacked the capacity to absorb the production volume.

> *"We started in 2020 with Grupo Mercon (CISA Exportadora). They explained the program to us and the objective of reaching the farmers with a 'bonus' payment for the carbon. We saw it as compatible with our type of production (improving the agroforestry system). Once they declared bankruptcy, we were left alone. We weren't thinking about the payment anymore. When they called me (in 2024) to tell me they were going to pay me, I couldn't believe it."* (P10, Carbon Offset Supplier).

Solidaridad's approach focuses on integrating income from the carbon market as an additional revenue stream for farmers, complementing efforts to enhance coffee production and adopt sustainable practices. By improving production systems, the project enables farmers to offset carbon and reduce CO_2 emissions. This holistic strategy is particularly well-suited to small-scale farmers, as it reduces transaction costs. Farmers are not required to pay for certification individually; instead, costs are distributed among all stakeholders in the project.

3.1.4 The Role of Plan Vivo

Plan Vivo conducts an eligibility review of projects before their inclusion in the Acorn platform. It provides a certification process to ensure adherence to criteria for environmental integrity, social equity, and sustainable development. This process includes rigorous monitoring, reporting, and verification procedures. The methodology developed by Acorn has been certified by Plan Vivo and is verified against its application and development requirements. It quantifies the difference in net CO_2 emissions from aboveground and belowground biomass between project and baseline scenarios. The methodology is designed for areas of 0.1 to 10 hectares, typically cultivated or degraded land at the start of the project. This makes it particularly suitable for smallholder agroforestry projects (Methodology for Quantifying Carbon Benefits from Small-Scale Agroforestry, prepared by Rabobank, v1.0, 2021, approved by AENOR and SCS Global Services).

Once a methodology is approved, all projects applying it are verified by Plan Vivo, expediting the process compared to other standards. This includes protocols for baseline creation, data collection, and more. Validation and verification are conducted periodically by Validation and Verification Bodies (VVBs) approved by Plan Vivo, which may involve on-site evaluations. Payments and contacts are managed through Acorn, covered by the platform's 10% fee.

> *"We work in close coordination with Acorn. If they have a new project come in, they send it over to us, and we review it. They sort everything out with their account managers. The account manager has a relationship with the project. Then it goes to the certification team, which verifies everything, and then, after they see that the eligibility is verified and good enough to send over to us. It comes to us, and we verify it until we're satisfied to approve it or ask for more information or any other actions. This process can take 6 months, which is much faster than others in Plan Vivo."* (P7, Standard Setting Organization/Certifier).

This methodology supports scalability across multiple large projects, enhancing efficiency compared to other carbon projects verified by Plan Vivo. These other projects often involve direct collaboration with NGOs during the design phase, requiring capacity building and extending timelines. While the streamlined approach with Acorn is more efficient, it involves less direct engagement with carbon offset suppliers.

Plan Vivo began its activities focusing on empowering communities and small-scale farmers to plant trees, generating the first carbon credits in the voluntary carbon market (VCM) in 1997. This history and mission make Plan Vivo presumably a compatible partner in initiatives aimed at environmental protection and community empowerment.

3.1.5 Coffee Farmers of San Rafael del Norte, Jinotega, Nicaragua

Farmers in this region had a longstanding trust-based relationship with CISA Exportadora, a company with several certifications, including Rainforest Alliance, UTZ, and C.A.F.E. Practices (CISA Exportadora S.A., 2017). CISA supported farmers through training and financing for crop maintenance (inputs and cash loans).

The company staff communicated the Acorn project idea to the coffee farmers and provided technical assistance to establish the agroforestry systems and implement changes in production, including post-harvest practices.

> *"The first training we received was about the pattern to plant the new trees. Then, we would receive the trees to plant, but the technicians suggested Mahogany and other trees that were not appropriate. They are not native. We proposed planting native trees, and we had to collect the seeds in the forest ourselves. It was a long and difficult process, but in the end, we planted around 3,000 trees. The next training was about pruning."* (P10, Carbon Offset Supplier).

The interviewed farmer allocated approximately 2.8 hectares, 35% of his coffee plantation, as a pilot plot for the project. This required considerable adjustments, including new cleaning techniques and a revised fertilizer formula designed to fix nitrogen without producing excess carbon. These fertilizers, along with additional labor for maintaining shaded areas, were costly, with estimated expenses ranging from C$17,000 to C$20,000 NIO (approximately €425 to €500).

Despite CISA Exportadora's bankruptcy and the initial uncertainty regarding compensation for carbon sequestration, the farmer described the experience with the pilot plot, which started by planting new trees in 2020, as 'excellent.' The new system allowed coffee plants to withstand more than 120 days without rain, showing no signs of hydric stress.

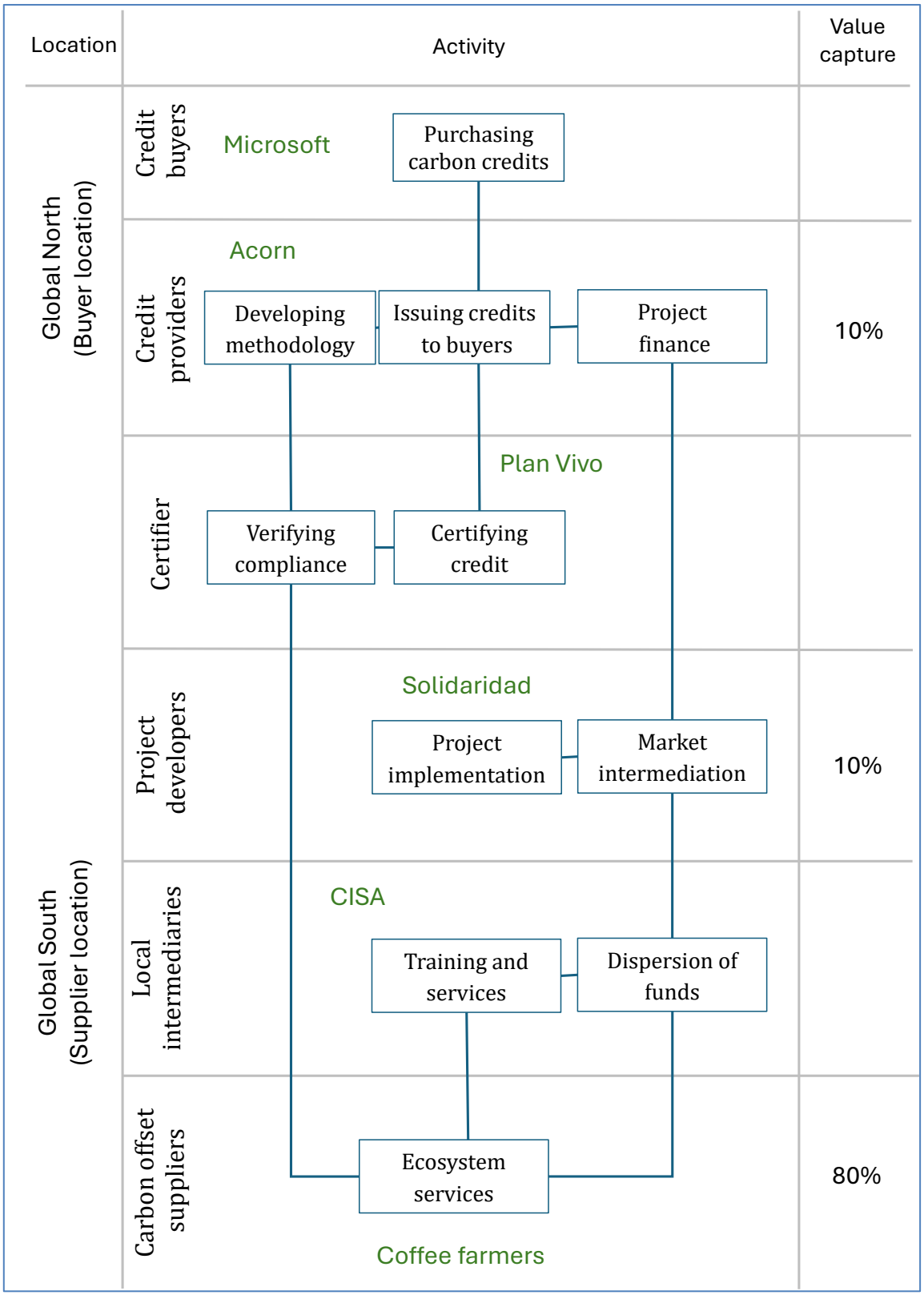
> *"Central America was affected by the drought, but my farm was not affected. We already know that the coffee plant lasts longer in the shade. For me, that was the most important thing. Before, in full sun, the plant lasted 3 or 4 years. In shade, the plant lasts 10–15 years."* (P10, Carbon Offset Supplier).

Although the financial return on investment was limited, the farmer recommended adopting the agroforestry system. Given sufficient resources, they expressed interest in expanding the practices implemented in the pilot plot.

> *"I answer that the payment is significant, but I say that it is because of the drought. I saw how the plants behaved because of the shade. The truth is, I don't quite understand how the relationship is established or how the payments are made. I think all producers experience the same. They receive the bonus, but they don't know how it works. Like you get money, but no one knows how it works. Like someone made a transfer in your bank account by mistake."* (P10, Carbon Offset Supplier).

Figure 5 summarizes the value chain of the Jinotega & Matagalpa Project, showcasing the interactions between the different stakeholders and the value captured at each level of the chain.

Figure 5. Jinotega & Matagalpa Project value chain

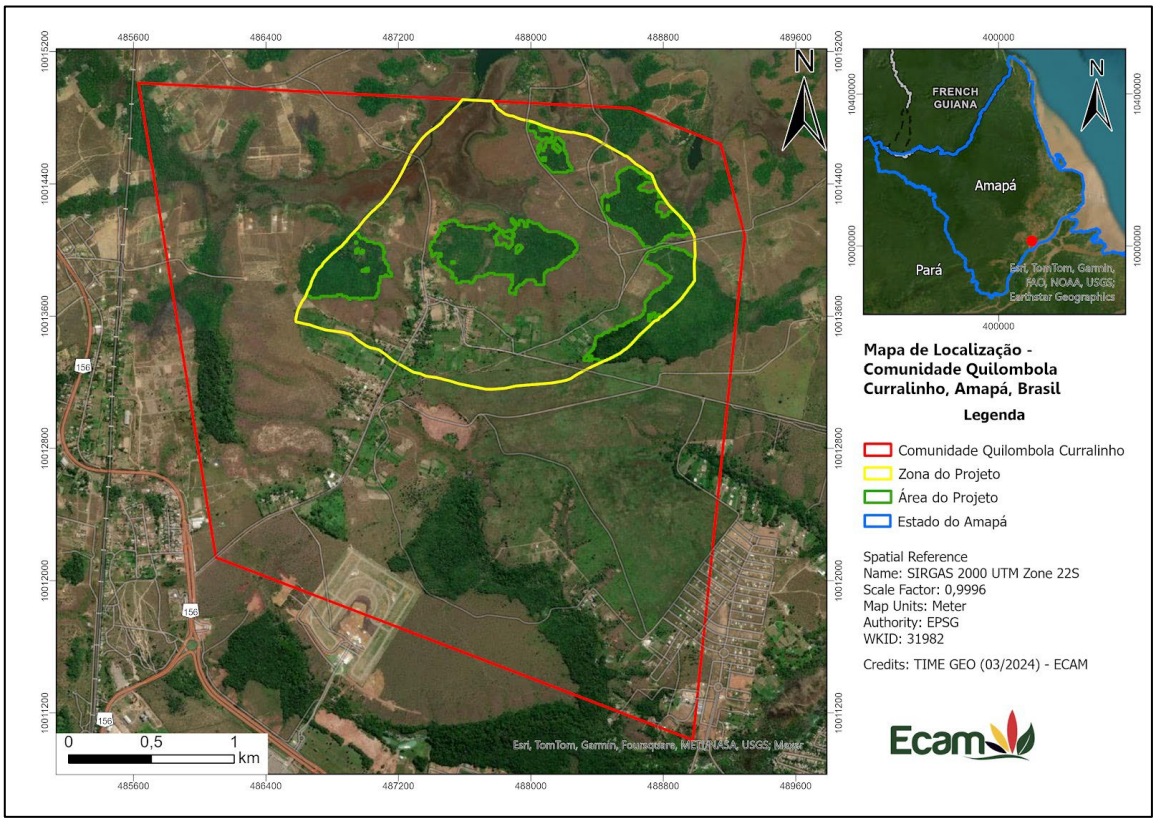


3.2 The Quilombolas Social Carbon Project in Brazil

3.2.1 Project Overview and Value Proposition

The "Curralinho Afro-Brazilian Social Carbon Project" is situated in the Environmental Protection Area (Área de Proteção Ambiental, APA) of the Curiaú River, in the rural zone of Macapá, Amapá province, within the Brazilian Amazon (see the map in Figure 6). The Brazilian government classifies this area as a conservation unit with sustainable use to organize territorial occupation and prioritize the protection and conservation of natural resources. The territory is inhabited by families from the Quilombola community, descendants of Afro-Brazilians who escaped from slave plantations. These communities are legally identified as ethnic-racial groups in Brazil based on the criteria of "self-attribution."

Figure 6. Location of the Curralinho Afro-Brazilian Social Carbon Project



Source: ECAM, "Curralinho Afro Brazilian Social Carbon Project, RSD-0002, Brazil," 2024.

The project area, marked by green lines, covers a collective forest of 66 hectares. The area outlined by the yellow line is specifically designated for project activities focused on generating net climate benefits.

The project generates carbon credits by recognizing the environmental services provided by the Quilombola community through sustainable natural resource management. The Environmental Protection Area of the Curiaú River spans 21,676 hectares, with a perimeter of 47.34 km. Within this area, 110 Quilombola families reside in peri-urban zones, surrounded by secondary Amazonian Forest patches covering 277 hectares, according to the project documents.

The project proponent is the Association of Remaining Quilombola Residents of the Curralinho Community (AMORQUIC), and the criterion adopted by the community to establish the boundaries of the project zone is based on the territorial extension over which the community exercises effective control. This is important to keep control of the objectives and integrity of the project. According to the protocol applied, the project lifecycle and crediting period is five years and can be renewed for a total of 20 years.

The main focus of the project is conservation as an ecosystem service. Its objectives include recognizing the Quilombolas' traditional way of life, alleviating socio-economic vulnerabilities, and safeguarding their sustainable relationship with the environment. The initial phase does not involve reforestation but acknowledges and sustains the Quilombolas' motivation to protect the soil and forest. Future phases may include carbon sequestration activities.

> *"This is really [about] understanding that smallholder farming is the main pillar for them to continue to be on the land that they have occupied for the last 300 years. Then, [it is] also [about] understanding the vulnerabilities that they face, mostly socioeconomic, legal, and [environmental] due to climate change, as well as their importance for food security. We wanted to go back and say, okay, these communities are performing real service, and they are at the forefront in terms of carbon stock management. They are protecting the forest that is there as well as the health of the soil."* (P4, Credit provider).

The Quilombolas engage primarily in subsistence farming, cultivating a mix of crops, fruits, and vegetables, with staples like manioc and bananas forming the core of their agricultural output. They manage permanent and intermittent cultivation areas, while forest harvesting, particularly palm fruits like açaí, provides substantial economic sustenance. Traditional methods are used to process manioc into flour (*fariña*), which they sell alongside fruits at local markets, occasionally through intermediaries.

According to the project documentation, securing financial resources from this project is fundamental to strengthening the communities, aiding them in the land regularization process, and promoting their financial autonomy. By improving community well-being and reducing their vulnerability, they will be better equipped to decrease pressure on the rainforest and help mitigate deforestation. According to the public information on the website, in September 2024, the project claimed 9,825 tons of CO_2 equivalents were conserved (ReSeed, n.d.-a)

Besides the Social Carbon project analyzed in this report, the Quilombola communities have proposed two similar projects in the region in partnership with Reseed. One is the "Curiau Afro Brazilian Social Carbon Project," which includes 760 forest hectares and 505 households. The other is the "Carmo do Maruanum Afro Brazilian Social Carbon Project," which includes 17 forest areas in hectares and 60 households (ReSeed, n.d.-b).

3.2.2 The Role of ReSeed

ReSeed is a recently established "carbon management platform" that offers services aimed at integrating the entire "carbon value chain." Its strategy builds on experience with small-scale farmers, and its mission is "to make it easier for these farmers to access climate finance by providing transparent, high-quality solutions that have a measurable impact on climate and biodiversity" (ReSeed, 2024)

> *"If you look at the carbon markets, fewer than 1% of all carbon credits have come from agriculture. And fewer than 0.03% have come from smallholder farmers or sustainable agriculture. So, there are these huge barriers to entry, [including] high transaction costs, higher upfront costs, and methodologies that are not built around the reality of smallholder farmers"* (P4, Credit provider).

ReSeed has developed a protocol called the Smallholder Farmer Social Carbon (SFSC), which applies the IPCC Vulnerability Assessment Index to measure social and climate vulnerability. This protocol also enables transparent tracking of the reduction of community vulnerabilities over time. The methodology underscores the necessity of acknowledging the conservation efforts of smallholder farmers and providing support to protect the carbon sinks they manage. These efforts contribute to global food security, biodiversity, access to clean water, and reduced global inequality. The payment prioritization approach emphasizes conservation actions initially, with removal actions considered subsequently. The latter requires significant investment, which is often beyond the means of farmers living in vulnerable conditions.

The SFSC protocol continually quantifies the improvements farmers have made over time in their above-ground carbon stocks and soil. This process generates additional payments corresponding to "removal credits." The business model and protocol challenge current carbon market standards—such as those used by Verra and Gold Standard—which are designed to support large enterprises and large-scale projects. These standards often exclude communities managing strategic regions like the Amazon rainforest, where addressing vulnerability is essential for environmental conservation and sustainable livelihoods (P4, Credit provider).

Recognizing that vulnerable communities could not participate in carbon markets without support, ReSeed collaborates with AMORQUIC as an upfront investor. It provides the necessary cash flow to cover technical and legal services required for project development and implementation, including technical surveys, legal support, validation, and verification fees.

ReSeed also works with the Associação de Moradores do Quilombola do Curiaú and the Associação dos Moradores e Produtores Rurais Remanescentes do Quilombola Carmo do Maruanum. The project proponents are represented by these legally constituted Civil Society Organizations (CSOs) under the Brazilian Civil Code. According to the information provided, ReSeed signed a Memorandum of Understanding (MoU) with these CSOs to define the roles and obligations of the project partners and establish the "benefit-sharing mechanism." Additionally, the CSOs have signed agreements such as the "Mechanism for Transparency and Grievance and Conflict Resolution." The project was developed and presented in September 2022, with the first verified credits issued in 2023. The community received its initial cash disbursement from these credits in September 2024.

3.2.3 The Role of the Equipe de Conservacao da Amazonia

Since its inception, the NGO Equipe de Conservacao da Amazonia (ECAM) has pursued the mission of strengthening traditional communities through a three-stage strategy: conducting diagnoses or preliminary studies, planning, and implementing territorial management. This strategy encompasses infrastructure development, health, education, culture, and the preservation of traditions. The organization has been active in the region since 2005, with a long history of qualification processes for traditional and vulnerable groups, primarily focused on territorial defense and legalization. Over the years, the NGO has established trust-based relationships with various communities and previously collaborated with Quilombola communities on projects to enhance family agriculture.

ECAM is fully integrated into the project's business model and has been hired by ReSeed as the local partner. Its role includes conducting participatory diagnoses and providing all necessary information for project documentation. ECAM played a critical role in guiding the verification team and helping them understand the territory's unique characteristics and the Quilombola communities' relationship with it, particularly in terms of conservation. The organization also carried out essential preparatory tasks for the project, such as conducting a forest inventory.

According to the project proposal, ECAM staff will continue supporting the community in the years to come, providing training on sustainable production and addressing other topics identified in the participatory diagnosis, such as education and health. ECAM views projects related to the carbon market as valuable opportunities to support these communities, particularly given the lack of government investment or strategies to strengthen forest protection and ensure their sustainability.

ECAM staff emphasized that the project benefits the community by reinforcing their sense of identity and belonging, as it highlights the importance of cooperation. Although there are no formal (signed) agreements regarding the use of additional resources from the carbon credits, it is understood that these resources cannot be used in ways that negatively impact the ecosystem. According to ECAM staff, the lessons learned from the process indicate that the community has become more aware of the value of the forest and is learning to collaborate with other organizations to advocate for its protection.

> *"The community has been preserving the forest for a long time without the project. Now, with the project, it will be an additional reason for them to protect [it] even more, right? They have been protecting it without receiving anything, and now, receiving something, it's not that they have an obligation, but rather a genuine commitment to continue preserving [it]"* (P11, Non-Profit Organization).

3.2.4 The Role of Foodchain

In 2024, FoodChain ID independently verified and approved this Social Carbon project. Established in 1996, FoodChain ID began as a specialist in Genetically Modified Organism (GMO) identification and has since evolved into a provider of technology-driven solutions for food safety, quality, and sustainability. The company's expanded portfolio now includes organic and non-GMO certifications, food safety audits, regulatory compliance, and product testing.

In 2023, FoodChain ID partnered with ReSeed to develop and offer services under a new Carbon Credit Verification Standard. This initiative aims to enhance transparency and accountability in the measurement of carbon credit offsets within the agri-food supply chain.

> *According to a credit provider, "FoodChain verifies organic and regenerative farming. They understand the reality of farmers. So, it is a small step for them to be able to verify carbon projects with smallholder farmers. They can do the verification at much lower costs, have much more capacity, and be more efficient. They also truly understand the realities of smallholder farmers, not just in Brazil but in India and Greece. That's why they're a critical partner"* (P4, Credit Provider).

FoodChain ID's team of independent technical experts conducts yearly audits of farm practices, adding third-party credibility to the measurement of soil carbon sequestration. ReSeed's CEO emphasized the company's international presence and extensive experience with small-scale farmers and agricultural conservation activities, identifying these attributes as key reasons for selecting FoodChain ID as the verifier for this project.

The carbon credit verification system promoted by FoodChain ID and ReSeed incentivizes farmers to 'guard' carbon through regenerative farming practices. Their protocol identifies two primary objectives (ReSeed, 2024, p. 18):

- **Goal 1**: Avoided emissions (maintenance of soil organic carbon assets): Oriented towards measuring avoided emissions by good management practices and continued carbon sink protection.
- **Goal 2**: Removals (addition of soil organic carbon assets): Oriented towards measuring the removal and storage of GHGs by soils.

Under this system, farmers can achieve initial recognition without financial investments and commit to a five-year "micro-cycle" during which their carbon stocks are measured annually. This verification process enables farmers to earn credits for avoided emissions, which they can reinvest into their assets to transition toward regenerative agriculture. The baseline measurement facilitates efficient estimation of additional sequestration, creating what the protocol refers to as a “blended approach.”

This model serves as both an incentive and a guarantee of farmers' permanent commitment to maintaining their existing carbon stocks while providing pathways for sustainable agricultural development.

3.2.5 Farmers in the Curralinho Region of Brazil

The Quilombola community has been defending its territory and way of life for generations. They are facing pressure from territorial expansion on the outskirts of the municipality of Macapá, where real estate speculation is fueled by legal uncertainty due to the lack of official recognition of their lands. This situation has led to invasions by outsiders and the abandonment of previously productive areas intended for family farming.

The Environmental Protection Area (APA) was established as a protected area to safeguard it from external threats and empower the community to conserve nature. The government has trained two community members to serve as park rangers who oversee the area. However, these rangers do not receive additional resources, which limits their ability to effectively monitor the territory. They have reported the presence of illegal visitors and misuse of resources, but the authorities have not responded to these complaints. Consequently, the park rangers can only educate and guide the community. Through the project, they aim to further strengthen communal control over the forest.

Interviewees from the non-profit organization and carbon offset suppliers consistently highlighted the project's significant support for the community, recognizing their harmonious relationship with the environment. They also noted that it is difficult for this vulnerable community to participate in discussions and stay informed about environmental issues and global compensation mechanisms related to environmental conservation, among other topics.

> *“For me and for the others, this helped open our minds because even though we live close to the city, we don’t know about environmental education and about public policies related to environmental education. And, to see that there are people who are not from here, but who are concerned about the people who live in the traditional communities and know the reality and the needs that these communities have, has been very important for us”.* (P13, Carbon Offset Supplier).

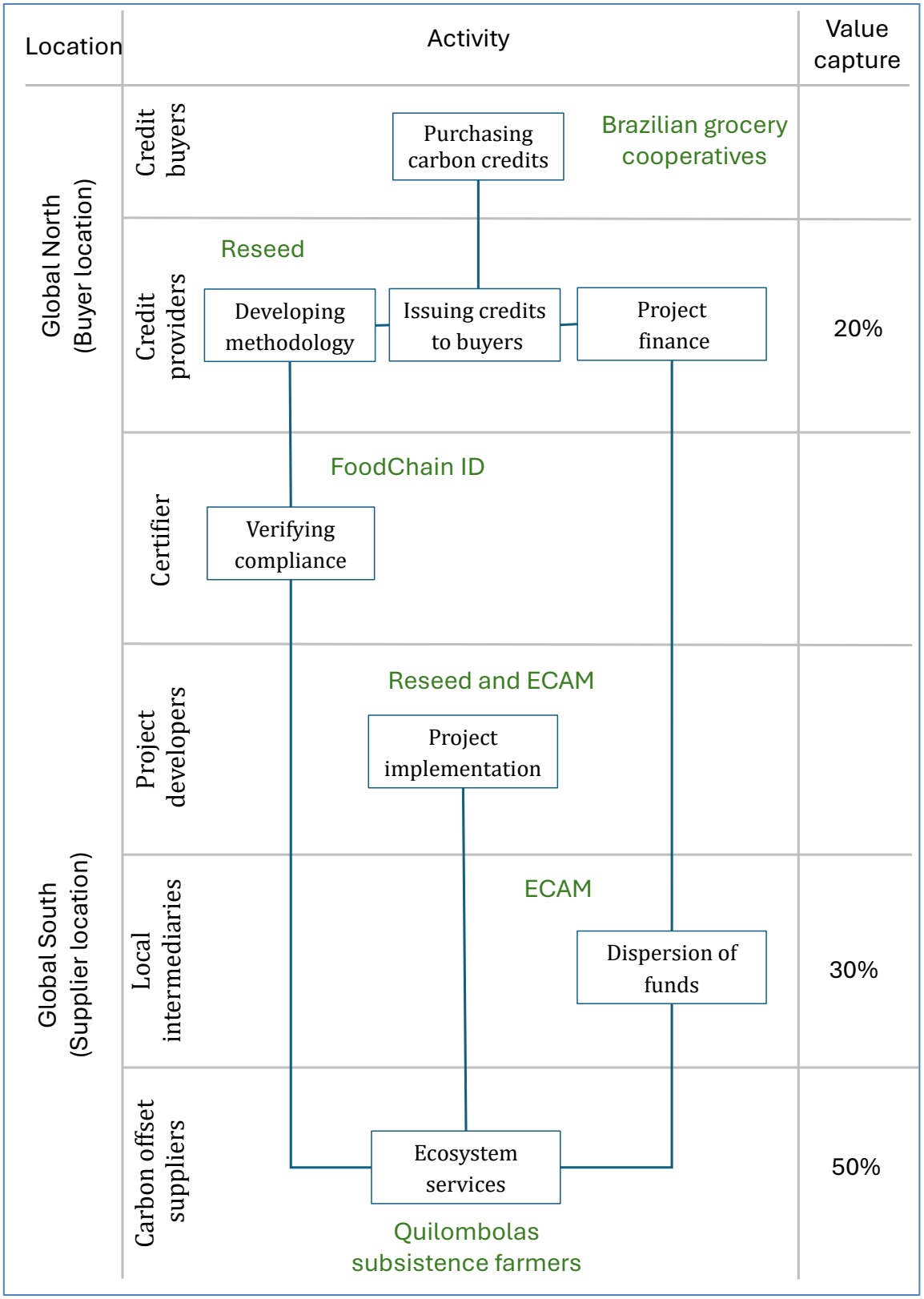
Some groups in the community have decided to allocate the money they received towards investing in solar panels, enhancing the aqueduct, and cleaning the water system. Specifically, in Curralihno, the community aims to use the funds to construct a local market for selling their products. They also plan to invest in tools and inputs to boost their agricultural production (P11, Non-profit Organization).

> "(W*ith the project), we will be able to take care of something that we have been already doing for a long time. We have been constantly preserving, preserving, and that is something that also has a future for our children*. (P14, Carbon Offset Supplier).

The investments are prioritized based on a plan developed with the support of ECAM. The objective is to reduce vulnerability, as outlined by the methodology proposed by ReSeed, consequently enabling improvements in their farming systems and enhancing the provision of environmental services.

Figure 7 summarizes the value chain of the Quilombolas Project, showcasing the interactions between the different stakeholders and the value captured at each level of the chain.

Figure 7. Quilombolas Project value chain



3.3 Projects Comparison

The Jinotega & Matagalpa Project in Nicaragua

This Acorn project in Nicaragua involves coffee farmers who own their land and usually come from families with a long tradition of coffee farming. Compensation for this project is derived from CO_2 removal, resulting from investments made in their coffee plantations by adding trees and adopting new farming practices. The primary social objective is to enhance the farmers' resilience to climate change. To participate, the farmers had to invest their own cash and resources, receiving their first compensation 3 to 5 years after planting the trees. Evaluations of the agroforestry system's results have been very positive, with the overall aim being to support farmers in adapting to climate change.

The Quilombolas Social Carbon Project in Brazil

The Quilombola community in Brazil is receiving compensation for their efforts to conserve traditional farming practices and protect the forests within their territory. This compensation is disbursed once the project is verified; however, ReSeed provides investment in advance to help implement the project. The primary social objective is to reduce the high vulnerability of these communities and mitigate any conditions that could alter their relationship with the forest, potentially leading to environmental damage. Since the land is communal, the compensation is also prioritized for the benefit of the entire community. ReSeed generates revenue through carbon credit sales, significantly reducing initial investment costs for establishing carbon credit projects. The aim is to replicate and scale this business model in various farming contexts.

While Solidaridad collaborates with Acorn to connect farmers to the carbon market, ReSeed manages the entire value chain, including placing the certificates in the market. Both projects involve external certification, using new protocols designed to meet the project developers' goals.

Table 3. provides a stylized overview of the two different chains. Although both projects involve smallholder farmers in Latin America, they are very different in approach, business model, and socioeconomic ecosystem.

Table 3. Value propositions and contractual arrangements of the analyzed projects

Project	Jinotega & Matagalpa Value Chain	Quilombolas Value Chain
Type of Credit	Carbon removal unit (CRU)	Tons of CO_2 Equivalents Conserved (TEC)
Ecosystem Service	Carbon sequestration (removal)	Carbon Conservation (and sequestration in the future)
Origin of the Methodology	Developed by Acorn with Plan Vivo	Developed by ReSeed
Verification	AENOR & SCS Global Services	FoodChain
Land Tenure	Required	Not Required
Payment/Compensation	Individual (per farmer)	Per community
Payment Frequency	Annual (expected between years 3 and 10)	Annual
Timeframe for the First Payment	3-5 years (once the carbon has been removed)	Immediate (once the project has been certified and sold)
Share for Farmers	80%	50% to 70%
Project Duration	14 years (max for payments)	20 years (fixed)

Note: In the Quilombolas value chain, the resources obtained are divided between technical support (30%) and project maintenance (20%), which are allocated to ReSeed from the second year onwards.

Appendix 8.5 provides a recapitulation of the value chains for both projects.

4. VCM Monetary and Non-monetary Benefits for Smallholder Farmers

This chapter examines the economic and practical aspects of smallholder farmers' participation in the VCM. It is divided into two sections, covering the monetary and non-monetary benefits from Acorn's project in Jinotega & Matagalpa (Nicaragua) and ReSeed's project in Quilombolas (Brazil).

4.1 VCM Monetary Benefits for Smallholder Farmers

4.1.1 Carbon Sequestration vs. Conservation: Models and Payments

The Acorn project in Jinotega and Matagalpa, Nicaragua, compensates farmers financially for their carbon sequestration efforts through the adoption of agroforestry practices. Notably, this initiative is the first of its kind in Nicaragua, a country that, due to its political situation, is largely disconnected from global markets and similar projects (P8, Project Developer). This carbon project has two crucial benefits: it provides smallholders with a new source of income and, perhaps more importantly, it encourages the adoption of climate-smart agricultural practices among farmers (P5, Project Developer).

The Acorn project aims to promote the integration of trees into farmers' agricultural systems. In addition to the financial compensation received from carbon sequestration certificates, adopting agroforestry practices directly enhances farmers' incomes and socioeconomic well-being. The positive effects of trees on soil health, water conservation, and erosion control contribute to increased crop yields and help protect against the harmful impacts of climate change (P10, Carbon Offset Supplier).

For this reason, Acorn and Solidaridad see the monetary payments to farmers from the carbon credits as an incentive for implementing agroforestry practices (P5, Project Developer). Farmers see these payments as a possible new source of income, which helps them transition to adopting climate-smart agricultural practices, such as agroforestry.

The ReSeed project in the Quilombola region of Brazil offers farmers monetary compensation for tree conservation. The project's goal is to integrate carbon conservation payments with carbon sequestration payments that stem from the implementation of agroforestry practices. However, it is important to note that, at this stage, the project has primarily focused on conservation efforts, while the introduction of agroforestry practices is anticipated to occur in the near future.

Once implemented, this combined approach will reduce the time between farmers' enrollment in the project and their first payment while also providing incentives to plant new trees (P4, Credit Provider). With the carbon conservation scheme, farmers receive an initial payment after their first year of participation. This strategy helps project organizers address one of the main challenges in carbon sequestration initiatives, which is the delay between the project's launch and the first payment. Without this arrangement, the waiting period could last three to four years.

It is important to note that carbon credits from sequestration schemes generally command higher market prices than those from conservation initiatives. The combination of these two mechanisms encourages farmers to protect existing trees on their properties while also planting new ones. ReSeed refers to this approach as the "blended model," which serves as an attractive incentive for farmers to participate in carbon projects and receive monetary compensation starting in the first year after implementing agroforestry practices on their land. After four or five years of participation, farmers will begin to receive carbon credits for their sequestration efforts, which increases their monetary compensation.

4.1.2 Value Distribution Along the Value Chains

In the Acorn project, the distribution of value from the sold CRUs is as follows: 80% goes to farmers, 10% to the local network that supports farmers' activities (including Solidaridad), and 10% to Acorn, which includes the verification organization. This value distribution proposition is fixed and monitored by Plan Vivo, ensuring that resources are allocated correctly according to this scheme. Farmers do not face any deductions, and all payments are made in cash (P8, Project Developer, and P10, Carbon Offset Supplier). However, in the near future, Solidaridad plans to develop a scheme that may allow farmers to receive payments in kind, particularly for items that can promote climate-smart agriculture.

ReSeed's value distribution of the sold carbon credits is organized as follows: 50% goes directly to farmers as monetary payments. In the first year, the remaining funds are allocated to project implementation, including legal support and other expenses. An administrative fee, which does not exceed 20% of the total, is paid to ReSeed to manage the program and sell the credits.

Starting from the second year, the total resources obtained are divided between two main areas: 30% is designated for technical support to help in-situ actors who work closely with farmers to implement the necessary actions to obtain the carbon certificate, and 20% is allocated for project maintenance, which goes to ReSeed (Curralinho Afro-Brazilian Social Carbon Project, 2024, p. 33). This distribution model ensures that all participants in the project receive the necessary incentives to continue their work. From ReSeed's viewpoint, the compensation for in-situ actors can be seen as in-kind resources that farmers receive for their participation in the carbon project (P4, Credit provider).

4.1.3 Carbon Offsets in the Market: Buyers and Payments

The estimations for Acorn's project in Nicaragua indicate that an agroforestry system with coffee sequesters an average of 5 to 6 tons of CO_2 equivalent (tCO_2 e) per year over a period of 15 years. An average producer in the portfolio maintains 1.4 hectares ha of coffee using agroforestry practices, which means that each year, a farmer can sequester between 7 and 8.4 tCO_2e.

From 2021 to 2023, the selling price of each CRU was €33. However, Acorn is currently negotiating a new batch of carbon credits for €40, reflecting an increase in market price as a sign of consolidation and growing trust in this project (P3, Credit Provider).

Between 2021 and 2023, farmers received annual payments ranging from €112 to €134 through Acorn's carbon project. These payments resulted in an annual income increase of 10% to 20% for farmers, depending on the prevailing coffee prices. With anticipated rises in carbon credit sale prices in 2024, farmers are expected to earn between €230 and €270 for their carbon farming activities (P8, Project Developer).

It is important to note that the additional income generated from agroforestry typically follows an 'S' curve. This indicates that, in the coming years, farmers participating in Acorn's project can anticipate a significant increase in income from their carbon farming activities. The initial years require upfront investments and additional efforts and are often the most challenging. However, they also hold the promise of an income increase in the future.

Acorn has several buyers for this project, with Microsoft and Lavazza being the two most significant (P3, Credit Provider). Additionally, Solidaridad is exploring the possibility of involving more stakeholders from the coffee value chain to purchase carbon credits from smallholders (P5, Project Developer). This initiative aims to create a more cohesive strategy for enhancing resilience in the coffee value chain while ensuring fair compensation for farmers.

> "*The average price per CRU has been $26, but we can see the difference between selling it to, for example, Microsoft or selling it to a coffee roaster right within the value chain. It's also the roasters who are buying those carbon credits. One of the things Solidaridad is trying to do is to involve the buyers within the same value chain, and somehow, they can pay a better price*". (P9, Project Developer).

Concerning the ReSeed project in Brazil, the buyers of the carbon certificates include national supermarket cooperatives, food brands, and individuals, among others. Detailed information has not yet been made public but is expected to be released in the first half of 2025. (P4, Credit Provider).

So far, ReSeed carbon projects in the Quilombola communities of Curralinho, Carmo do Maruanum, and Curiau have transferred the following resources (information provided by ECAM):

- Curiau Quilombola Community: €50,000 was transferred to the association to manage the producers, and €30,000 was set as a collective fund for technical support for producers.
- Carmo do Maruanum Quilombola Community: €8,500 was transferred to the association to manage the producers, and €5,000 was set as a collective fund for technical assistance for producers.
- Curralinho Quilombola Community: €16,500 was transferred to the association to manage the producers, and €10,000 was set as a collective fund for technical support for producers.

In addition to the aforementioned amounts, an annual investment of up to €11,500 is planned to support the National Coordination for the Articulation of Quilombolas in Amapá. This funding will also benefit two other regional projects: the Curiau Quilombola Community and the Carmo do Maruanum Quilombola Community.

These resources are part of agreements designed to guarantee sustainability and enhance the commitment to protect the forest. With this fund, the community will receive training and support from ECAM and ReSeed. The recent cash flow received by the community consists of a combination of resources from ReSeed and sales of certificates (P4, Credit Provider). As mentioned previously, starting from the second year, the total resources obtained will be divided as follows: 30% for technical support and 20% for project maintenance, which will be allocated to ReSeed.

> *"And then with that, the 30% of farmer support services is to support them on the ground, with their techniques, practices, as well as legal assistance and access to markets for their products. So, all of that is then designed in an investment plan to help, based on the vulnerability assessment, these farmers address those vulnerabilities so they can stay on their land and maintain their practice. And that's the logic behind the protocol. So, it's a social carbon protocol focused on the people providing those ecosystem services".* (P4, Credit Provider).

This percentage will enable continued support from the NGOs involved, including training and assistance in the project's governance and decision-making process to utilize the acquired resources.

For farmers in Brazil, the financial compensation for generating carbon credits makes a significant difference. According to estimations by ReSeed, farmers can potentially increase their annual incomes by 30% to 50%, (P4, Credit Provider). However, with the anticipated implementation of agroforestry practices, the direct payments are expected to increase further.

To ensure the project's financial sustainability and maintain fairness in compensating all participating actors, Acorn and ReSeed have established a minimum price for selling carbon credits. This minimum price is set at $20 per CRU. This approach not only makes the project more appealing for enrollment but also guarantees a fair minimum compensation, particularly for farmers.

4.1.4 Smallholders' Access to Monetary Payments and Other Alternatives

Acorn's project operates without intermediaries between project managers and farmers when it comes to payments. Solidaridad is the organization responsible for transferring monetary compensation to farmers whose carbon credits are sold in the market. So far, payments go directly to the farmers without allowing other representatives to collect these funds on their behalf. This initiative aims to empower smallholders by giving them the freedom to decide how to use the monetary compensation they receive for their carbon farming activities.

Additionally, Solidaridad is working on a scheme that will enable farmers to use their carbon farming certificates as collateral for credit loans (P5, Project Developer). This initiative will greatly enhance financial inclusion for smallholder farmers as they participate in carbon farming activities, ultimately improving their socioeconomic conditions.

In the ReSeed project, farmers have the option to choose how they receive monetary payments for their carbon credits. As mentioned, the project collaborates with a local partner, ECAM, which allows farmers to receive payments directly. However, farmers who are part of cooperatives have two options: they can either accept direct payments or designate another organization to collect and distribute the funds on their behalf. ReSeed is committed to providing farmers with the flexibility to select their preferred method of receiving compensation for their carbon credits. This flexibility allows farmers to combine different payment schemes based on their preferences and convenience.

ReSeed is working on a new scheme that will enable farmers to use their monetary payments to create a fund and earn interest. This fund will be used exclusively to provide small loans within their communities, thereby promoting financial inclusion. The option to lend the resources generated from carbon credit payments will be based on the farmers' preferences.

4.1.5 Impacts on Smallholders' Well-being: Beyond Monetary Payments

Carbon farming activities, especially those involving agroforestry, provide numerous financial benefits that extend well beyond the direct payments received from carbon credits. Ultimately, these financial advantages positively impact the well-being of smallholders, helping them become more resilient to various challenges, such as climate change (P10, Carbon Offset Supplier).

For instance, the additional monetary benefits identified from Acorn's project in Nicaragua stem from higher coffee yields and improved product quality. Currently, there are no objective measurements or metrics to assess the impact of these factors on farmers' incomes. However, it is important to note that these improvements may create new opportunities for farmers to enhance their position in the coffee value chain by delivering a higher-quality product. Moreover, as agroforestry practices help farmers adapt to climate change, they can ensure stable quantities of coffee, thereby increasing their reliability within the supply chain (P8, Project Developer).

The Acorn project provides benefits not only to farmers but also to everyone involved in the value chain. The certifications that farmers receive for their deforestation-free polygons are advantageous for all stakeholders (P8, Project Developer). This shared benefit is particularly important for market access, especially as interest grows in major coffee-importing regions, such as the European Union, which aims to reduce food imports linked to deforestation. Obtaining certification for a polygon as deforestation-free offers monetary gains for farmers, cooperatives, exporters, and other local actors involved in the value chain.

ReSeed has developed a standardized indicator to identify the right farming communities for their project and to monitor how their participation in the initiative impacts their overall well-being (P4, Credit Provider). ReSeed's project influences two main areas: vulnerability to climate change and socioeconomic vulnerability. These areas represent a comprehensive approach to measuring and analyzing how farmers' living conditions improve over time due to the carbon project (P4, Credit Provider).

4.2 VCM Non-monetary Benefits for Smallholder Farmers

Participation in the Acorn and ReSeed projects allows farmers to access various non-monetary benefits. According to the developers of the ReSeed project, farmers in Brazil's Quilombola region receive legal services as one of the main non-monetary forms of compensation. Legal tenure is a significant issue for many farmers living in this area, which negatively impacts their market inclusion, such as their ability to obtain credit loans. Through an NGO involved in the project, farmers receive assistance in dealing with legal authorities to regularize and register their property. This support represents a significant step towards their stability in the region (P4, Credit provider, and P13, Carbon Offset Supplier). In some cases, families may have lived and worked on the land for generations without proper legal documentation. Thanks to the carbon project, these smallholders can now regularize their tenure situation, an advantage that enhances their market inclusion (P15, Carbon offset Supplier).

Another set of non-monetary benefits for farmers is the comprehensive capacity building for agroforestry practices. The Acorn project focuses on planting new shade trees in farmers' production areas. This practice not only helps to remove carbon from the air but also improves farming yields and enhances resilience to climate change. The Reseed project is expected to include an agroforestry component, though this has not yet been implemented. Successful implementation of agroforestry practices requires that farmers acquire new knowledge and adapt their routines for managing main crops. To aid in this transition, farmers participating in these projects receive extensive support and extension services.

Acorn and Solidaridad have developed a digital platform called "The Carbon Farming Academy" to enhance their capacity-building strategy across Latin America and Africa (Acorn, 2024c). This learning platform connects small-scale agroforestry projects with carbon credit markets and explains how the Acorn model operates. Additionally, the online platform offers open educational materials that promote skill development, empowering participants to take ownership of their understanding of the carbon compensation model. Learners are required to complete activities and evaluations to earn a diploma upon completing the course. Through this platform, Acorn aims to reach a larger number of farmers worldwide, encouraging the adoption of carbon farming practices.

Through this project, Solidaridad is committed to educating farmers not only on how to plant and protect new trees but also to build their resilience to climate change through sustainable agroforestry management practices (P5, Project Developer). To achieve this, they have implemented a "train the trainers" program in complementary areas of carbon farming. Topics covered include soil and water management, fertilization, and the use of bio inputs. Ultimately, these practices contribute to farmers' adaptation to climate change.

A third and critical non-monetary benefit of farmers' participation in these VCM projects is the enhancement of local biodiversity (P10, Carbon Offset Supplier). Forest conservation and the implementation of agroforestry practices significantly benefit ecosystems by facilitating interactions between crops, trees, and other native plants. This development of biological corridors creates thriving conditions for various plant, animal, and insect species, including those that perform essential pollination functions, thus altering the monoculture cropping landscape.
Despite the general consensus among different stakeholders about the positive impact on local biodiversity, none of the projects currently measures this aspect. To address this gap, ReSeed has initiated a partnership with local universities to develop a tool that will capture and demonstrate how the VCM can contribute to biodiversity.

4.3 Costs and Challenges

4.3.1 Costs Associated with Participating in the VCM

Participation in the VCM involves several direct monetary costs for farmers. They often have to cover operational expenses such as purchasing seedlings, fertilizers, and other inputs needed for carbon sequestration activities. In some instances, these costs are deducted from their carbon payments, which limits their ability to fully engage in these initiatives (P10, Carbon Offset Supplier).

Additionally, farmers are expected to invest time in acquiring the necessary skills to adopt climate-smart agricultural practices; however, project budgets do not always provide funding for training expenses (P1, Non-profit Organization). The time commitment and learning curve associated with these new practices complicate the challenges further (P13, P14, P15, Carbon Offset Suppliers).

As mentioned previously, Acorn's project in Nicaragua began with a plot of approximately 2.8 hectares, which corresponds to 35% of the coffee plantation in question. The implementation of initiatives aimed at fostering the transition to an agroforestry production system required significant additional investments and changes in farmers' routines. For example, this included new formats for setting up campaigns and implementing a revised fertilizer formula designed to fix nitrogen in the soil without generating additional carbon. These fertilizers are more expensive, as is the additional labor needed to plant and grow the shade trees.

The purchase of seedlings, a core component of these projects, represents one of the most significant upfront costs for farmers. They can choose between various options, ranging from fruit trees to other species that provide higher shade coverage. Obtaining healthy seedlings and planning the selection of trees pose challenges that require substantial investments. Overall, the estimated cost of this process ranges from €425 to €500 per plot of land.

4.3.2 Challenges in Mitigating Costs and Increasing Benefits

Farmers encounter several challenges in minimizing the costs associated with participating in the VCM and maximizing the benefits. A significant issue is delayed financial compensation. While carbon credit payments are a primary advantage of participation, farmers often report experiencing delays in receiving these payments. This delay leads to cash flow problems and restricts their ability to invest in necessary operational costs upfront (P8, Project Developer; P13, P14, P15, Carbon Offset Suppliers).

Farmers face multiple challenges in minimizing the costs of participating in the Voluntary Carbon Market (VCM) while maximizing its benefits. A key issue is delayed financial compensation. Although carbon credit payments are one of the main incentives for participation, many farmers experience long waiting periods before receiving their payments. These delays create cash flow problems, limiting their ability to cover essential operational costs upfront (P8, Project Developer; P13, P14, P15, Carbon Offset Suppliers).

In addition to financial delays, many farmers struggle to align VCM participation with their existing agricultural practices. Mono-cropping remains widespread in local communities despite its potential negative effects on the environment and biodiversity. While both projects aim to encourage a transition toward more sustainable farming methods, meeting the complex standards of the carbon market often requires significant changes to traditional practices. These adjustments, though potentially beneficial in the long term, do not always yield immediate economic returns, making adoption more difficult (P1, Non-Profit Organization).

Beyond the challenge of adapting farming systems, the financial benefits of carbon credit payments are highly uncertain due to price volatility in the carbon market. In some cases, the price at which carbon credits are sold does not fully cover farmers' operational expenses, resulting in lower-than-expected returns (P8, Project Developer). Additionally, payments are typically tied to the amount of carbon sequestered, which takes time to materialize. This misalignment between farmers' initial investments and the delayed realization of financial returns further complicates their participation in the market (P1, Non-Profit Organization).

Despite these financial uncertainties, participation in the VCM can provide long-term non-monetary benefits. Practices such as agroforestry contribute to improved soil health, enhancing farm productivity over time. Sustainability certifications and adherence to climate-smart practices may also create better market access as buyers increasingly prioritize sustainable sourcing. In some cases, farmers can secure higher prices for crops produced under carbon-conscious practices, further incentivizing long-term engagement in the VCM (P13, P14, P15, Carbon Offset Suppliers).

However, the operational costs associated with VCM participation can be prohibitive, particularly for small-scale farmers. In regions such as Nicaragua and Brazil, farmers report that the expenses of purchasing seedlings, fertilizers, and other inputs often exceed their immediate financial capacities, especially when upfront project funding is unavailable (P10, Carbon Offset Supplier). Additionally, the time investment required to manage carbon projects can divert attention from other farming activities, potentially reducing yields from traditional crops and creating opportunity costs for farmers who might otherwise engage in more profitable ventures (P8, Project Developer).

These financial and operational constraints are compounded by significant power imbalances between farmers and external stakeholders, such as project managers, banks, and verification organizations. Farmers often have little control over project design, pricing mechanisms, and decision-making processes, leaving them dependent on these entities. If organizations withdraw or experience financial instability, farmers are left particularly vulnerable (P2, Project Developer). Many also struggle to understand how carbon credit prices are determined, leading to a lack of transparency that fosters distrust and dissatisfaction with the market. Larger institutions, including banks and sustainability certification bodies, often hold disproportionate influence, making farmers subject to decisions made without their direct input (P1, Non-Profit Organization).

Another critical challenge is the misallocation of project funding. Farmers report that resources intended to support their transition to climate-smart practices are sometimes not effectively distributed. For example, project budgets often fail to cover essential activities such as coffee plant rejuvenation, which is necessary for sustaining long-term productivity (P10, Carbon Offset Supplier).

5. Optimizing the Benefits for Smallholders: The Key Challenges

This chapter of the report will explore the key challenges smallholders face in maximizing their benefits from the VCM. It will focus on the contribution to farmer income, the role of co-benefits, carbon credit pricing dynamics, the importance of verification bodies, and the drivers of demand in the carbon market. Addressing these challenges is essential for creating a more equitable and sustainable system where smallholders can thrive while contributing to global carbon reduction efforts.

Smallholder farmers are the backbone of many agricultural systems in the Global South, and their role in the VCM is becoming increasingly significant. As already stated, smallholder farmers contribute not only to carbon sequestration but also to enhancing biodiversity, improving soil health, and increasing agricultural productivity by engaging in carbon offset activities such as agroforestry, reforestation, and nature conservation. These activities are vital to global efforts to combat climate change. However, while these environmental contributions are clear, the economic and social benefits that smallholder farmers receive in return are often not optimized.

The key challenge in the VCM lies in ensuring that smallholder farmers are adequately compensated for their efforts. Unlike large corporations or industrial entities that can easily access carbon markets, smallholders face unique barriers. These include limited market access, insufficient technical support, high upfront costs, and delayed payments. As a result, many smallholders struggle to see tangible financial benefits from their participation in these markets despite their crucial role in carbon sequestration.

*"We are constantly seeking ways to create economically viable models that extend the value through the supply chain to the farmers. This is not just about meeting certification standards like those set by Plan Vivo but also about ensuring these models facilitate pre-financing and sustainable practices that directly benefit local communities. The ultimate goal is to see these payments for ecosystem services act as a stepping stone towards enhancing climate-smart agriculture and improving farmer resilience." (*P5, Project Developer).

5.1 Optimizing Compensation

5.1.1 Importance of Fairness and Transparency in Compensation

For smallholder farmers to remain committed to VCM projects, the payments they receive must be fair and transparent. Carbon payments should reflect not only the amount of carbon sequestered but also the time, labor, and resources invested by the farmers. Often, farmers are required to make significant upfront investments in planting trees or adopting agroforestry practices, with the promise of future payments once carbon sequestration has been verified. However, this delayed payment structure can place a financial strain on smallholders, who may have to wait several years before receiving any compensation (P5, Project Developer).

Transparent pricing helps ensure that the value of carbon credits reflects the true cost and effort involved in carbon sequestration activities. In some cases, farmers receive a fraction of the value generated by their efforts due to opaque market dynamics or the involvement of multiple intermediaries. Verification and certification bodies and project developers play a crucial role in ensuring that smallholders receive a fair share of the revenue generated from carbon credit sales.

"Knowing the real value of what we do here changes everything. When we see the price our carbon credits sell for and that it matches the effort we've put in, it makes all the difference. It's about fairness, about seeing our hard work reflected in our earnings. This transparency doesn't just mean more money, and we are not only interested in that, given that we did not get paid for many years; it means respect for our contribution to fighting climate change." (P10, Carbon offset Supplier)

Moreover, transparent pricing allows smallholders to better understand the value of their work and negotiate for fairer terms. For example, projects working with certification bodies like Gold Standard or Plan Vivo often have higher levels of transparency and more rigorous criteria, which can help farmers attract better prices for their carbon credits.

5.1.2 Challenges in Achieving Adequate Compensation

Despite efforts to create a fair and transparent compensation mechanism, many smallholder farmers struggle to understand how and when they will be compensated. One of the main challenges is the delayed nature of payments in carbon markets. Activities like tree planting, which contribute to carbon sequestration, take time to yield measurable results. As a result, farmers often experience a gap of several years between the start of a project and their first payment. This delay can be particularly problematic for smallholders who need immediate income to cover their daily expenses.

Achieving adequate compensation through carbon credit payments presents several challenges. The variability in carbon credit prices—affected by global market trends, the perceived quality of the credits, and the rigor of certification processes—adds uncertainty to farmers' incomes. Furthermore, disparities in living wage achievements are evident when comparing projects across different regions. For example, farmers in East Africa involved in similar agroforestry projects often experience greater financial instability due to lower carbon credit prices and less favorable market conditions. In contrast, their counterparts in Latin America benefit from stronger local markets and government support mechanisms, leading to more consistent and fair payments.

5.1.3 Relevance of Co-benefits

> *"Co-benefits are crucial for us. They range from improved soil health and water retention to enhanced agricultural productivity and biodiversity conservation. Not only do these support sustainable farming practices, but they also help in maintaining the ecological balance necessary for our long-term goals. It's about more than just carbon; it's about creating a sustainable environment where our community can thrive."* (P5, Project Developer).

The successful integration of co-benefits into carbon credit compensation involves several key steps:

- **Assessment and recognition**: Environmental and social impact assessments must identify potential co-benefits early in the project planning phase.
- **Quantification and verification**: Reliable methods need to be developed to measure these benefits accurately, which can then be verified by third-party certifiers such as Plan Vivo.
- **Monetization and compensation**: Once quantified, these co-benefits should be monetized appropriately, ensuring they contribute to the overall compensation package offered to farmers. This guarantees that the full range of benefits is recognized and delivered, not just carbon sequestration.

While integrating co-benefits into the VCM offers significant advantages, it also presents challenges, particularly in terms of the cost and complexity of measurement and verification. Small-scale projects often struggle with these requirements unless supported by external funding or partnerships. Additionally, markets for certain co-benefits, such as biodiversity credits, are not as developed as those for carbon credits, requiring innovative market development strategies (VCM report).

5.2 The Role of Value Chain Governance

5.2.1 Drivers Behind Carbon Credit Prices

As discussed earlier, the pricing of carbon credits is influenced by a complex interplay of market dynamics, regulatory frameworks, and project-specific factors, all of which determine the financial viability of carbon offset projects for smallholder farmers. Key factors influencing carbon credit prices include:

- **Supply and demand dynamics**: The global demand for carbon credits is influenced by corporate sustainability goals and regulatory requirements, while the supply is determined by the number of projects and their scales. Variations in supply and demand can lead to significant fluctuations in credit prices, impacting the predictability of income for smallholders.

- **Verification and certification standards**: Projects certified under rigorous standards are generally considered more reliable and command higher prices in the market. These standards ensure that carbon sequestration is real, measurable, and permanent, adding to the credibility and attractiveness of credits.

- **Market transparency and accessibility**: Transparency in how projects are reported and how benefits are distributed among stakeholders influences market perception. Greater transparency leads to higher trust and potentially better prices. Moreover, accessibility to markets for smallholders through cooperative structures or digital platforms can reduce transaction costs and improve revenue streams.

5.2.2 The Role of Demand and Market Access

The demand for carbon credits is influenced by several factors, including corporate sustainability objectives, regulatory pressures, and a growing awareness of the impacts of climate change. Understanding these demand drivers is crucial for maximizing the benefits for smallholder farmers (P1, Non-Profit Organization). Corporate buyers, driven by sustainability goals or legal requirements, often look for high-quality, verifiable carbon credits. The visibility and accessibility of these credits in the market are essential for projects involving smallholders. Effective marketing and the capacity to reach potential buyers can significantly affect the success of a project and the advantages it provides to small farmers.

Smallholder farmers frequently face barriers to market access due to lack of information, inadequate infrastructure, and limited bargaining power. Overcoming these barriers often requires collective action, such as forming cooperatives or the intervention of NGOs that can facilitate market connections and ensure fair trade practices. Raising awareness among buyers about the full impact of their purchases, including the social and environmental co-benefits of carbon credits, can drive demand for higher-quality credits. Educating buyers about the specific advantages of supporting smallholder-led carbon projects can lead to more targeted and impactful investments.

5.2.3 The Role of Certification Bodies

Certification bodies play a pivotal role in the VCM by setting standards, ensuring project credibility, and enhancing marketability. Their influence is vital in shaping the benefits that accrue to smallholder farmers and the broader environmental impacts of carbon offset projects.

> *"It's crucial for certification bodies to consider the real-world impact of carbon offset projects on local communities. We need a framework that does more than just measure carbon; it should verify that the benefits promised to communities are actually delivered."* (P1, Non-Profit Organization).

For smallholder farmers, working under the standards of recognized certification bodies can lead to better project outcomes and higher compensation. Certified projects are more likely to attract premium prices and offer better terms of trade. Moreover, these projects often include capacity building and technical assistance, which improve agricultural practices and long-term sustainability. In fact, certification not only enhances credibility but also significantly boosts the marketability of carbon credits. Credits verified by respected bodies are more attractive in the global market, where buyers prioritize credits that can be showcased in sustainability reports and contribute positively to corporate social responsibility goals.

6. Conclusions

This chapter summarizes key findings on the opportunities and challenges of the Voluntary Carbon Market (VCM) for smallholder farmers. It further outlines key insights, proposes governance improvements, and recommends strategies to enhance farmer participation and resilience.

6.1 Summary of Findings

This report is structured around three main research questions outlined in Chapter 2. We aimed to gain insights into these questions through desk research (literature review), two case studies, and interviews with participants in the VCM value chains (stakeholders and expert practitioners). We recognize that the research questions are broad, and our answers are drawn from the specific contexts of the case studies. With this in mind, the findings can be summarized as follows.

Does the VCM provide a window of opportunity for smallholders in the Global South?
The case studies indicate that the VCM provides both financial and non-financial benefits to smallholder farmers, although the extent of these benefits can vary significantly by region and context. Smallholders earn direct income from selling carbon credits, and they also experience improvements in ecosystem services, enhanced skills, and access to more sustainable agricultural practices, such as agroforestry. These activities contribute to greater crop resilience and support sustainable livelihoods.

However, opportunities in the VCM come with challenges. While the financial rewards are tangible, they can sometimes be modest, and smallholders may encounter delays in receiving payments. Moreover, the costs associated with participating in these markets—such as meeting certification standards or adapting land-use practices—can be burdensome, diminishing the overall appeal of the VCM as a long-term solution for enhancing livelihoods.

Additionally, the indirect benefits, like improved agricultural resilience and ecosystem services, often surpass the financial compensation. This suggests that the co-benefits are a significant factor in the value that the VCM provides to smallholders.

How does the VCM governance affect the nature and extent of farmer benefits?

The governance structure of the VCM, particularly the role of intermediaries, significantly influences how benefits are delivered to smallholders. Intermediaries, including project developers and certification bodies, play a crucial role in determining both the financial and non-financial benefits that reach smallholders. However, the complexity of the value chain, power imbalances, and the lack of transparency in pricing mechanisms often limit smallholders' ability to fully capture these benefits.

As highlighted in interviews, intermediaries frequently exert considerable control over project design, certification protocols, and payments. This reduces farmers' autonomy and control over their participation in the VCM. Certification standards, such as those established by Plan Vivo or the Gold Standard, significantly affect the flow of benefits. However, these standards sometimes prioritize environmental metrics over the social and economic outcomes for farmers. This creates a governance gap, where farmers may successfully meet environmental objectives but struggle to receive substantial financial returns.

How can the VCM governance be improved to maximize farmer benefits?

Improving governance in the VCM involves enhancing transparency and accountability while reducing reliance on intermediaries. Key steps to maximize benefits for smallholder farmers include simplifying certification processes, creating mechanisms for farmers to have a more direct stake in the value chain, and ensuring timely and fair payments.

In addition, co-creating market processes, where farmers are more directly involved in designing certification and credit pricing mechanisms, can help improve fairness. Addressing issues such as literacy levels and technical knowledge among farmers is essential to empower them to make informed decisions.

Moreover, establishing transparent pricing models that reflect the real value of carbon credits and ensuring farmers have access to financing for upfront investments—such as planting trees or adopting agroforestry—would strengthen their participation and benefits in the VCM. Programs that provide microloans to farmers, repayable with carbon credits, could help reduce financial barriers to entry.

It is also crucial to ensure a fair distribution of profits along the value chain, minimize value capture by intermediaries, and allow smallholders to retain a larger share of profits. Finally, developing a feedback loop that fosters continuous communication between farmers, certification bodies, and buyers will improve governance and enhance trust in the system.

6.2 Key Challenges and Recommendations

This report highlights the dynamics and potential of the VCM for smallholder farmers, emphasizing the necessity to move beyond the current methods of organizing value chains and compensation.

The two VCM value chains examined in this report are relatively favorable to farmers, as the prices of their carbon credits are significantly higher than global averages. Moreover, a substantial portion of the carbon credit prices benefits the farmer communities involved. This trend is a positive step toward preventing a race to the bottom in VCM governance, which could lead to pressure for further price reductions. Such competition may jeopardize the quality of programs and fail to provide sufficient incentives that encourage long-term participation from farmers. Impactful projects incur costs that must be reflected in their prices. However, many of these costs are often overlooked, and future efforts should focus on finding ways to monetize what is currently considered a co-benefit. This could be a crucial strategy to promote a race to the top from the supply side, but it necessitates the mainstreaming of farmer-centric standards.

A strategy that addresses immediate needs while building capacity will ensure long-term sustainability and deliver meaningful benefits. To support this, we have identified several short-term, mid-term, and long-term recommendations aligned with the insights gathered from the analyzed projects. These recommendations are structured to guide action at various stages of implementation.

Short-term Recommendations

- Provide seedlings, fertilizers, and technical support through subsidies or pre-financing schemes to reduce the initial costs of agroforestry adoption.
- Establish clear communication channels to explain payment structures, timelines, and goals.
- Offer interim financial incentives or small grants during the gap between enrolment and compensation.
- Leverage local partnerships (or intermediaries) to deliver targeted technical training and advisory services, ensuring immediate support.

Short-term measures are crucial for reducing the barriers that smallholder farmers encounter when participating in Voluntary Carbon Markets (VCM) programs. Providing subsidized inputs, such as seedlings, fertilizers, and technical support, can significantly alleviate the financial burden of transitioning to agroforestry practices. These initial resources ensure that farmers are not discouraged by the costs associated with starting this process. Additionally, technical assistance through local partnerships or agricultural cooperatives can provide targeted and culturally relevant advice to address specific challenges. Establishing clear communication channels is essential for building trust and ensuring that farmers understand the markets in which they are engaged. Often, farmers face uncertainty regarding how payments are structured, calculated, and distributed. Tools such as workshops, visual guides, and dashboards can enhance transparency in these processes. Programs should also offer interim financial incentives or small grants to bridge the gap between enrollment and the first carbon removal compensation, helping to mitigate financial vulnerability during the early stages of participation. These steps will establish the foundational support systems necessary for farmers to engage with confidence.

Mid-term Recommendations

- Develop customized capacity-building programs on climate-smart agricultural practices and financial literacy.
- Promote the value of co-benefits like soil health, biodiversity, and increased crop yields through education campaigns.
- Introduce community-led workshops to foster peer learning and share success stories.
- Establish participatory governance models to involve farmers in decision-making for payment structures and programs.

After addressing initial barriers, programs should focus on building farmers' capacity and engagement. Customized training programs on climate-smart agricultural practices and financial literacy are essential for empowering farmers. These initiatives not only help participants maximize the benefits of agroforestry but also prepare them to adapt to changing environmental and economic conditions. Farmers who are well-informed are more likely to commit to sustainable practices and become advocates for the program within their communities.

In addition to financial payments, farmers gain significant value from improved soil health, increased crop yields, and biodiversity restoration. It is important to communicate these benefits as part of the value proposition of VCM programs, highlighting the various ways in which agroforestry enhances resilience and livelihoods. Community-led workshops can provide a platform for peer learning, allowing farmers to share their experiences and success stories, which fosters a sense of collective achievement.

Participatory governance models are also critical at this stage. By involving farmers in decision-making processes, such as setting payment structures or prioritizing co-benefits, carbon projects can strengthen farmer ownership and ensure that their needs are effectively addressed. This approach should aim to include carbon offset suppliers as partners rather than merely as beneficiaries.

Long-term Recommendations

- Scale agroforestry programs to enhance ecosystem services like carbon sequestration and biodiversity conservation.
- Position farmers as stewards of environmental sustainability, emphasizing their global contributions.
- Develop multi-year support systems to align incentives with resilience-building initiatives like soil management.
- Implement blended financing models that combine carbon payments with grants or loans for financial security.

In the long term, these projects should focus on scaling the benefits of VCM programs and ensuring their sustainability. Initiatives such as carbon sequestration and biodiversity conservation should be expanded to enhance ecosystem services.

It's crucial that these programs align with global sustainability goals, positioning farmers as stewards of environmental progress. Implementing multi-year support systems, such as those focused on long-term soil management or agroforestry resilience, can better align farmer incentives with broader ecological objectives. Blended financing models represent another critical innovation. By combining carbon payments with grants, low-interest loans, or ecosystem service payments, these programs can provide farmers with greater financial stability and reduce their dependency on external aid. Over time, this approach can help farmers develop self-sustaining systems that generate both environmental and economic benefits.

Additionally, efforts should be made to highlight the global significance of smallholder farmers' contributions. Farmers should be recognized as leaders in sustainability, demonstrating their essential role in achieving carbon reduction and ecosystem restoration goals. By celebrating their efforts, programs can inspire greater participation and reinforce the importance of their work on a global scale.

Cross-cutting Recommendations

- Ensure transparent monitoring systems to track carbon contributions and rewards, enhancing accountability.
- Educate farmers on how satellite technology can efficiently measure carbon tracking, lowering operational costs and improving accuracy.
- Expand the program's reach by targeting more cooperative farming groups, enabling greater collective impact.
- Collaborate with certification bodies to standardize payment metrics for both carbon removal and conservation.

Financial incentives are a fundamental driver of participation in the VCM, but the direct payments that farmers currently receive are not enough to significantly improve their livelihoods. Price formation is a critical issue in this context, yet it is largely beyond the control of individual actors in the supply chain. Therefore, the recommendations in this report focus on practical changes to the VCM that aim to enhance the benefits for suppliers. By implementing these recommendations, VCM programs can maximize suppliers' advantages and encourage more rewarding participation in these markets.

Future research should explore the complex dynamics of price formation within the VCM in greater depth. While this report has examined the supply side and its potential to enhance benefits, future studies should also investigate the interplay between supply and demand. This includes looking at how institutional and legislative frameworks influence these dynamics. Identifying key leverage points—such as regulatory measures, certification standards, or buyer commitments—could help create a positive cycle in the VCM, where improved prices more accurately reflect the value of smallholder contributions.

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8. Appendices

8.1 Key Terms Used in the Report

Term	Definition
Carbon Credit	A permit that allows a company or individual to emit a certain amount of carbon dioxide or other greenhouse gases. One credit permits the emission of a mass equal to one ton of carbon dioxide.
Carbon offset	A reduction in emissions of carbon dioxide or other greenhouse gases that is made to compensate for emissions made elsewhere. Offsets are generated from activities such as reforestation or renewable energy projects.
Carbon Removal Units (CRU)	Units that represent the removal of one ton of CO_2 from the atmosphere, usually through activities such as reforestation or agroforestry, measured and verified under certain standards.
Carbon Sequestration	The process of capturing and storing atmospheric carbon dioxide. It is a key mechanism for reducing the amount of carbon in the atmosphere, with methods such as reforestation and soil management.
Co-benefits	In the context of carbon markets, these refer to additional positive outcomes from carbon offset projects beyond carbon sequestration, such as biodiversity conservation, improved soil health, or socioeconomic benefits for local communities.
Environmental, Social, and Governance (ESG)	A set of standards for a company's operations that socially conscious investors use to screen potential investments. ESG criteria focus on the company's impact on the environment, relationships with employees, suppliers, customers, and communities, and internal systems for transparency and accountability.
Voluntary Carbon Market	A market where carbon credits are traded on a voluntary basis, allowing individuals and organizations to offset their carbon emissions by purchasing carbon credits from projects that reduce or sequester carbon.
Nature-based solution	Actions that leverage natural processes to address societal challenges, such as climate change, disaster risk reduction, or water security, while providing environmental, social, and economic benefits.
Tons CO_2 Equivalents Conserved	Tons CO_2 Equivalents Conserved quantifies greenhouse gas reductions, expressed as CO_2-equivalents based on their global warming impact over a typical 100-year horizon.

8.2 Data Collection and Analysis

To answer the research questions, the research team employed two main data collection methods:

- **Desk Research**: This involved gathering secondary data, such as reports and whitepapers, to explore the nature and design of the voluntary carbon market (VCM). The desk research examined criteria and indicators of benefits related to the terms of trade for smallholder farmers participating in the VCM.

- **Stakeholder Interviews**: Semi-structured interviews were conducted with stakeholders within the value chains of the VCM involving smallholder farmers. The goal was to explore how these stakeholders influence pricing mechanisms and the overall distribution of benefits. The research focused on two specific smallholder farmer projects and their associated value chains: (1) The Jinotega & Matagalpa project in Nicaragua and (2) The Quilombolas Social Carbon Project in Brazil. These projects cover different aspects of the VCM, with the former primarily focused on agroforestry and the latter on nature conservation.

During the desk research phase, the team identified four main themes for the interviews:

1. Organizational issues and aspects of the VCM value chain.
2. Monetary and non-monetary benefits.
3. Costs associated with smallholder farmers' participation in the VCM.
4. Obstacles and challenges to smallholder farmer benefits.

Each interview was centered around these four themes, though the emphasis varied depending on the context. The research team used a coding approach to categorize interview statements according to each theme. This allowed for triangulation of information and perspectives as they emerged from different stakeholders.

8.3 List of Interviewees

Respondent ID	Category in VCM	Role	Country	Gender
P1	Non-profit Organization	Policy Analyst on State of Sustainability Initiatives.	Canada	Female
P2	Project Developer	Carbon Reduction & Biodiversity Project	The Netherlands	Male
P3	Credit Provider	Carbon Monitoring & Reporting Specialist	The Netherlands	Male
P4	Credit Provider	CEO and co-founder	Brazil	Male
P5	Project Developer	Head of PES (Payment for Ecosystems Services)	The Netherlands	Female
P6	Standard Setting Organization/Certifier	Carbon Markets Coordinator	United Kingdom	Female
P7	Standard Setting Organization/Certifier	Projects Officer	United Kingdom	Male
P8	Project Developer	Partnership Liaison for Latin America	Nicaragua	Male
P9	Project Developer	Manager Central America	Nicaragua	Female
P10	Carbon Offset Supplier	Coffee Farmer	Nicaragua	Male
P11	Non-profit Organization	Staff in office	Brazil	Female
P12	Non-profit Organization	Staff in office	Brazil	Male
P13	Carbon Offset Supplier	Director Communitarian Organization	Brazil	Male
P14	Carbon Offset Supplier	Community member	Brazil	Male
P15	Carbon Offset Supplier	Community member	Brazil	Male

8.4 Analyzed Documents

Organization	Date	Title	Link
Acorn	2021	Agroforestry Methodology (Version 1.0)	**Link**
Acorn	2021	The Acorn Framework (Version 1.0)	Not online
Acorn	2024	Acorn Sampling Procedure (March 28, 2024)	Not online.
Acorn	2024	Methodology for Quantifying Carbon Benefits from Small-scale Agroforestry (Version 2.0)	Not online
Acorn	2024	The Acorn Framework for Voluntary (Ex-Post) Agroforestry Carbon Removal Units (Version 2.0)	**Link**
Curralinho	N/A	Curralinho Afro Brazilian Social Carbon Project	Not online
Fairfood	N/A	Carbon Insetting	**Link**
IISD	2024	State of the Voluntary Carbon Markets	**Link**
ReSeed	N/A	Cocoa Brazil Presentation	**Link**
ReSeed	N/A	Prospectus	**Link**
ReSeed	2024	Benchmarking White Paper (Version 1, May 2024)	**Link**
Solidaridad	N/A	Carbon Market Work for Smallholders	**Link**
Solidaridad	N/A	Nicaragua Case Study	**Link**
Solidaridad	2022	Climate Finance Paper	**Link**
VSI	N/A	Voluntary Standards Initiatives Carbon Management	**Link**
VSI	N/A	Voluntary Standards Initiatives Carbon Management	**Link**
	N/A	Carbon Farming Infographic: Business Models	Not online
	N/A	Climate Standard	Not online
	2023	Voluntary Carbon Market Developer Overview 2023 _ 2024	Not online

8.5 Overview of the Projects' Value Chains

Overview of Jinotega & Matagalpa Project (Nicaragua)

Value chain actor	Name	Location	Activities	Costs per credit	% value added
Credit buyers	Lavazza, Microsoft	USA	- Purchasing CRUs offsetting corporate emissions	$20-40 per credit	(100%)
Credit providers	Acorn	Netherlands	- Issuing credits to buyers - Financing project activities - Carbon credit quality assurance	$2-4	10%
Standard-setting organizations	Plan Vivo	United Kingdom	- Certifying methodology - Verifying compliance - Feedback on the methodology (if required)	$0.2 (Fixed fee per project eligibility review and unknown percentage per CRU)	
Project developers	Solidaridad	Netherlands (Utrecht), Nicaragua	- Carbon market intermediation - Project implementation - Intermediation with NGOs, cooperatives, or traders to connect with the farmers	$2-4	10%
Local intermediaries	CISA Exportadora	Nicaragua (Managua)	- Training and technical support - Communication with farmers - Dispersion of funds	N/A (Share of 80%)	N/A
Carbon offset suppliers	Coffee farmers	Nicaragua	- Provision of ecosystem services (Agroforestry)	$16-32	80%

Overview of Quilombolas Social Carbon Project (Brazil)

Value chain actor	Name	Location	Activities	Costs	% value added
Credit buyers	Brazilian supermarket cooperatives, food brands, individuals	Brazil	- Purchase carbon credits generated by conservation activities in the Amazon, offsetting their emissions and supporting sustainable development.	$20 per credit	(100%)
Credit providers	ReSeed	United States (Topanga, California)	- Provides financing and support for the development of carbon credits, including the methodology and platform for tracking and trading credits.	$4	20%
Standard-setting organizations	FoodChain ID	United States (Fairfield, Iowa)	- Verifies the carbon credits and ensures transparency, credibility, and measurement of conservation impacts through third-party verification.	N/A	
Project developers	ReSeed ECAM /	Brazil (Brasília)	- Develop and manage the carbon project, support conservation activities in the Quilombola communities, and facilitate market access for carbon credits.	N/A	
Local intermediaries	ECAM	Brazil (Brasília)	- Acts as the local partner, providing technical support and capacity-building and helping implement conservation activities in the Quilombola communities.	$6	30%
Carbon offset suppliers	Quilombolas subsistence farmers	Brazil (Curralinho, Macapá, Amapá province)	- Quilombola communities conserve traditional agricultural and forest practices, protecting carbon sinks and earning carbon credits for their conservation efforts.	$10 (€50,000 collective funds)	50%