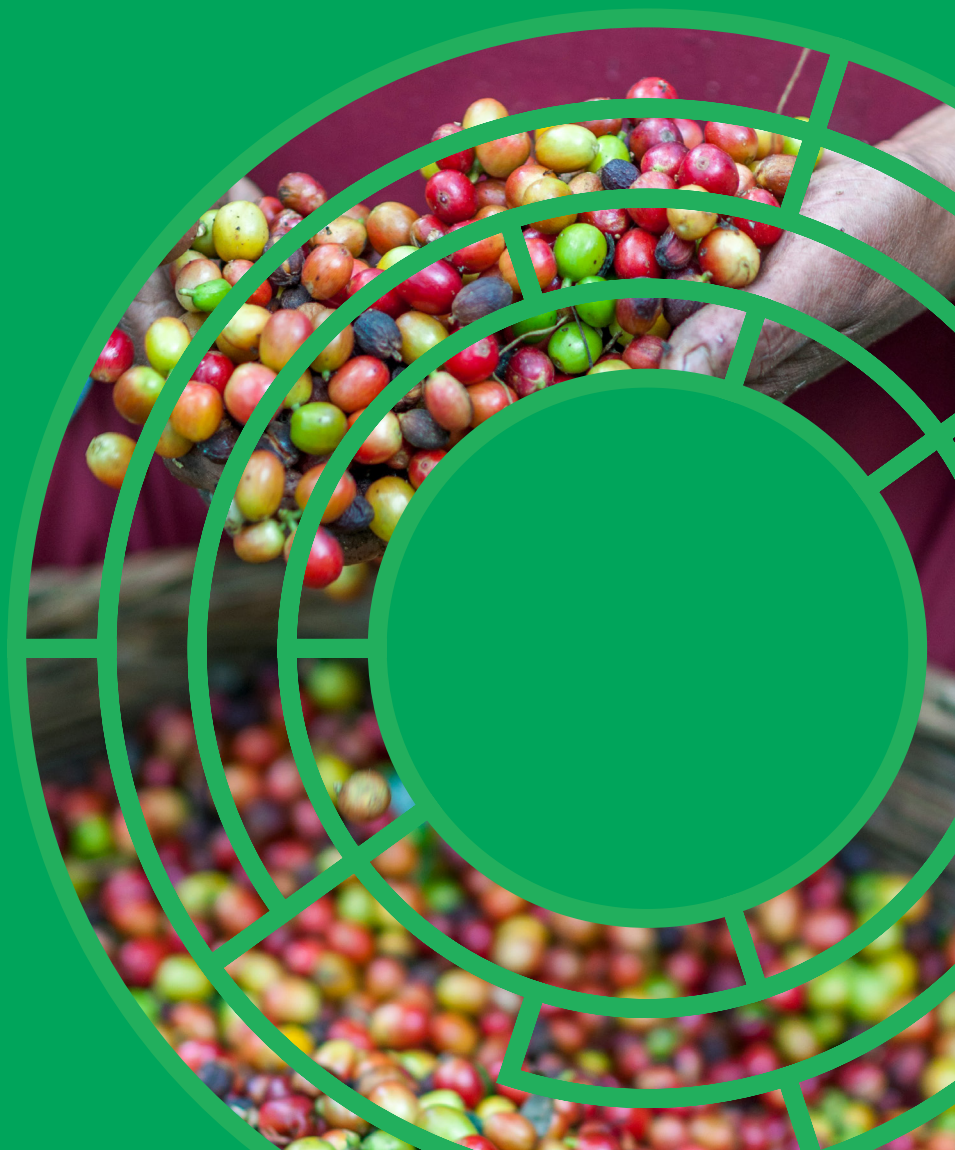
CARBON MARKET OPPORTUNITIES IN LIVESTOCK PRODUCTION, AND COCOA AND COFFEE AGROFORESTRY SYSTEMS

4 December 2023



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Carbon Market Opportunities in livestock production, and cocoa and coffee agroforestry systems: An analysis of opportunities in Latin America and the Caribbean

4 December 2023

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LIST OF ACRONYMS

A/R	Afforestation/reforestation
A6.2	Article 6.2 of the Paris Agreement
A6.4	Article 6.4 of the Paris Agreement
ACR	American Carbon Registry
CAF	Development Bank for Latin America and the Caribbean
CATIE	Teaching and Research Center for Tropical Agronomy
CDM	Clean Development Mechanism
CF	Climate Forward
CH_4	Methane
CLDLAC	Commission on Livestock Development in Latin America and the Caribbean
CNAF	National Council of Family Farming
CO_2 or CO_2eq	Carbon dioxide or carbon dioxide equivalents
ERR	Emission reductions or removals
FAO	The Food and Agriculture Organization of the United Nations
GCC	Global Carbon Council
GHG	Greenhouse gas
GRASS	Grassland Restoration and Stewardship in South Africa
GS	Gold Standard
IADB	Interamerican Development Bank
IC-VCM	Integrity Council for the Voluntary Carbon Market
IICA	Inter-American Institute for Cooperation on Agriculture
ITMO	Internationally Transferred Mitigation Outcomes
LAC	Latin America and the Caribbean
MRV	Monitoring, reporting, and verification
N_2O	Nitrous oxide
NAMA	Nationally Appropriate Mitigation Action
NbS	Nature-based solutions
NDC	Nationally Determined Contribution
PV	Plan Vivo
REDD+	Reducing Emissions from Deforestation and Forest Degradation and the role of conservation, sustainable management of forests and enhancement of forest carbon stocks
RIMISP	Latin American Center for Rural Development
SDGs	Sustainable Development Goals
VCM	Voluntary carbon market
VCMI	Voluntary Carbon Markets Integrity Initiative
VCS	Verified Carbon Standard

CONTENTS

1. INTRODUCTION

The Voluntary Carbon Market (VCM) provides an opportunity for the countries of Latin America and the Caribbean (LAC) to access private capital to support the transformation to climate-resilient, productive, and sustainable agriculture. Carbon markets have grown significantly over the last decade and hold the potential to mobilize private sector finance to enable changes in practice in the agricultural sector. LAC has significant experience in tapping into carbon finance opportunities, and local and international project developers and investors are ready to deploy more finance into the region. However, for this to occur, several enabling conditions for carbon markets must be further strengthened.

Implementation and measurement barriers have made it difficult for the agricultural sector to benefit from carbon finance. Since the carbon reductions delivered by individual farmers are small, the success of carbon finance programs depends on their aggregation. While carbon measurement and monitoring systems have seen great technological advances over the last decade, it remains challenging to accurately monitor carbon stored in biological systems.

To realize the agricultural carbon market potential in LAC, government agencies and private partners must collaborate to overcome several investment barriers. Unclear land titles, a deficit of correctly implemented policies and enforced laws, and a lack of technical capacity and governance frameworks means agricultural VCM investors often face higher risk relative to other sectors. It is therefore essential that public and private actors collaborate to reduce these risks and strengthen an enabling environment to allow markets to mobilize funding that supports significant greenhouse gas (GHG) reductions and removals in the land sector.

The acceptance of carbon investments by local populations will depend on combining climate mitigation efforts, increased farm system productivity, and the resilience of rural livelihoods. Carbon projects and programs can facilitate the transition to more sustainable land use. However, efforts to reduce GHG emissions or enhance GHG removals alone – without improved productivity and livelihoods – will often fail to build political will, ensure local support, and mobilize longer-term finance.

Once a government has determined that it wants to engage with international carbon markets, it can develop its carbon market strategy rooted in high integrity principles. A carbon market strategy helps a host country maximize investments into carbon market activities that are aligned with national climate plans and that contribute to – or go beyond – the goals and targets of its Nationally Determined Contribution (NDC).

To facilitate the development of such carbon market access strategies for the agricultural sector, this report seeks to (i) identify carbon opportunities in the agricultural sector that yield multiple social and environmental benefits, and (ii) outline measures that can be taken

by governments to tap into those opportunities while ensuring integrity, transparency, and accountability.

About this Report

This Sectorial Access Strategy Report is the result of a collaboration among the Interamerican Cooperation Institute for Agriculture (IICA), the Voluntary Carbon Markets Integrity Initiative (VCMI), and Climate Focus. The purpose of this report is to provide an overview of the VCM opportunities in the agriculture sector, specifically in sustainable livestock and agroforestry practices, in LAC to the governments of countries in the region that are or are likely to be hosting VCM projects. The report aims to increase governments' understanding of and capacity to strategically engage with the VCM in the agriculture sector. The target audiences of this report are government decision-makers, specifically ministries of agriculture and environment and advisors to decision-makers in LAC.

The report builds on an initial review of opportunities published in September 2023 and offers a more detailed analysis of carbon market opportunities in the livestock sector, and agroforestry systems.[1] These sectors were selected as they are widespread across all LAC countries and offer significant VCM opportunities. An analysis of VCM opportunities in other crop systems and coastal land systems- may be executed at a later stage.

THIS REPORT IS STRUCTURED AS FOLLOWS:

Chapter 1: Overview of the Voluntary Carbon Markets explains briefly how carbon markets work, current market trends, how carbon markets contribute to sustainable development, and the links between the VCM and Article 6 of the Paris Agreement.

Chapter 2: Carbon Market Opportunities in the Livestock Sector describes the potential of livestock sector in LAC to attract VCM investments and highlights relevant institutional and policy arrangements in individual countries that enable the implementation of carbon market projects and programs.

Chapter 3: Carbon Market Opportunities in Cocoa and Coffee Agroforestry describes the potential for agroforestry systems (specifically, cocoa and coffee agroforestry) in LAC to attract VCM investments and underlines the relevant institutional and policy arrangements that support the implementation of carbon market projects and programs in individual countries.

Chapter 4: Implementing Projects and Programs explains the main barriers and challenges to implementing carbon market projects and programs in the agriculture sector and presents strategies to overcome them.

Chapter 5: Government Support for High-Integrity VCM explains the role of host country governments in carbon markets and how they can engage with the VCM and enable investments in the agriculture sector.

Chapter 6: Summary and Outlook provides a summary of this report and outlines potential next steps for governments – specifically, ministries of agriculture and environment – to consider in engaging with the VCM.

2. OVERVIEW OF THE VOLUNTARY CARBON MARKET

2.1. Basics of the Voluntary Carbon Market

The VCM is where private individuals and organizations issue, buy, and sell carbon credits outside of regulated or mandatory carbon pricing instruments (Table 1).[2] Carbon credits represent certified emission reductions and removals (ERRs) of GHG emissions achieved through the implementation of carbon projects or programs, quantified in metric tons of carbon dioxide (tCO_2) or carbon dioxide equivalents (tCO_2eq). The term "emission reduction" refers to decreasing ongoing GHG emissions to the atmosphere (e.g., reducing emissions from grassland degradation), while "removals" refers to capturing from the atmosphere previously emitted GHG by enhancing the land carbon sinks and durably storing it in carbon reservoirs (e.g., vegetation, soils, marine sediments).[3]

Table 1. Demand and supply actors in the Voluntary Carbon Market. VCM Primer (2022)

BUYERS (DEMAND)	INTERMEDIARIES	SELLERS (SUPPLY)
Who: Companies, public agencies, or individuals that acquire credits	**Who:** Traders or investors	**Who:** Private actors, local communities, non-governmental organizations, or governments
Goals: Achieve own climate goals, differentiate from competitors, market or acquire "carbon neutral" products and services	**Goals:** Connect demand and supply, invest in projects or programs, stabilize market and provide capital to de-risk investments	**Goals:** Seek access to finance by implementing projects or programs that reduce, avoid, or remove GHG emissions

Companies, governments, nongovernmental organizations, and other public and private stakeholders participate in the VCM (see Figure 1). In the case of companies, their participation in the VCM is linked to:

- Investing in projects and programs that generate tradable GHG credits;
- Acquiring credits to meet voluntary climate goals or pledges; or
- Supporting climate change mitigation by financing activities that reduce GHG emissions or remove GHGs from the atmosphere.

Governments develop projects and programs to access VCM finance in order to support policy interventions and governance reforms that support sustainable development. Local communities, private landowners, subnational governments, and other stakeholders also engage in the VCM through project and program development and as beneficiaries of

climate change mitigation activities. These stakeholders are supported by technical service providers during planning, certification and implementation of projects and programs.

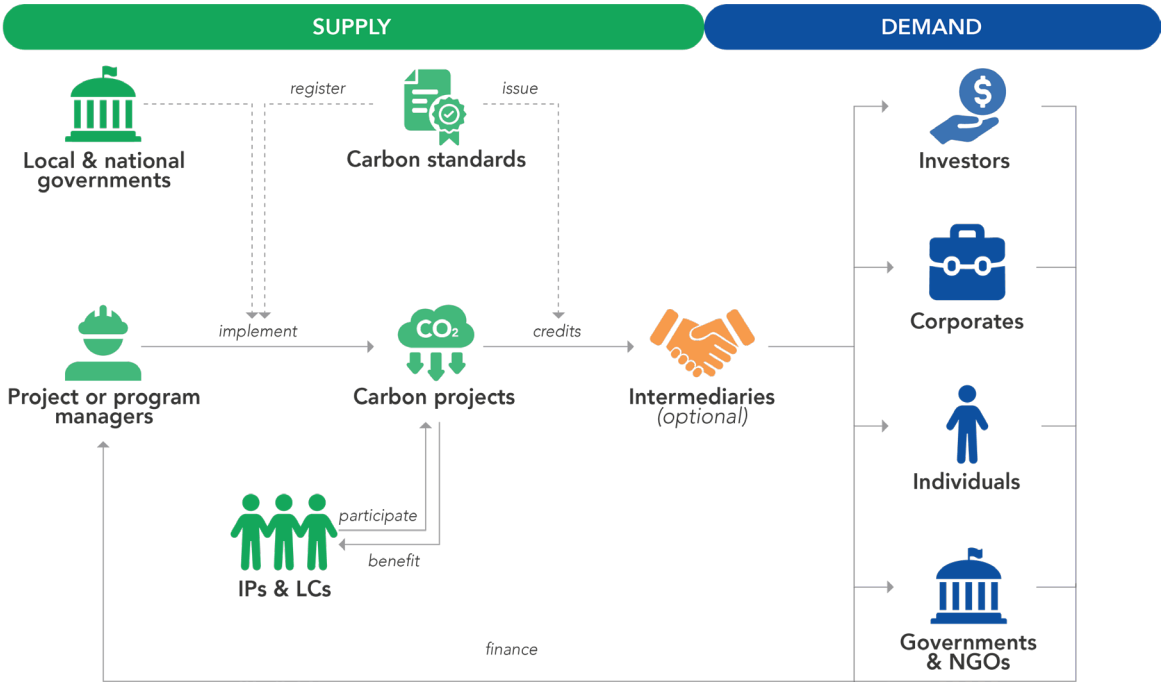


Figure 1. Carbon Credit Market. Source: Climate Focus VCM Primer (2022)

Actors can implement carbon projects to mitigate emissions in various sectors, including forestry and land use, agriculture, renewable energy, transportation, and waste management. Activities that aim to mitigate emissions through the conservation, restoration, or improved management of natural or managed ecosystems – including agricultural lands – fall under the category of nature-based solutions (NbS). These activities also help addressing societal challenges by providing multiple co-benefits to both people and nature.[4]

Carbon crediting programs – or "standards" – certify and issue the carbon credits traded on the VCM. Carbon standards define the methodologies to quantify projects' GHG emission reductions or removals. Projects should fulfill all methodological requirements and procedures to be validated and verified, which is usually done through independent auditing. This certification process also ensures that the principles of additionality, permanence, and leakage are complied with, lending credibility to the projects and to the overall market (see Box 1. High integrity carbon credits on page 7). These standards also host registries of carbon projects and issue credits. Leading VCM standards that certify NbS projects include Verified Carbon Standard (VCS) (with a market share of about 90 percent[5]), Gold Standard (GS), Plan Vivo (PV), American Carbon Registry (ACR), Climate Forward (CF), and Global Carbon Council (GCC).

2.2. Carbon Credit Volumes and Trends

Since the inception of the VCM, the total volume of issued carbon credits generated by NbS projects has been substantial, with these credits representing more than a third of the total carbon credits issued to date (Figure 2).[6] As of June 2023, NbS and renewable energy jointly represented nearly two-thirds of all issuances (Figure 2).[7] Among NbS projects, issuances by agriculture and blue carbon projects are gaining traction – though, until now, forestry-related projects (e.g., REDD+ and improved forest management) have been predominant.[8] Since the start of the VCM, LAC countries have contributed to more than 18 percent of total credit issuances and more than 14 percent of total NbS issuances.

Forecasts indicate that the demand for carbon credits on the VCM will continue to increase. This trend is led by companies with near- and long-term climate commitments aligned with the Paris Agreement. These companies seek to use carbon credits to compliment internal decarbonization efforts, demonstrate climate ambition, and compensate for residual or hard-to-abate emissions. Some estimates project that global demand for carbon credits could reach 1.5-2 gigatons of CO_2 ($GtCO_2$) per year by 2030 with a market value between USD 5 billion and USD 50 billion.[9] Other estimates are even more optimistic, projecting the market's growth to USD 100 billion by 2030.[10]

Despite a drop in carbon credit prices in 2023, future prices are also expected to generally increase, especially for high-quality carbon credits. Estimates vary widely depending on assumptions about future demand. Under a business-as-usual scenario, prices are expected to remain between USD 13 and 35 per tCO_2 until 2050. However, prices could substantially increase, peaking at more than USD 250 per tCO_2 if the demand for high-quality carbon credits (see Box 1) is satisfied.[11]

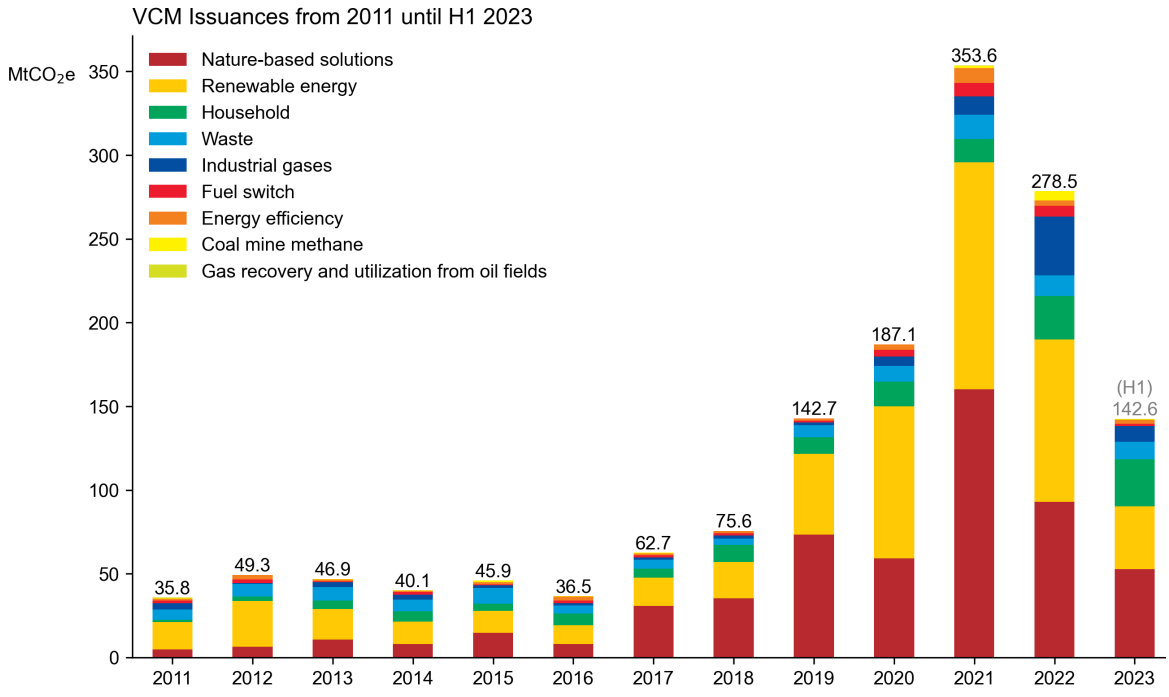


Figure 2. NBS carbon credits (pink bars) issued (VCS, GS, ACR, CAR). Source: Climate Focus VCM Dashboard

2.3. The VCM and Article 6 of the Paris Agreement

The generation and trade of carbon credits on the VCM is regulated by private carbon standards and their carbon crediting requirements. However, the boundaries between mandatory (i.e., publicly regulated) and voluntary (i.e., privately regulated) carbon markets are blurry. There are companies whose engagement in carbon markets appears to be voluntarily, but is de-facto spurred by external influences such as investor or potential future government demands into carbon investments. Engagement in the VCM allows corporates to meet climate targets cost-efficiently through additional, complementary investments in mitigation activities beyond their operations and value chains. Where corporates are mandated to meet climate targets, governments may accept carbon credits issued by private standards for compliance purposes, often to offset corporate emissions. While it is up to the host countries to decide whether and how to use ERRs as part of their NDC or as Internationally Transferable Mitigation Outcomes (ITMOs), ERRs may also be used in the context of national carbon pricing strategies. For example, carbon taxes in Colombia and South Africa authorize the use of carbon credits issued by approved VCM standards for compliance purposes.

Article 6 of the Paris Agreement provides governments the opportunity to voluntarily cooperate in the implementation of NDCs "to allow for higher ambition in their mitigation and adaptation actions" (Article 6.1). This opens the door for countries to engage in different carbon finance mechanisms that complement VCM activities.

Under Article 6.2 or 6.4, GHG emission reductions or removals can be transferred between countries as ITMOs. These transfers can be used towards i) a country's NDC, ii) "international mitigation purposes other than NDCs", or iii) "other purposes." The term "other purposes" is generally understood to refer to the use of ITMOs towards corporate and other voluntary climate commitments. ITMOs can result from Article 6.2 cooperative approaches or Article 6.4 activities. When emission reductions are transferred to another country as ITMOs, a corresponding adjustment must be applied to balance the emissions accounting under the Paris Agreement. With a corresponding adjustment, an emission reduction is removed from the accounts of the selling country and added to the accounts of the buying country. This ensures that ERRs are not accounted for twice (usually referred to as "double counting").

While VCM activities can continue without reference to Article 6 of the Paris Agreement, host countries may choose to integrate VCM activities with Article 6 mechanisms. To do this, host countries may choose to include VCM activities in Article 6.2 cooperative approaches or approve VCM activities under Article 6.4. In that case, some of the resulting ERRs may or may not be authorized for corresponding adjustments. Here, the trade-off is that the more authorizations for corresponding adjustments a host country issues, the fewer ERRs the country can claim against its own NDC. In ensuring host countries can meet their NDCs, they must have a thorough understanding of NDC targets, implementation plans and how correspondingly adjusted emission reductions can support or hinder meeting these targets. Where host countries do not want to rely on the VCM alone, they may decide to use emission reductions under Article 6.4 also known as "mitigation contribution A6.4 ERs" for results-based climate finance, domestic mitigation pricing schemes, or domestic price-based measures. Like in the case of the VCM, these emission reductions could be counted towards the host country's NDC at the same time as being counted towards the recipient company's climate goals, without the host country having to apply a corresponding adjustment. It must be noted, however, that it may take some time until Article 6.4 offers methodologies for agricultural activities within carbon markets. Additionally, whether removal activities can be credited under Article 6.4 remains contested. In the meantime, VCM activities may offer more and more versatile investment opportunities.

2.4. Market Opportunities in the Agriculture Sector

Countries in the LAC region could annually mitigate at least 3.4 $GtCO_2eq$ through cost-effective forest and agriculture sector interventions.[12] After interventions to reduce deforestation, agricultural interventions (e.g., biochar application, soil organic carbon management in grasslands, agroforestry) provide the highest mitigation potential in LAC. Among individual countries in the region, Brazil has the highest cost-effective mitigation potential and accounts for about 50 percent of LAC's cost-effective mitigation potential. This is mostly due to the scale of Brazil's forests, grasslands, and agricultural lands. Brazil is followed by Colombia, Mexico, Argentina, and Bolivia, within which some of the highest potential interventions include protecting forests, restoring forests, and carbon sequestration in agriculture.[13] Countries with high forest cover and lower fossil fuel emissions – including Guyana, Suriname, Bolivia, Peru, Colombia, Brazil, and Costa Rica – all have surplus mitigation potentials, meaning their potential is over 100 percent of their total emissions.

The land sector is the region's main source of emissions and offers the largest climate change mitigation potential. The main sources of agricultural emissions are livestock production, mostly from enteric fermentation and manure left on pasture by grazing animals, in addition to livestock production that drives deforestation. Croplands and rice cultivation provide additional mitigation opportunities (Figure 3). Brazil, Mexico, Argentina, Colombia, and Venezuela have the highest agricultural emissions in the region.

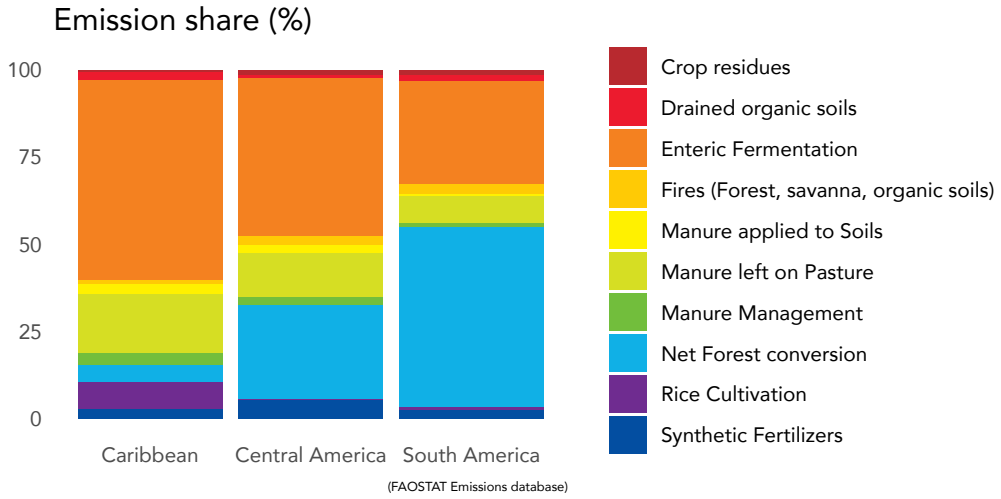


Figure 3. Sources of emissions in the land sector in Latin America and the Caribbean for the year 2020. Source: FAOSTAT Emission database.

Transformational change in the agriculture sector is therefore critical to achieving the NDCs of these countries under the Paris Agreement. Out of 20 Latin American countries, 16 of them (80 percent) included emission reduction targets and policy measures for the agriculture sector in their NDCs.[14] Eleven countries in LAC have committed to achieving net-zero emissions by 2050.[15] It is estimated that a transition to net zero by 2050 will cost countries in the region USD 700 billion per year.[16]

Without public incentives and support, carbon markets are unlikely to accelerate sustainable, larger-scale changes in agricultural systems. Carbon prices are volatile and alone will not be able to fully cover the investments projects need. It is therefore essential that carbon projects do not exclusively focus on mitigating emissions but also on increasing profitability for farmers and improving food system resilience. Public investments in agricultural research, rural infrastructure, human health and education, and animal sanitation

and welfare are essential for improving the productivity of agricultural systems and for creating improved livelihood opportunities that enable farmers to participate in carbon projects. Governments can help improve conditions for investment by clarifying land titles and reform subsidies. They can also take measures to enable activities that channel finance to those who need it most and ensure that markets do not further cement disparities in welfare and opportunities. Finally, governments can formulate safeguards and benefit-sharing rules to manage risks of poorly implemented carbon programs.

Carbon markets contribute to climate change mitigation and sustainable development only if they are of high integrity. The credibility of carbon markets can be undermined (i) on the supply side,[17] by the generation of carbon credits that do not represent real emission reduction or removals,[18] or produce negative outcomes for local communities and environments, and (ii) on the demand side,[19] by buyers' using of carbon credits instead of ambitious internal corporate decarbonization efforts (often linked to greenwashing accusations).

High quality carbon markets demand the generation of real, additional, and verified ERRs that avoid generating negative outcomes for local communities and environments. In the context of agricultural carbon market initiatives, major environmental integrity risks relate to ERRs' accurate monitoring, ensuring their permanence, and ensuring their additionality. For instance, monitoring carbon removals is particularly challenging in the case of soil carbon sequestration and agroforestry systems. For soil carbon, the release of carbon is often discreet, which makes its monitoring challenging. Additionally, carbon stored in soils can be reversed by natural disturbances (e.g., fire or drought) or through changes in soil management. Climate change itself can also lead to a release of carbon from soils and above-ground biomass. Especially strict management of ERRs' non-permanence, additionality, leakage, and measurement is required when credits are used for offsetting emissions. Carbon market activities can also generate social risks when there are inadequately enforced safeguards and poor or absent benefit-sharing arrangements with local communities.

To address these issues, several public and private initiatives aim to improve the integrity and functionality of the VCM. The Integrity Council for the Voluntary Carbon Market (IC-VCM)'s Core Carbon Principles define a set of criteria for assessing if carbon credits sold on the markets are of high quality (See Box 1).[20] On the demand side, the Voluntary Carbon Markets Integrity Initiative (VCMI) Claims Code of Practice[21] provides companies with guidance on the credible use of carbon credits.

In addition to being certified under crediting programs with transparent and accountable governance and robust monitoring and verification requirements, based on core principles of IC-VCM, a credit is of high integrity if:

1. The GHG reductions or removals from the mitigation activity is additional, i.e., they would not have occurred in the absence of the incentive created by carbon credit revenues.
2. The GHG emission reductions or removals from the mitigation activity is permanent or, where there is a risk of reversal, there are measures in place to address those risks and compensate reversals.
3. The GHG emission reductions or removals from the mitigation activity is robustly quantified, based on conservative approaches, completeness, and scientific methods.
4. The GHG emission reductions or removals from the mitigation activity is not double counted, i.e., they are only counted once towards achieving mitigation targets or goals. Double counting covers double issuance, double claiming, and double use.
5. The mitigation activity goes beyond widely established industry best practices on social and environmental safeguards while delivering positive sustainable development impacts.

Box 1. High integrity carbon credits. Source: IC-VCM The 10 Core Carbon Principles: https://icvcm.org/the-core-carbon-principles/

2.5. The VCM Project and Program Cycle

Every carbon project or program that wishes to produce and sell credits must meet the requirements of a carbon standard's project cycle. For projects or program developers to request registration under a carbon standard, they must produce documentation on the project, its activities, and its carbon accounting in line with standard-approved methodologies (See Box 2). Prior to a project's official registration under a standard, this documentation must undergo an independent audit to ensure compliance with the standard's rules (i.e., the process of "validation"). Carbon credits are issued only when the project has subsequently monitored ERRs, produced monitoring documentation, and once this monitoring report has passed its own independent audit (i.e., the process of "verification").

Figure 4 illustrates the standard project and program cycle, highlighting the different steps to successfully certify a project or program under a standard.

Figure 4. Carbon project and program development cycle and associated steps. (Source: Climate Focus)

ERRs from mitigation activities are determined by comparing carbon stock changes (e.g., in vegetation and soil) and/or GHG emissions (e.g., from fertilizer use) under a project scenario and a baseline scenario. Methodologies approved under VCM standards provide procedures for the calculation and periodic update of ERR baselines, and the periodic monitoring, reporting, and verification (MRV) of project performance.

Project proponents need to identify suitable methodologies that are applicable to the planned mitigation activities and follow the specific requirements and procedures to be able to generate carbon credits. The common requirements of methodologies include but are not limited to:

1. Demonstrate that the project meets the eligibility criteria (e.g., the project are does not include wetlands or organic soils; the land has not been deforested within the last 10 years).
2. Demonstrate additionality (i.e., demonstrate that the project would not have been possible without the carbon finance).
3. Quantify carbon stock changes and GHG emissions in the baseline scenario. This scenario represents the carbon stocks under business-as-usual land use (i.e., what would happen in absence of project activities).
4. Quantify carbon stock changes and GHG emissions in the project scenario (i.e., with project activities).
5. Quantify emission leakage (i.e., increase of emissions due to displacement of baseline activities outside the project area).
6. Quantify uncertainties in the estimated ERR. The methodologies use conservative assumptions and procedures to ensure that the net ERRs are not overestimated.

Box 2. Selecting and applying a VCM methodology. Source: Climate Focus

2.6. Socio-economic Relevance of Agriculture in LAC

The agricultural landscape in LAC is highly diverse. The Southern Cone – particularly Argentina and Brazil – is characterized by large-scale, export-oriented farms.[22] In other LAC countries, uneven land distribution leads to large, less commercially managed farms. Roughly 80 percent of farms in the region are considered small-scale, with less than ten hectares in mountainous areas and 50 hectares in flat regions. Overall, smallholder agriculture is the basis of about 15 million livelihoods and provides work to more than 14 percent of LAC's total workforce.[23] In countries like Bolivia, Ecuador, Guatemala, Honduras, Haiti, Nicaragua, and Peru, more than a quarter of the labor force works in agriculture.[24]

The livestock sector is an important driver of economic growth in LAC. The livestock sector contributes to 46 percent of the region's agricultural GDP,[25] with projections of a further 28 percent growth in the next ten years.[26] Currently, the net value of livestock production in the region stands at USD 183 billion, poised to increase by about 11 percent to about USD 203 billion by 2031.[27] The beef and milk sectors are highly relevant for the region, with the region accounting for 16 percent of global livestock production.[28] The trade balance of the livestock sector amounted to USD 23.9 billion in 2022, of which USD 45 billion comes from exports mainly to the United States (USD 16.8 million) and China (USD 15.4 million), a significant share of which is beef. Moreover, by 2031, the region is set to represent 40 percent of global beef exports.[29]

Perennial crops, such as coffee, cocoa, avocado, as well as many fruits, are also an important part of LAC's agriculture sector. For example, the region is responsible for 60 percent of the global coffee supply.[30] Brazil and Colombia are the first and second largest producers and exporters of coffee, respectively, and Mexico and Peru are the leading producers of organic coffee.[31] Revenue from coffee in the region is projected to grow to USD 12 billion by 2028.[32] The region is similarly known for high-quality premium cocoa, supplying nearly 20 percent of the world's cocoa and over 80 percent of the world's fine, flavor, and organic cocoa grown by over 400,000 farming families across 25 countries.[33] The cocoa and chocolate market was worth USD 18 billion in 2022 and is expected to grow to over USD 20 billion in the next five years.[34]

The coffee and cocoa sectors in the LAC region are essential for regional livelihoods and employment. These sectors provide employment for approximately 14 million individuals in the coffee industry and benefiting 1.7 million people in the cocoa sector.[35] Coffee is the sole income source for many smallholders in the region, where 90 percent of coffee is produced in farms of less than five hectares. For instance, in Brazil, two-thirds of the farms that produce coffee are small scale.[36] Countries such as Ecuador, Honduras, Guatemala, and Peru face major economic and environmental challenges in these sectors. For instance, 85 percent of Ecuador's cocoa and coffee producers have low incomes.[37] Further, coffee, and cocoa producers will increasingly be exposed to climate change conditions and vulnerabilities.

Despite an impressive growth in productivity, the agriculture sector faces many challenges. In certain regions, cattle ranching is linked to unproductive land-grabbing with low livestock unit density per hectare. This is most prevalent in Argentina and Brazil, putting pressure on crops, like soybeans and corn, and impacting food security in the region.[38] In countries such as Brazil, Colombia, and Peru – which hold significant portions of the Amazon rainforest – land grabbing is linked to deforestation and changes in land use beyond the agricultural frontier. In Colombia, cattle ranching is also linked to land conflicts and money laundering.[39] As a result, a cattle market with unrealistic prices is generated, which can negatively impact legitimate cattle ranchers by driving prices below the cost of production.[40]

The agriculture sector is also confronted by adverse climate change impacts, persistently low incomes for farmers, and low crop productivity. The implementation of carbon projects could help address these challenges. Ultimately, there is an important opportunity in LAC to enhance the agriculture sector while reducing GHG emissions.

2.7. Main Sustainable Development Benefits

Carbon projects can have significant positive impacts beyond just reducing emissions, thereby contributing to multiple Sustainable Development Goals (SDGs).[41] For example, carbon projects can enhance biodiversity, food security, environmental and human health, livelihoods, animal and crop performance, farmers' quality of life, and overall farm-family well-being. These sustainable development benefits are crucial given that they can motivate a range of stakeholders to participate in carbon markets.[42] For instance, increasing productivity and income are key drivers for farmers to engage in carbon markets. These benefits are also relevant for governments, since almost half of the rural population in LAC lives in poverty.[43] Sustainable development benefits also leads to more interest from the demand side of the market.[44] Overall, these positive impacts are meaningful to drive behavioral changes in adopting sustainable practices and contribute to the permanence of such practices.

Investments in the livestock and agroforestry sectors through the VCM can catalyze a much-needed transition towards sustainable and climate-resilient production systems in the region. Implementing carbon projects and programs in LAC can:

i. Facilitate a transformation towards more sustainable, resilient, and profitable practices while providing empirical evidence on the environmental, economic, and social impact of carbon programs.

ii. Secure funding from private sector investors that can be used for both mitigating and adapting to the impacts of climate change.

iii. Receive support from international partnerships, development partners, and multilateral organizations – e.g., Latin American Center for Rural Development (RIMISP), The Food and Agriculture Organization of the United Nations (FAO), IICA, Interamerican Development Bank (IADB), The World Bank, Development Bank for Latin America and the Caribbean (CAF) – promoting the transformational shift in the agricultural sector.

These institutions can offer support through technical assistance, resource supply, grants, and direct financing.

Carbon projects and programs not only help mitigate climate change but also improve landscape resilience by enhancing ecosystem functioning and ecosystem service provision, including biodiversity and water retention. These projects have a twofold impact on the income and food security of farmers. First, they generate monetary benefits by selling carbon credits. Second, these projects can increase the productivity of farms, which directly results in increased sales volume, product quality, and – potentially – premium market prices. In marginalized rural areas of LAC, additional income generated from carbon projects can play an important role in reducing poverty and inequality. For smallholder farmers, participation in a carbon project – which is usually accompanied by extension services, technical assistance, and catalytic financing for mitigation activities – can help professionalize farm operations and enhance access to markets. Various standards exist to certify co-benefits and SDG contributions of carbon projects, such as the Climate, Community, and Biodiversity Standard, the Sustainable Development Verified Impact Standard, and the Gold Standard for the Global Goals.

Agroforestry and silvopastoral systems contribute to the protection and conservation of biodiversity by enhancing plant diversity while reducing the loss and fragmentation of habitats. This is especially true for agricultural activity taking place in the buffer zones of highly diverse and protected areas. For instance, agroforestry systems developed in Brazil with rubber as a main crop were used by endangered monkey species as part of their home range.[45] Additionally, coffee, and cocoa agroforestry systems aid in controlling the microclimate, which promotes natural weed and pest control.[46]

The adoption of mitigation and adaptation measures in the agricultural sector face several implementation barriers. These barriers include low investments, lack of education and technical knowledge, and political, institutional, and cultural barriers. The use of better pastures and improved grazing management and water access (including through silvopastoral and agroforestry systems) and improving farm management practices can all lead to increased productivity. This inevitably also results in greater biomass and soil carbon capture, decreased soil degradation, and increased biodiversity benefits. However, the current low adoption of these practices is partly due to the weak extension services provided in the region and the lack of appropriate training approaches for smallholders.[47] Public spending on extension services in the region is very low, and there is under-spending on public goods with the potential to accelerate rural development.[48]

3. CARBON MARKET OPPORTUNITIES IN THE LIVESTOCK SECTOR

3.1. Emissions and Mitigation Potential

Emissions

LAC countries produce approximately 25 percent of global livestock anthropogenic methane emissions.[49] In both milk and meat production, CO_2eq emissions come from three sources: (i) methane (CH_4) produced during microbe-mediated enteric fermentation, (ii) nitrous oxide (N_2O) from urine patches, and (iii) carbon dioxide (CO_2) from land conversion.[50] Methane and nitrous oxide arise from animal digestion processes (i.e., enteric fermentation) and excreta (i.e., manure), while carbon dioxide largely results from unsustainable land-use practices like overgrazing and deforestation.

Enteric fermentation is the second largest contributor of emissions from the land sector in LAC, accounting for about 31 percent of the total, followed by emissions from manure on pastures, with about 8 percent (see Figure 3 for region-specific shares).[51] Owing to the extensive nature of the cow-calf systems, carbon dioxide emissions associated with feed production, fertilizer production and use as part of livestock systems are relatively low in the region. However, as production intensifies, the share of emissions from enteric methane reduces and there is a shift towards other emission sources. Emissions intensity per kilogram live weight is also reduced as livestock systems intensify.

Mitigation Potential

The global mitigation potential associated with land-based livestock sector activities amounts to approximately 1.7 $GtCO_2$ per year.[52] This refers to the technically achievable potential (i.e., possible with available technology, without accounting for the technology's costs) of activities such as improved grasslands management, reduced emissions from enteric fermentation, and manure management. Close to 18 percent of this potential (0.3 $GtCO_2$ y–1) is in LAC. Across the three measures, improved grassland management that increases carbon sequestration in soils has the highest potential in most countries of the region (Figure 5).[53] If this level of carbon removal was realized, it could abate 43 percent of LAC's on-farm emissions from cattle in 2019 (which was 0.7 $GtCO_2$ y–1).[54] Additional mitigation potential can be achieved through expanding silvopastoral systems (i.e., by introducing trees into pasturelands), which together with other agroforestry systems could provide up to 5.6 $GtCO_2$ y-1 (0.6 $GtCO_2$ y–1 in LAC).

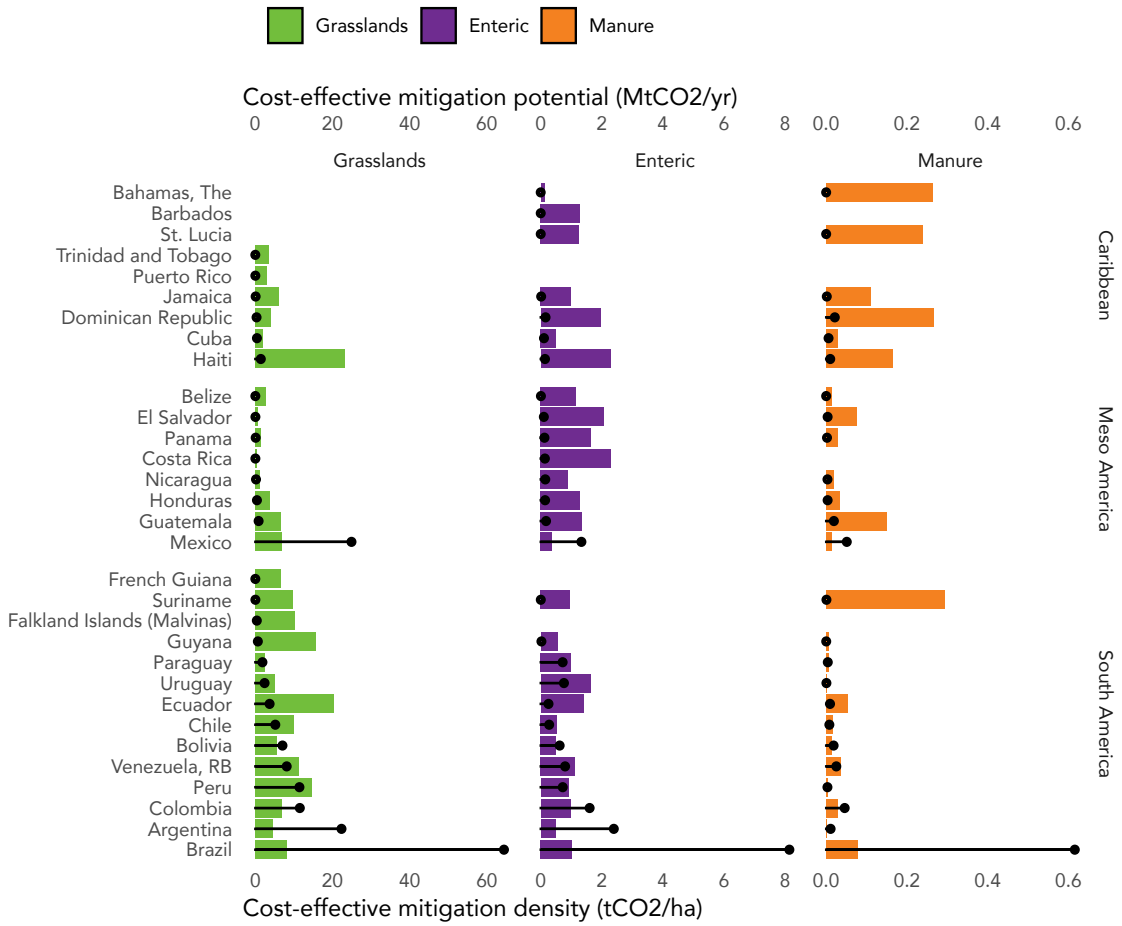


Figure 5. Cost-effective mitigation potential of the livestock sector in Latin America and the Caribbean countries by 2030 displayed as mitigation density per hectare (bars) and total potential per year (black dots) (Source: Roe at al., 2021)

Mitigation interventions such as silvopastoral systems, improved pasture management, improved reproductive efficiency of livestock, grazing with supplements and crop diversification, and improved forage quality have been tested in various countries in the LAC region.[55] If these measures were implemented effectively, methane emissions could be significantly reduced. Tested mitigation actions have demonstrated success. For instance, the conversion to silvopastoral systems has yielded a 23.4 percent decrease in methane emissions in Colombia, and a 36 percent and 51 percent decrease in two different regions in Mexico.[56] Additionally, improved pasture management has yielded a 50.1 percent decrease in Colombia. Improved forage quality managed to reduce methane emissions by 30 percent in Costa Rica and 79 percent in Peru.[57] In Argentina, the improved reproductive efficiency of livestock has led to 50 percent decrease and grazing with supplements to a 26 percent decrease in methane emissions.[58] Improved grassland management yield around 12 percent in Uruguay and crop diversification a 6 percent decrease in methane emissions in Brazil.[59]

3.2. Mitigation Activities

Among the activities that mitigate livestock emissions, some are more cost-effective and simple, and some are more complex, expensive, and demand specific technologies. Through grassland restoration, increased soil carbon, rotational management of livestock, nutrient management, and introducing new forage species, emissions can be reduced while the sector's productivity and profitability increases. Implementing better animal husbandry practices – such as improved feed, grazing management, and breeding – can reduce GHG emissions intensity. Planting trees and improving forages will sequester carbon. Table 2 summarizes the main practices that lead to reduced emissions in the livestock sector.

Table 2. Mitigation activities for the livestock production system. Source: Climate Focus

GHG MITIGATED	DESCRIPTION	ADVANTAGES	CHALLENGES	CO-BENEFITS
Improved forage species and their management				
CH_4 emissions reduced, CO_2 sequestered	Planting grassland species adapted to soils, nitrogen fixing species, high protein grasses. These species will sequester higher amounts of CO_2 and improve feeding cycles, reducing emission from enteric fermentation.	Measures that improve the productivity of livestock operations and include benefits for biodiversity, and enhanced productivity. Leads to the professionalization of livestock operations.	Requires upfront investment. Reduction of methane emissions is difficult to measure in absolute terms, and monitor. Methodologies focus on efficiency gains (accelerated weight gain).	- Increases supply of forage for animal feed to boost weight gain and shorten livestock growth and sales time. - Employment opportunities associated to seed or seedling production, farm management, and technical assistance. Particularly significant for young people in rural areas, who often have limited employment prospects and are fast migrating to urban areas.
Improved grazing management				
CO_2 sequestered	Rotational grazing, improved forage system. Allowing the soils and grasses to recover allowing for increases in productivity and soil carbon sequestration.	Forms part of a suite of measures (in combination with improved pasture management and silvopastoral systems) that increase the competitiveness of the livestock sector, while increasing agricultural resilience.	Increase carbon content in soils remains challenging to measure and monitor.	
Silvo-pastoral systems				
CO_2 sequestered	Holistic system for managing a cattle ranching farm. It includes the planting of trees and legumes. Not one single solution and may have various degrees of implementations	Easy to implement, tested practice with multiple benefits (biodiversity uplift, enhanced productivity, increased resilience). Can be combined with other practices such as improved pastures, grazing management, enhanced breeding and enteric fermentation management.	CO_2 sequestration takes time, requires advance finance and targeted technical assistance. In many parts of LAC, there is an insufficient supply of certified forest nurseries. The survival of trees on farms must be ensured.	- Increases animal welfare by establishing trees that reduce the heat stress, leading to higher quality meat and milk. - Increases biodiversity and landscape value by establishing bird habitat forests in cattle ranches.

Enteric fermentation				
CH_4 emissions reduced	Feeding cattle methane inhibiting antibiotics and test emerging technological solutions to reduce methane emissions generated by enteric fermentation.	Addresses the most important source of GHG emissions from livestock operations.	Enteric fermentation is the largest source of methane from livestock production, however, changes that can be made to direct livestock emissions are limited and not cost-effective. The direct measurement of emission reductions from enteric fermentation is costly.	Improvement of the overall perception and image of livestock farming as an environmentally sustainable activity, which can increase market demand for sustainable livestock and associated products with premium prices.
Manure management				
CH_4 and N_2O emissions reduced, CO_2reduced	Capturing and use of manure	Use of biogas instead of fossil fuels or fuel wood	Mitigation option not suitable for extensive cattle operation that make the capture of manure difficult	Livestock waste is repurposed as fertilizer or energy, promoting circular economy.

The transition to a low emission, resilient, and productive livestock sector is possible, but action needs to be urgently taken given the livestock sector's rapid growth. The growth of the livestock sector, mismanagement of pastures, and policy neglect have led to overgrazing and environmental and socio-economic losses. Action to shift the livestock sector's trajectory towards a more sustainable future is pressing.

Considering the livestock sector's cultural, logistical, and financing considerations within the region, LAC can effectively mitigate GHG emissions through improved pasture management, improved grazing, and silvopastoral systems. These three activities can provide opportunities for ERRs and significant sustainable development benefits. Meanwhile, direct reduction in emissions from enteric fermentation and manure management may provide ERR opportunities in the future. However, implementing these latter two mitigation activities is not cost-efficient in LAC given their high implementation costs and lower mitigation potential.[60]

3.3. VCM Opportunity in Improved Livestock Management

Improved pasture and livestock management involves several activities with the potential to enhance carbon stored in soils (i.e., soil organic carbon, or SOC), enhance carbon stored in biomass, and reduce the overall emission intensity of milk and beef products. Activities can be grouped in three general categories (Table 3):

Table 3. Description of mitigation activities, available methodologies, and project examples in livestock sector. Source: Climate Focus

CO_2 SEQUESTRATION POTENTIAL (TCO_2 PER HECTARE)	AVAILABLE GHG ACCOUNTING METHODOLOGIES	IMPLEMENTATION CHALLENGES	PROJECT EXAMPLES
Improved pasture management with forage species Introduction of locally adapted forage (i.e., grass) species can improve the nutritional value of pastures for livestock, thereby enhance productivity, and enhance carbon stored in soils.			
124 - 224.8	VM0042; VM0047, VM0026,	- High costs of improved seeds. - Non-productive periods from sowing until the pasture becomes ready for grazing (6 months). - Requires specialized technical assistance.	Grazing management Plans improve pasture selection by cattle and forage quality in sub-alpine and alpines grasslands[61]
Improved grazing management Rotational grazing is a livestock management technique that mimics the natural movement of large wild herds. It involves dividing pasture areas into smaller paddocks and proactively rotating animals to achieve optimal grazing of fodder available in one paddock while allowing the pasture and soil in the other paddocks to regenerate. By doing so, it promotes optimal utilization of fodder resources to enhance productivity, prevents overgrazing and allows optimal recovery of grazed areas, and promotes healthier soils that can store greater volumes of carbon over time.[62]			
124 – 259	VM0042; VM0026; AR-AMS0007; VM0047	- Requires high investment and labor in lot division fences and livestock aqueducts.	-"Forestry PRODICOM" Reforestation of pasture lands on the Peruvian Northern Andes[63] - 'Ecoplanet Bamboo Central America' Reforestation Program in Southeastern Region of Nicaragua on degraded pasture land.[64] - Reforestation of pastures in Campo Verde with native species, Pucallpa, Peru.[65]
Silvopastoral systems This refers to the practice of establishing shade and fodder trees within livestock farms. In addition to improving animal welfare and productivity, trees store carbon in above and below ground biomass, and can enhance carbon stored in soils. Around 50 percent of a tree's dry organic is made up of carbon. The amount of carbon sequestered per hectare of silvopastoral system depends on tree species and the number of trees planted per hectare.			
231.1 – 261.4	AR-ACM0001; AR-AM0003; VM0042; VM0047; GS - Afforestation/reforestation GHG Emissions Reduction & Sequestration Methodology	- The expenses linked with buying, planting, and maintaining trees are considerable. - Insufficient supply of certified forest nurseries	- ACP Sustainable Forest Cover Establishment Project, Panama.[66] - 'IBERPAPEL' Silvopastoral System on Degraded Land, Uruguay.[67]

Note: Studies conducted in tropical areas of Latin America were used to obtain CO_2 sequestration potential range. See: Baseline sequestration = 50 tCO_2 per hectare.[68,69]

3.4. GHG Accounting and VCM Methodologies

Interest in carbon finance for livestock systems has increased in recent years. Livestock based carbon projects are increasingly seeking registration under leading standards, and methodologies for developing livestock-based carbon projects are available through Verra and Gold Standard. Currently, most projects have been developed in countries like the United States and China. In the LAC region, projects in Mexico and Argentina are seeking registration under Verra's Sustainable Grassland Management methodology (VM0026). Both projects have several key differences, highlighting the wide range of possibilities for developing carbon livestock projects in the region:

- The Northern Mexico Sustainable Grazing Carbon Capture Project is a grouped project to be developed on privately owned lands. This project is estimated to reduce annually 152,864 tCO_2eq by implementing Short-Duration High-Density (SDHD) livestock management practices and virtual fencing technologies.[70]
- The Santa Nicolasa North Patagonia Regenerative Grazing Project in Argentina will be developed on an individual farm that covers 70,000 hectares.[71] This project is planned to annually reduce 71,000 tCO_2eq by implementing a regenerative grazing model where cattle are restricted to relatively small paddocks to generate intensive grazing in short periods.[72]

Verra and the Gold Standard have developed new methodologies to facilitate the registration of sustainable livestock projects. Verra's recently published VM0042 methodology for Improved Agricultural Land Management includes tools for soil carbon measurement and monitoring, as well as tools to make it more user friendly.[73] In October 2023, the first project developed under this methodology was registered and more than 100 projects are currently in the pipeline of the standard (See Box 3).[74] In quantifying emissions from feed supplements, Gold Standard together with Cargill, developed a methodology for beef producers.[75] The methodology defines a series of parameters to quantify reductions in methane emissions.[76]

FIRST PROJECT UNDER VM0042: THE GRASSLAND RESTORATION AND STEWARDSHIP IN SOUTH AFRICA (GRASS)[77]

The Grassland Restoration and Stewardship in South Africa (GRASS) is a grouped project designed to unlock, upscale, and incentivize the adoption of improved agricultural land management and ecosystem restoration in the grassy biomes of South Africa. Achieving this will mitigate GHG emissions by sequestering carbon into the soil and reducing methane emissions from livestock enteric fermentation. The project is expected to generate 488,659 tCO_2eq per year. The GRASS Project will implement the Herding for Health (H4H) model under this project. The model includes farmer and herder empowerment through smallholder livestock value chain development to build resilience to climate change. Furthermore, the model supports rangeland restoration and GHG sinks while reducing GHG emissions by sequestering carbon into the soil and reducing methane emissions from livestock enteric fermentation.

Box 3. Description of first project registered under Verra's Improved Agricultural Land Management methodology.

Because dedicated methodologies do not yet exist for silvopastoral systems, silvo-pastoral projects must seek GHG crediting under afforestation/reforestation methodologies. For instance, a commonly used methodology for silvopastoral projects is the CDM's AR-ACM0001 methodology. This methodology applies to activities on degraded land that are expected to remain degraded in the absence of the project.[78] The activities covered

under the methodology include planting trees and soil organic carbon sequestration, which are common mitigation activities in silvopastoral systems.[79]

Table 4 provides an overview of current methodologies broadly applicable to livestock production systems, in improved pastures, improved grazing management and silvopastoral systems, which are the mitigation activities relevant for the LAC region.

Table 4. Methodologies for calculating GHG emissions, reductions, and removals applicable to livestock in the LAC region. Source: Climate Focus

STANDARD	METHODOLOGY ID	SCOPE
VCS	VM0026	Methodology for Sustainable Grassland Management (SGM), v1.1
VCS	VM0042	Methodology for Improved Agricultural Land Management, v2.0
VCS	VM0044	Methodology for Biochar Utilization in Soil and Non-Soil Applications, v1.1
VCS	VM0047	Methodology for Afforestation, Reforestation, and Revegetation v1.0
GS		Suppressed Demand Small-scale Methodology for Energy Use for the Processing of Agricultural Products
GS		Smallholder Dairy Methodology (Draft)
GS		Reducing Methane Emissions from Enteric Fermentation in Dairy Cows through Application of Feed Supplements
GS		Afforestation/reforestation GHG Emissions Reduction & Sequestration Methodology

LAC countries are already implementing projects that have the potential to be – but are not yet – verified under the carbon project standards. Institutions like IICA, FONTAGRO, and others are supporting initiatives in the livestock sector that set an example of what carbon projects in the livestock sector can look like, such as the ones described in Box 4.

Improved pasture and grazing management practices in Colombia

GANADERIA SOSTENIBLE – GANSO, COLOMBIA[80]

GANSO is a technical assistance service provider that supports farmers in Colombia in implementing sustainable practices in livestock productive systems. GANSO has a certification process (Aval GANSO) that allows farmers to access different market benefits, such as premium prices from large retailers. Among other sustainable practices, GANSO implements improved pasture and grazing management. Collaborating with farmers, GANSO develops an enhancement plan for the farm, which includes technical assistance on delimiting the paddocks to maximize grazing time and nutrient intake while allowing soil carbon sequestration. GANSO also implements activities such as planting forage species and legumes, which provide a diverse feeding source for cattle and a possibility of reducing methane emissions from enteric fermentation. GANSO currently implements improved land management practices in 22 farms covering more than 31,000 hectares.

FONTAGRO SUSTAINABLE LIVESTOCK PROGRAMS

Silvopastoral and multipurpose systems in smallholder farming in Colombia and Peru[81]

One **FONTAGRO** program identified the need to plant trees on farms for cattle grazing. Timber tree species help diversify feeding sources for cattle, provide comfort to the cattle, and improve ecosystem services for the farm. The program is helping to develop a network of farms that implement silvopastoral systems to allow for knowledge sharing and collaboration between farms. During phase 1, the program implemented 20 silvopastoral systems (ten each in Colombia and Peru), which combined, support 47 families.

Sustainable Intensification of Livestock Systems by Planting Legumes[82]

FONTAGRO also implements an improved pasture management program across eight LAC countries: Argentina, Chile, Ecuador, Nicaragua, Paraguay, Dominican Republic, Uruguay, and Brazil. By planting legumes in cattle ranching farms, the program aims to increase the nutritional value of cattle diets while decreasing emissions from the productive system. Legume forage also decreases the use of fertilizers, ultimately reducing these costs for farmers. The program also has research and knowledge-sharing components. The program has benefited 2,532 people, including farmers, technical assistants, researchers, and students.

BIOPASOS INITIATIVE[83]

Biopasos is a silvopastoral project implemented by the Teaching and Research Center for Tropical Agronomy (CATIE) and IICA. The project is implemented in three Mexican landscapes and aims to restore degraded areas, increase livestock productivity, and enhance climate adaptation. Among the practices implemented by Biopasos are the planting of timber and fruit tree species, live fences, grazing management, and planting forage species.

Box 4. Examples of initiatives with VCM potential

3.5. Synergies with Existing Policies and Measures

Countries in the region are already implementing livestock policies that could serve as a starting point for VCM projects and programs (Table 6). Many countries in the LAC region are implementing national policies to support the transition to sustainable livestock models for both meat and dairy, examples of which are listed below. However, for these interventions to integrate within the VCM and generate carbon credits, they would need to go above and beyond existing regulatory requirements.

- Colombia, Costa Rica, and Mexico have implemented livestock Nationally Appropriate Mitigation Actions (NAMA), which formulate sustainability guidelines for the sector.
- Guatemala is implementing a National Strategy for Low GHG Emissions Livestock to modernize traditional livestock systems and achieve a more productive and sustainable value chain.[84] The strategy prioritizes activities such as pasture management, silvopastoral systems, and improved animal management practices.
- In 2015, the government of Argentina enacted the National Forest Management Plan with Integrated Livestock (PNMBGI) to front the expansion of the agricultural frontier into native forests. The PNMBGI proposes technical tools for farm planning, which includes areas for conservation, biodiversity corridors, and reforestation areas coupled with sustainable livestock practices.[85]
- The Uruguayan government promoted a strategy aimed at improving efficiency and productivity, increasing producer's income, and a more resilient production system. The program trains farmers on how to produce more with fewer resources.[86]
- Ecuador has implemented the program Climate Smart Cattle Ranching with the purpose of reducing soil degradation and emissions from the sector. The program has supported seven local microcredit organizations and has disbursed USD 25,000 to promote smallholders' access to credit. The program has supported the implementation of sustainable livestock practices across 40,000 hectares and increased farmers' productivity by 15.83 percent.[87] The creation of a green credit line under the program has potentially reduced 1,000 tCO_2eq.[88]

Table 5. Policy examples of projects and programs relevant to the VCM in the region. Source: Climate Focus

COUNTRY	POLICY/INITIATIVE OBJECTIVE	IMPLEMENTING AGENCY	FUNDER
Brazil	Provide financial support to livestock farmers	Ministry of Agriculture	Brazilian Government
Bolivia	Integrate climate change adaptation and mitigation measures on livestock farms	Agricultural Research Institute (INIA)	FONTAGRO
Colombia	Define the policy guidelines for sustainable livestock	Ministry of Agriculture and Rural Development	Colombian Government
Costa Rica	Define the national sustainable livestock policy	Ministry of Agriculture and Livestock)	Costa Rica government
Jamaica	Develop a project to reduce methane emissions from livestock sector.	Green Climate Fund and IICA	GCF and IICA
Chile	Promote efficient use of fertilizers, improved emission reduction treatments for pig manure, and sustainability standards with mitigation actions for dairy, poultry, and pork subsectors.	Ministry of Agriculture	Chilean government
Dominican Republic	Promote climate-smart livestock management	Ministry of Environment and Natural Resources and the Ministry of Agriculture	Global Environmental Facility

Other countries are creating institutions to support the transition to sustainable and low-carbon livestock production. These institutions are key to supporting farmers to access carbon finance.

- Colombia, Uruguay, and Paraguay have national sustainable beef roundtables. Roundtables bring together stakeholders relevant to the sector – including unions, public decision-makers, private sector actors, and farmers associations – to facilitate agreements and mainstream sustainable practices.
- Chile has the Office for Agrarian Policies and Studies, an institution part of the Ministry of Agriculture. Among the objectives of the Office are the delivery of specialized training on silvopastoral systems and the support of decision-makers with sectorial information on agriculture and livestock. In 2022, the Office concluded the Climate Change Adaptation plan for the sector and designed the Incentive System for Sustainable Land Management Law aimed at promoting the adoption of practices that contribute to sustainable rural development.[89]

Additionally, international cooperative institutions are supporting a region-level approach to **create a cohesive strategy and promote national efforts.** Organizations like the IADB, CAF, and the FAO are supporting regional coalitions for the adoption of sustainable practices in the livestock value chain. For instance, the FAO has the Commission on Livestock Development in Latin America and the Caribbean (CLDLAC), which is a technical advisory body that brings together governments and private sector actors. The Commission engages actors in the development of livestock policies and programs and strategies to strengthen cooperation.[90] Box 5 presents the recent decisions from the CLDLAC.

CLDLAC[91]

In 2023, 20 Latin American and Caribbean countries – who are part of CODEGALAC, the Commission on Livestock Development for Latin America and the Caribbean, which is a technical advisory committee for livestock production – signed a deal to decrease GHG emissions that arise from livestock systems in the region. The objective of this agreement is to encourage communication, share knowledge, and collect resources from various sources to shift livestock systems towards sustainable or regenerative models. Additionally, CODEGALAC aids in developing policy frameworks for the sector and assists in the design and execution of livestock development programs at national and regional levels.

Box 5. Actions from the CLDLAC.

4. CARBON MARKET OPPORTUNITIES IN COCOA AND COFFEE AGROFORESTRY

4.1. Emissions and Mitigation Potential

Land use change is a primary driver of emissions in the agricultural sector, especially the conversion of forests into croplands and pastures. In the LAC region, about 49 percent of total AFOLU emissions arise from net forest conversion.[92] In Peru, for example, the net emissions from croplands and pastures total 93 $MtCO_2$ per year, equating to 68.7 percent of the sector's emissions.[93] These changes are a consequence of complex land-use dynamics that involve rural livelihoods, land tenure, and governance that prevents straightforward solutions.

Implementing agroforestry systems (including in cocoa and coffee production) has a global mitigation potential of approximately 5.6 $GtCO_2$ per year.[94] Of this, as much as 1.1 $GtCO_2$ per year could be realized cost-effectively (i.e., with a cost of up to 100 USD per tCO_2eq). The LAC region could provide 11 percent of this global potential, with Brazil having the highest cost-effective mitigation potential (55 $MtCO^2$ per year), followed by Argentina (28 $MtCO_2$ per year), and Mexico (15 $MtCO_2$ per year) (Figure 6, black dots). In relative terms, however, smaller countries often have higher mitigation potential per hectare that is often higher than the global average of 45 tCO_2 per hectare achievable until 2050 (Figure 6, colored bars).

Significant mitigation potential in the coffee and cocoa sector exists in activities such as land preparation, sowing, fertilization, pest management, pruning, and harvesting. Cultivation management practices with mitigation potential within the coffee and cocoa sector should focus on reducing emissions due to land-use change, which can account for up to 99 percent of emissions in crops established in newly deforested areas. Preventing deforestation in the cocoa sector and establishing new cocoa plantation areas in degraded zones has a notable effect on emissions reduction. In Peru, for example, it is estimated that 250 tCO_2eq per hectare of emissions could be avoided if cocoa crops are established in areas other than primary forests. This mitigation can be significantly increased if the disturbance of organic soils or peatlands, which can contain up to 700 tCO_2eq per hectare, is also avoided. [95]

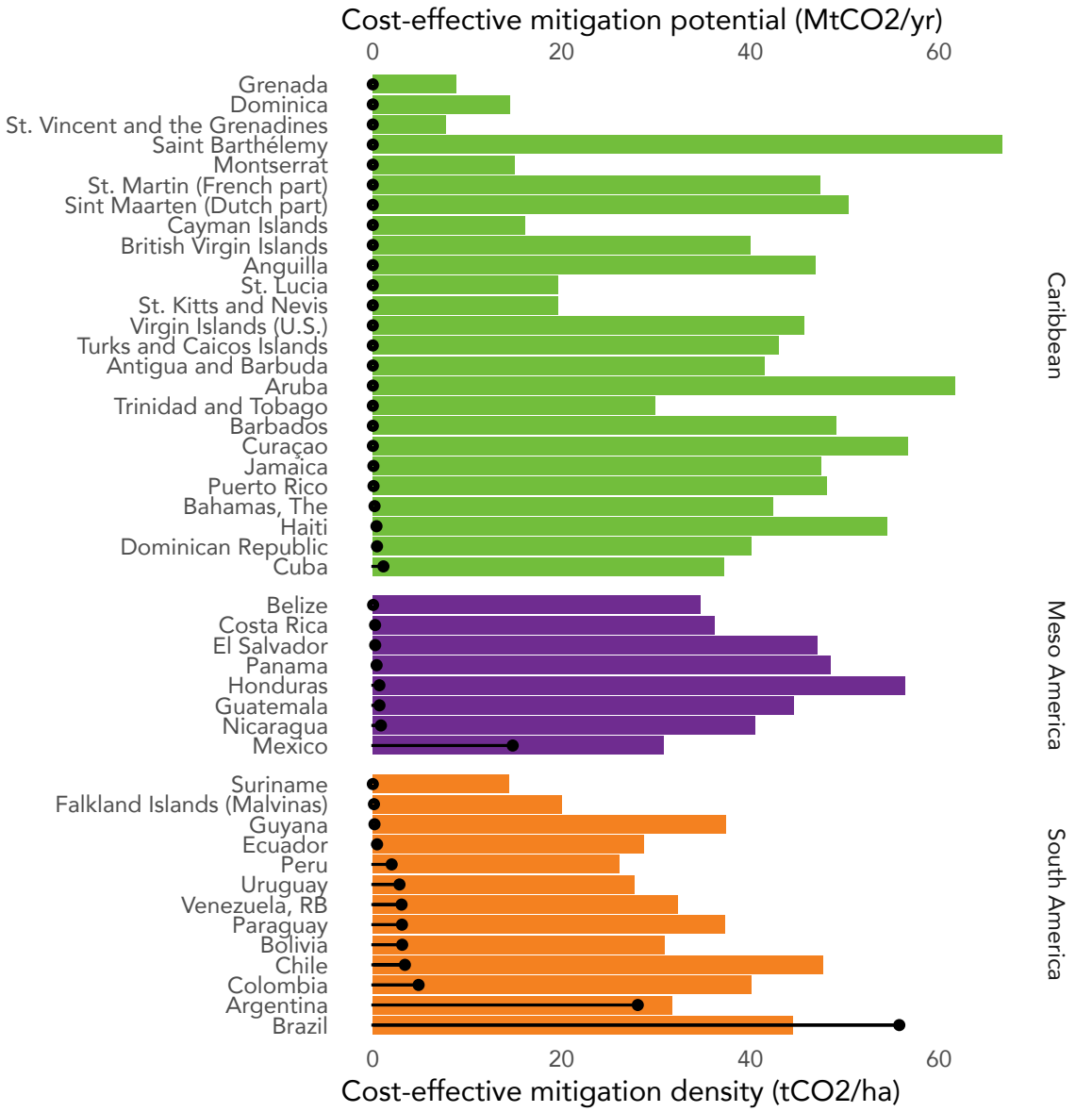


Figure 6. Cost-effective mitigation potential of agroforestry systems in LAC countries by 2030 displayed as mitigation density per hectare (bars) and total potential per year (black dots) (Source: Roe at al., 2021).

4.2. Mitigation Activities

The establishment of agroforestry systems for coffee or cocoa yields environmental benefits. Trees in agroforestry systems provide shade, improve soil health, enhance biodiversity, and improve air and water quality.[96] Additionally, agroforestry systems sequester carbon in soil and in above and below ground biomass of trees planned with cocoa and coffee.[97]

Agroforestry systems focus on a flagship crop (e.g., coffee, avocado, cocoa) and add other trees to the system. Some combine one crop species and one tree species, whereas others are more complex systems with multiple crops and trees.[98] For example, a simple coffee agroforestry system combines coffee and service trees with a high density of coffee

plants, whereas highly diversified agroforestry systems include coffee, timber trees, and fruit trees where timber trees dominate.[99]

The design of agroforestry systems must consider the optimal sunlight and shade requirements from various crops. The management of tree densities, shade cover, and cropping practices are crucial for optimal yields, environmental outcomes, and avoiding diseases and yield loss.[100] Besides sunlight, agroforestry systems must avoid water competition among the crop species. The flagship crop will determine the rest of the system. Trees and additional crops must be selected to maximize the benefits of the flagship crop, as well as the economic benefits. Box 6 describes two agroforestry system models that have been developed in LAC.

- In the Peruvian Amazon region, the Cacao Peru alliance has implemented agroforestry models, including 1111 cocoa trees and 135 native forest trees per hectare. The forest species are: Bolaina (*Guazuma crinita*) and Capirona *(Calycophyllum spruceanum).*[101]
- In Colombia, the National Federation of Coffee Growers promotes agroforestry systems using native forest species, such as Nogal Cafetero (*Cordia alliodora)* or Guamo (*Inga edulis)* trees. The model consists of 4000 coffee trees and 100 forest trees, per hectare.[102]

Box 6. Agroforestry systems models developed in LAC countries.

4.3. VCM Opportunity in Cocoa and Coffee Agroforestry

LAC covers a variety of agroecological zones and topographies, which allows for the production of many types of tree crops. LAC produces several important crops that thrive in agroforestry systems such as coffee, cocoa (both shaded crops), avocado, mango, and other fruits (which are shading trees). Although grown in a relatively small area compared to staple crops, coffee and cocoa provide an important source of revenue and are often the sole income source for many regional smallholders. The region offers multiple alternatives for agroforestry arrangements to optimize crop production, farmer income, carbon storage, environmental benefits, and supply chain resilience. Profitable agroforestry systems have the potential to be sustainable, control erosion, increase biodiversity, and conserve carbon, if nutrient absorption is balanced with nutrient recovery through litter and strategic use of fertilizers.[103]

The amount of carbon stored per hectare in cocoa or coffee agroforestry systems can vary based on several factors, such as the number of trees per hectare, the species of trees, tree ages, soil type, and local climatic conditions. Studies conducted in Amazonian areas of Peru and in the Orinoquia region in Colombia have shown that, for cocoa agroforestry systems, the amount of both soil and aboveground CO_2 ranges from 133.6 tCO_2 per hectare to 156.8 tCO_2 per hectare.[104;105] In contrast, agroforestry systems with coffee in Central and South American countries have been found to sequester carbon between 89.01 and 119.02 tCO_2 per hectare.[106] Box 7 describes the carbon sequestration potential of cocoa and coffee-based agroforestry systems.

CARBON SEQUESTRATION POTENTIAL IN COCOA AND COFFEE-BASED AGROFORESTRY SYSTEMS

In humid tropical regions like the Orinoquia in Colombia, a cocoa agroforestry system can sequester up to 157 tCO_2 per hectare in the soil and in the aerial and terrestrial tree mass.[107] Sequestration rates in non-agroforestry crops can be up to 20 percent lower.[108]

In Central America, establishing 110-280 forest trees in coffee crops can increase carbon sequestration between 5 and 30 Mg per hectare, depending on the forest species planted. A coffee agroforestry system can sequester 143 tCO_2 per hectare.[109]

Box 7. Carbon sequestration potential in cocoa and coffee-based agroforestry systems

Agroforestry-based carbon projects are being implemented in the region in many forms. Private sector-led initiatives are implementing innovative MRV solutions that reduce the costs of project validation. Box 8 includes an example of a private-led innovative carbon project.

ACORN INITIATIVE: OVERCOMING MONITORING AND VERIFICATION COSTS[110]

Acorn, Rabobank, and Plan Vivo, have developed and certified a crediting framework designed for smallholders. This framework differs from other standards in that it is specifically designed for smallholders implementing agroforestry systems and performing biomass measurement using satellite data. By measuring and certifying the sequestered carbon in a low-cost manner, the framework enables smallholders to access and participate in the VCM.

The program pays 80 percent of the carbon revenue to farmers, 10 percent to implementing partners, and 10 percent to Acorn. The system is creating an extra stream of income in Africa, Latin America, and Asia. For instance, in Colombia, the program has supported over 10,000 coffee growers in Risaralda and has captured more than 20,000 of CO_2eq. The agroforestry arrangements include native shade and medicinal trees in coffee plantations that enhance the micro-climate, increasing the number of pollinators and increasing the farm productivity and income. Solidaridad serves as a local partner, providing agroforestry training and advice, planting resources, and overall supervision of the implementation and maintenance of the agroforestry systems. The income received from the carbon credits will allow smallholders to afford the necessary materials needed for the long-term maintenance of the system.

Box 8 Acorn Initiative: Overcoming monitoring and verification costs[111]

Other crops besides coffee and cocoa can also be integrated into agroforestry systems. Due to the diversity in agroforestry arrangements and the variety of tree crops grown in the LAC region, there are multiple crops with which agroforestry arrangements can be developed. In the region, there are some initiatives that do not focus on coffee and cocoa, like the ones described in Box 9.

PARÁ STATE FRUIT TREE AGROFORESTRY PROJECT[112]

The software company Salesforce awarded funds and technology for work on NbS for the climate crisis. CIFOR-ICRAF's Agroforestry and Reforestation Accelerator (ARA) project in Brazil's *Pará* State is building a public-private partnership for restoration through agroforestry-based carbon sequestration. This initiative supports implementing a range of agroforestry systems and practices, which are tailored to local contexts and farmers' goals. The project seeks to sequester 9.6 million tCO_2 by implementing 18,000 hectares of agroforestry systems supporting 3,000 farming families. Co-designed with local communities, the portfolios include fruits (along with vegetables) that are prioritized based on their nutrient density and ability to provide vital micronutrients. The project includes gender-inclusive awareness campaigns for communities about the importance of diversifying production and diets, relying on schools, health facilities, co-operatives, and municipalities as outreach entry points.

COCONUT AGROFORESTRY IN SURINAME[113]

Pomeroon Trading is a sustainable agriculture company operating in the Coronie District of Suriname. In September 2023, the company began tree planting on a 1,200 hectare farm site leased from the Government of the Republic of Suriname. These agroforestry projects combine coconut and hardwood trees to generate carbon credits. The Project considers local communities´ livelihoods and has submitted initial documentation for pipeline listing with Verra.

Box 9. Examples of agroforestry projects with different crops

4.4. GHG Accounting and VCM Methodologies

There are currently three main standards in the VCM that enable the generation of carbon credits from agroforestry projects: Verified Carbon Standard, Gold Standard, and Plan Vivo. Agroforestry usually falls under Afforestation/Reforestation (A/R) activities, which are activities that increase carbon sequestration (i.e., remove carbon from the atmosphere) and/or reduce GHG emissions by establishing, enhancing, or restoring woody vegetation. While the Verified Carbon Standard and Gold Standard provide specific methodologies, Plan Vivo allows developers to adapt methodologies from other standards to the specific projects (Table 7).

Table 6. Carbon methodologies for calculating GHG emissions, reductions, and removals applicable to agroforestry projects.

STANDARD	METHODOLOGY
VCS	VM0047 – Afforestation, Reforestation and Revegetation V1.0* *(*note, this methodology has been released in October 2023, and many projects are still registered under older methodologies)*
GS	Afforestation/Reforestation (A/R) GHGs Emission Reduction & Sequestration V2.0
PV	New methodologies are currently under development. Existing projects used methodologies from other standards (e.g. CDM) and are subject to project-specific assessment by Plan Vivo.

There are already several agroforestry projects registered under VCM standards (Table 8). Projects vary in size, and the largest project is over 12,000 hectares in Peru (Shade Coffee & Cacao Reforestation Project) with more than 30 cooperatives of small coffee and cocoa producers. This project combines the climate and financial benefits achieved through generating carbon credits, with the promotion of sustainable production of high-quality products, and the restoration of ecological systems.

Other existing projects in the region are supporting smallholders' livelihoods and their adaptation to climate change. For instance, the PUR Jubilación Segura Project in Peru is promoting the reforestation of degraded landscapes by implementing cocoa and coffee agroforestry systems. The project has helped to diversify and increase farmers' income in the Yungas Peruanas region through the sales of flowers, short-cycled crops, honey and bees' byproducts, and carpentry products from sustainable timber harvest.

Table 7. Cocoa or coffee agroforestry project registered under the main carbon standards (Verified Carbon Standard and Gold Standard) until September 2023.

NAME	STANDARD	METHODOLOGY	COUNTRY	ESTIMATED CREDITS PER YEAR (TCO_2/YEAR)
Shade Coffee & Cacao Reforestation Project	VCS	AR-ACM0003	Peru	49,198
Agroforestry and forest restoration for ecological connectivity, poverty reduction and biodiversity conservation in Cerro San Gil, Caribbean Guatemala	VCS	AR-ACM0003	Guatemala	1,727
Sustainable cocoa plantation system (agroforestry) in East Nicaragua	GS	Afforestation/Reforestation GHG Emissions Reduction & Sequestration Methodology	Nicaragua	379
Regenerating Colombian Coffee Ecosystems	VCS	AR-AMS0007	Colombia	178
Sustainable Climate-Friendly Coffee (CO_2 Coffee)	VCS	AR-AM0007	Mexico	144
Jubilación Segura : Agroforestry And Reforestation With Smallscale Farmers in Peru	VCS	AR-AMS0007	Peru	75
Aprosacao Reforestation Project: community reforestation and agroforestry with small-scale cocoa farmers in Honduras.	GS	Afforestation/Reforestation GHG Emissions Reduction & Sequestration Methodology	Honduras	21
Conversion Of Intensive Agricultural Systems To Dynamic Agroforestry Systems For Sustainable Cocoa Production In Ecuador	GS	Afforestation/Reforestation GHG Emissions Reduction & Sequestration Methodology	Ecuador	9,125
San Pablo Del Lago Reforestation Project	GS	Afforestation/Reforestation GHG Emissions Reduction & Sequestration Methodology	Ecuador	111,609

Communitree Community Carbon Project	PV	-	Nicaragua	-
ArBolivia	PV	-	Bolivia	-
Scolel Te	PV	-	Mexico	-

Beyond their emissions accounting methodologies, standards also have methodologies and processes to quantify other sustainable development benefits. Both the Gold Standard for the Global Goals and Verra set requirements to design projects for maximum positive impact on climate and sustainable development, and to measure and report outcomes in a credible, efficient manner. Projects under these standards must contribute to a minimum of three SDGs, including SDG 13 (Climate Action). The Gold Standard for the Global Goals has developed methodologies and tools to support projects in monitoring and reporting their SDG contributions. In countries such as Ecuador where there is a limitation on generation and use of carbon credits, projects can certify their sustainable development contributions to give assurance and transparency to the partners of the social and environmental positive claims resulted from the project.[114]

4.5. Synergies with Existing Policies and Measures

Around one-third of LAC countries intend to use agroforestry to meet national climate commitments.[115] For instance, the decarbonization strategy of Costa Rica includes agroforestry systems as an activity to achieve sustainable growth and reduce deforestation.[116] Many countries in the region have adopted policies to support agroforestry interventions as part of their climate and development plans. These existing policy frameworks can facilitate further engagement with and scaling of VCM projects and programs in LAC countries. For example:

- In June 2023, the government of Nicaragua adopted the Forest Policy to promote, among other goals, restoring the right of native peoples, afro-descendants, and rural communities to enjoy the benefits generated by forest ecosystems in an environmentally sustainable manner.[117] The Forest Policy adopted in 2023 includes six strategies to avoid deforestation and promote forest restoration including strengthening forest and agricultural regulations, providing incentives to farmers and using carbon markets approaches for forest restoration.
- Similarly, Peru's National Agrarian Policy 2021-2030 provides a framework definition for agroforestry to facilitate the alignment of public and private institutions in favor of the design of interventions and policies that promote the adoption of agroforestry in the country.[118]
- In 2021, El Salvador enacted the Smallholder Agricultural Law (*Ley de Agricultura Familiar*), with the objective of supporting the implementation of sustainable, small-scale, agroecological and resilient agriculture that contributes to social inclusion and economic development.[119] The law intends to promote climate change mitigation activities, such as agroforestry systems, to contribute to an inclusive and profitable agricultural sector. The law also created the National Council of Family Farming (CNAF). This institution will oversee the formulation of projects and plans, coordinate with other relevant stakeholders, and catalyze public, international, and private finance to support the implementation of sustainable and inclusive agricultural systems. Public institutions like CNAF are good examples of initiatives that can provide support to farmers to overcome access barriers to the VCM.

There are also several examples of governments promoting the proper management of timber tree crops in agroforestry systems which improves the permanence of tree

cover in cocoa and coffee systems. For instance, the Honduran government's Program of Agroforestry, Environment, and Climate Change (Decree 56-2007) promotes the planting of timber trees in coffee farms. The National Coffee Institute has the capacity to certify tree planting to facilitate the harvest, transportation, and use of timber produced in coffee farms. As of 2017, over 1.5 million timber trees had been planted as a result of this program.[120] In Guatemala, the National Forest Law created a portfolio of economic incentives to stimulate the implementation of agroforestry systems, including coffee and cocoa.[121] The Incentives Program for forestry and agricultural smallholders (PINPEP), is aimed at landowners of less than 15 hectares, and has supported some 20 thousand reforestation projects 69,405 hectares with governmental support approximating USD 58 million.[122]

5. IMPLEMENTING PROJECTS AND PROGRAMS

There are several implementation barriers for mitigation and adaptation measures in the agricultural sector. These include low investments, the lack of education and technical knowledge, and other political, institutional, and cultural barriers. For instance, the low adoption of sustainable practices is partly due to the weak extension services provided in the region and the lack of appropriate training approaches for smallholders.[123] Public spending in extension services in the region is very low, where there is under-spending on public goods with the potential to accelerate rural development.[124]

Carbon project development in the livestock, coffee, and cocoa sectors faces specific risks related to carbon project development in addition to typical project risks. In addition to more common problems, carbon projects need to address several technical management challenges. Any carbon project must consider elements such as the farmers' preferences, the business case, and the emission reduction carbon sequestration potential. Key considerations include:

- **Business case for farmers:** How can the system maximize long-term economic and social benefits for farmers (including smallholders)?
- **Scale potential:** Has the program the potential to cover a sufficient number of farmers and farms to justify the development of a carbon project?
- **Carbon sequestration potential:** How much carbon can be sequestered per year per hectare?
- **Upfront investments per hectare:** How much money is required per hectare and per farm to set up a project or program?
- **Ongoing monitoring and verification costs:** What will be the costs for monitoring and validating the results of the project, and how can new technologies be implemented to reduce the costs and simplify the processes?
- **Legal and political risk:** How can legal and political risks be overcome? How can risks around weak institutions or missing land titles be addressed?
- **Project integrity:** How can the project or program ensure integrity, including through environmental (e.g., mitigating the risks of reversal and impermanence) and social (e.g., appropriate benefit sharing provisions) safeguards?

Entities that manage VCM projects must be able to oversee the carbon project development, aggregate a multitude of farmers, operate effective MRV systems, and ensure financial sustainability and integrity.

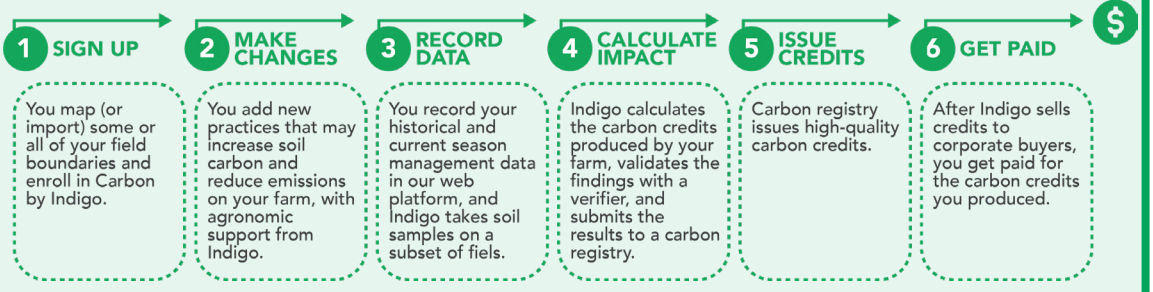
5.1. Effective Project Aggregation

While project aggregation is essential to successful carbon programs in LAC's agriculture and livestock sector, it also presents a unique challenge. Managing long-term relationships with many farmers requires trust and long-term commitment. An entity acting as the aggregator needs to have strong managerial capacities as it will be responsible for bringing together the various organizational, marketing, financial, legal, and technical aspects in a coherent structure and business plan. This entity will be responsible for:

- Structuring the project or program;
- Clearly articulating the value proposition and implementation model for farmers and signing them up to the program
- Arranging finance for the program's development; and
- Managing all aspects of eventual design and implementation, including (but not limited to) managing the training farmers, providing farm level implementation support, MRV across the program, carbon sales, and the fair distribution of benefits. See Box 10 for an example of a program that aggregates credits across a multitude of farms.

CARBON BY INDIGO

Carbon by Indigo is a carbon program by Indigo, an organization that provides technological solutions to maintain or improve yields while reducing the negative environmental impact of conventional crop inputs such as synthetic fertilizers, pesticides, and fungicides. Indigo's carbon program aims to enable farmers to earn income for adopting sustainable practices that lead to the generation of certified carbon credits. The program offers a minimum price of USD 20 per credit to farmers, with 75 percent of carbon revenue going to farmers and 25 percent to Indigo and its partners. The program aggregates credits at the program level which is then verified and certified by Verra and Climate Action Reserve. As of November 2023, the program has enrolled more than 2,000 farmers covering more than 5.5 million acres (about 2.2 million ha) of farmland and issued 133,000 carbon credits. Farmers can enroll in the program following the below steps:



Box 10. Carbon by Indigo. See: https://www.indigoag.com/about

Successful carbon project aggregation models tend to rely on preexisting aggregation or support structures such as cooperatives or community associations. While possible, building completely new cooperatives and other support structures from the ground up requires more resources and higher transaction costs. Existing cooperatives and community associations have the benefit of managing an existing network of farmers. They also tend to have experience in supporting associated farmers with production methods and commercialization. A carbon program can effectively be layered on top of existing support structures and business models.

5.2. Equitable Benefit Sharing

The costs and benefits of carbon projects and programs must be shared fairly. Most carbon projects tend to involve a range of stakeholders beyond farmers. This is due to the broad nature of the carbon project cycle, which includes financing the mitigation activities, supporting project development, facilitating reporting, and selling carbon credits. These other stakeholders include investors, technical partners, and intermediaries. Long-term success in partnerships between these stakeholders is only possible through equitable and transparent benefit sharing arrangements. These arrangements must identify which stakeholders are beneficiaries, how the monetary and non-monetary benefits will be distributed, and the logistics behind how the benefits will be allocated.[125] This calls for careful design of partnership structures that allocate risk and incentives across carbon projects' long lifespans. The negotiation of benefit sharing structures can be complex and potentially leave parties feeling unfairly compensated, unless carefully planned and transparently communicated.

Project costs and benefits must be transparently communicated throughout the overall business case and terms of participation. Costs and benefits may include both monetary and non-monetary elements. For example, in most programs, farmers tend to benefit upfront by receiving inputs and training. These inputs and trainings can represent substantial upfront costs incurred by a project proponent or investor but are crucial for implementing these projects and programs. Once carbon revenues start to flow, these should be distributed equitably between project proponent, farmers, and other relevant stakeholders. Carbon revenue streams must allow the project proponent or investor to recover their investments including applicable profit margins and must provide long-term incentives for farmers.

5.3. Reversal Risk

Carbon projects are a long-term commitment that require consistent maintenance to avoid the reversal of climate benefits. Carbon credits generated from agriculture face natural risks such as fire, disease, pest outbreaks, and other natural disasters, in addition to risks related to mismanagement or neglect of the activity. VCM standards offer strategies on how to address such reversal risks, given that a reversal of the sequestered carbon will devalue the associated carbon credit.

However, long-term commitment to a project's mitigation activities may conflict with farmers preferences. Such preferences may shift overtime unless the program delivers sustained performance in terms of income and farmers' livelihood beyond carbon. Given a project lifetime of 20-30 years, a smallholder farm may experience a boom or bust in a key crop, a change in ownership, and a range of other challenges during that time.[126] These considerations may result in farmers discontinuing mitigation activities, ERRs being reversed, and future carbon credit issuance being jeopardized. This risk requires reliable aggregation models and appropriate insurance mechanisms.

Reversal risks can be managed through a strong, convincing business case that delivers long-term value to farmers, including financial benefits resulting directly from the sale of carbon credits (e.g., equitable benefit sharing) and benefits beyond carbon (e.g., improved productivity, resilience, access to quality markets). Projects may also employ additional carbon credit buffer reserves to cover any reversals that result from non-performing farmers, or farmers exiting the program, to avoid those who remain bearing the cost of reversals. Buyers of carbon credits can also manage risks by diversifying their carbon credit portfolios to include several projects or types of projects (thus distributing the risk), or use methods such as adjusting credit retirements to account for risks of reversal.[127]

5.4. Upfront Costs

Carbon project implementation costs

Most mitigation activities in the agriculture sector require substantial upfront investment, whereas benefits (e.g., income from carbon credit sales or enhanced productivity) accrue slowly. This can lead to cash-flow challenges and make investments financially unattractive or unviable. In the case of carbon removals in particular (i.e., additional carbon storage in biomass and soils), ecosystems take time to sequester carbon. Carbon credits cannot be generated until such sequestration occurs and is monitored. Many farmers living in poverty – who could benefit from adopting agroforestry and improved livestock management practices – lack financial resources or access to credit to finance long-term investments.

To enable mitigation activities' implementation and ongoing maintenance, program managers must develop financing models that ensure an adequate supply of materials, training, and assistance to farmers. Long-term financing typically must be secured by the project or program proponent and channeled to farmers, unless farmers are able to finance all or part of implementation cost through their capital and labor, or secure credit. Many existing examples of carbon market projects and programs provide farmers with materials, training, and all MRV services in exchange for carbon rights. Farmers benefit from improved productivity and resilience as well as an eventual share in carbon revenues. However, such models require a project proponent that can raise required capital. This in turn, requires the demonstration of sound financial management and sufficient operational capacity, which can be a tall order for small aggregators. Linking project costs to government programs and existing support (i.e., subsidy programs) as well as donor funding and blended finance can reduce these costs.

Carbon project transaction costs

In addition to implementation costs, there are substantial transaction costs associated with designing and setting up carbon projects that require effective aggregation. Individual farmers – and in some cases, even cooperatives – often cannot assume these costs. The cost of designing and registering a carbon project or program, including the independent audits (validations and verifications) tends to be upwards of USD 100,000 and will be followed by periodic MRV costs.

Successful MRV requires a sophisticated, centralized, and regularly updated database of project data and information, and cost-effective procedures to collect data from program participants. Thus, aggregation is crucial to achieve economies of scale and make projects economically viable. Smallholder-focused programs tend to be designed as grouped or aggregated projects, which allows new project areas to be added as the program grows. To reduce transaction costs, projects must be streamlined and must develop efficient MRV systems. The processes of gathering, storing, and processing data for reporting and verification should be standardized as much as possible. A growing number of monitoring solutions and platforms exist to streamline these processes. New tools also help with processing and reporting data.

6. GOVERNMENT SUPPORT FOR A HIGH-INTEGRITY VCM

In most LAC countries, carbon markets have so far been driven by private sector initiatives and have had limited steering by governments. However, this hands-off approach by the government can limit carbon market investment in the agricultural sector. If governments work actively to overcome investment barriers and, while doing so, steer carbon market investment towards priority regions or activities, they can help achieve scale and yield additional climate and development benefits for rural populations.

Governments can play a key role in harnessing the potential of the VCM by creating developing environmental and institutional frameworks that enable growth. For instance, governments can incentivize the participation of the private sector by minimizing investment risks (e.g., through clarification of land titles, provision of data, or aggregating famers). Further, governments can link carbon market programs to public policies to ensure overall policy alignment and coherence. Government involvement should also ensure that the interests of local actors are protected through fair benefit-sharing rules, and that safeguards are complied with. This includes ensuring that carbon programs comply with agroecological principles and enhance biodiversity. Table 9 below lists the reasons that motivate governments to engage in carbon markets.

Table 8. Why host country governments are interested in the VCM[128]

GOVERNMENTS' REASONS FOR ENGAGEMENT		GOVERNMENTS' INTERESTS AND CONCERNS
Harnessing opportunity	**Using carbon markets to support national and global climate goals**	Governments may be interested in learning more about the potential of carbon markets to support their climate change mitigation goals and financing needs.
	Using carbon markets in the context of national carbon pricing policies	Governments that already have experience with carbon markets may wish to integrate carbon markets into national policy and legal instruments, such as allowing liable entities to meet carbon tax obligations with VCM credits.
	Using carbon markets in the context of agricultural policies	Governments may use carbon finance to catalyze the agricultural transition to more sustainable, resilient and productive agricultural production systems.
Mitigating non-compliance risks	**Ensuring that carbon market activities support the nationally determined contributions (NDC)**	Governments may worry that carbon markets export emission reductions and removals needed to meet the country's NDC. By engaging with carbon markets, governments can ensure that the understand any decisions they are making about authorization of VCM projects under Article 6 and direct VCM activities toward sectors that are conditionally covered or not covered by their NDC.

Safeguarding the integrity of projects and credits	**Ensuring that ongoing carbon market activities are aligned with national policies and priorities**	Governments may want to ensure that activities are of high environmental integrity and compliant with national law and aligned with strategic policy priorities.
Addressing risk	**Exposure to risks that relate to the carbon market**	Governments may find themselves needing to respond to allegations by international actors with respect to problematic projects or issues of non-compliance in their countries. They can alleviate these problems by regulating and directing VCM activity.

However, before governments can engage strategically in agricultural carbon markets, several institutional, capacity and knowledge gaps need to be addressed to effectively tap into carbon market investment opportunities. Public officials need to develop an understanding of carbon markets and of specific local and sectoral investment opportunities. Data gaps should be closed, and institutions strengthened.

6.1. Role of Governments in the VCM

The voluntary, private sector driven nature of the VCM distinguishes it from regulated carbon crediting programs, including Article 6 of the Paris Agreement. However, governments can provide regulatory and political certainty to VCM transactions by clarifying the rules of engagement for the VCM in their countries. They can also confirm their will to support project developers and investors in complying with relevant rules, regulations, fiscal incentives, and safeguards. The VCM also influences public policy and compliance markets, and in some cases, voluntary carbon crediting programs directly interact with government carbon pricing schemes. The carbon pricing policies of Colombia is an example where governments have harnessed VCM activities to achieve climate goals. Entities that are liable to pay the Colombian carbon tax may use VCM carbon credits to partly fulfill their obligations. To engage with the VCM, host country governments can act as regulators, implementers, and/or facilitators (see Table 10).

Table 9. The role governments can play in the VCM

	**As regulators**, governments institute policies, regulations, and safeguards to guide the development of carbon projects in their territories and attract beneficial carbon market finance. Public agencies collect data and enhance the transparency of the market. They can require projects, project developers, or other participating entities to submit projects to a public registry. Rules and guidelines can also formulate and enforce safeguards and benefit-sharing arrangements to drive carbon market activities to contribute to social and environmental goals beyond climate and to ensure that carbon market activities do not cause harm. Governments may also permit the use of VCM credits in mandatory carbon pricing schemes (e.g., carbon tax, ETS).
	**As facilitators**, governments support climate change actions financed by investments in projects and/or programs and the purchase of carbon credits. In this role, governments also help develop carbon markets by incentivizing and publicly encouraging investment in agricultural activities that generate carbon credits. Governments can direct carbon investments into agriculture.

As implementers, governments engage directly with the VCM. Subnational entities (e.g., municipalities or states), public agencies (e.g., park authorities or investment agencies), or public utilities (e.g., municipal waste management or energy generating entities) can be sponsors and co-implementers of carbon projects in partnership with project developers. Governments can also sponsor sectoral and regional approaches (see section 6.2 below on programmatic approaches).

Governments as Regulators

Government guidelines and regulations can ensure that VCM activities consider government priorities and follow national safeguards. Governments can also help to ensure fair and equitable benefit sharing. They can further secure the link between the VCM and Article 6 activities.[129]

Governments are likely to adopt rules that govern the implementation of Article 6 approaches and activities. This includes defining project approval criteria as well as the rules to authorize the public and private entities that wish to participate in Article 6 transactions. They will also have to decide whether to authorize the use of Article 6 mitigation outcomes towards NDCs or other international targets. If a country intends to implement some VCM activities under Article 6.2, it must adopt a formal regulation (in most cases, a law) to establish and define the right to receive necessary authorizations.

Host governments may also adopt rules that require carbon market activities to periodically report on their activities. VCMs suffer from a lack of transparency and governments often know little about the carbon market activities within their countries. Considering the impact carbon markets have on a country's ability to achieve and enhance its NDC, governments may decide to require carbon market projects sponsors to provide the government with design information about the project and projected ERRs yields. Such ex-ante reporting can be complemented by requirements for project or program developers to submit annual monitoring data to the government. This information can be stored and made available in a national GHG and carbon market registry.

Host country governments may adopt additional safeguarding requirements where existing environmental and social guidelines for investment projects do not sufficiently address carbon market-related risks. Approvals and authorizations can be made contingent on projects and programs proving that they meet safeguard requirements, and relevant requirements can be checked periodically in environmental and social compliance checks. In the broader context of national safeguards, governments can also adopt rules for fair benefit sharing with local communities.

Governments as Facilitators

Governments can provide regulatory certainty by establishing clear, efficient, and standardized processes for investors and project developers interested in investing in agricultural projects and programs through the VCM. Governments can establish effective communication mechanisms with relevant national and subnational authorities and minimize risks for private investors. Clarifying land titles, harmonizing policies that impact the agricultural sector, sharing baseline emission data, and supporting the development of credible monitoring systems can become crucial support that governments can provide. In addition, governments can provide guidance to ensure equitable benefit-sharing from carbon revenues and safeguarding the rights of indigenous peoples and local communities.

Measures that governments can implement to support VCM investments in the agricultural sector include:

- **Governments can support the creation of farmer cooperatives and the delivery of technical assistance.** The success of VCM mitigation activities depends on, among other factors, the provision of training, including financial management, and support to access markets for non-carbon products. In this context, governments can support the creation and formalization of farmer cooperatives and associations whose members could participate in an aggregated VCM carbon program. Such structures ensure that technical assistance is delivered effectively and consistently, benefit sharing is implemented efficiently and fairly, and monitoring of carbon impact is applied continuously and over the accounting period of the activity.
- **Governments can also facilitate better coordination between public technical assistance and extension programs and financial services provided by local banks.** Technical assistance programs should include financial aspects and align with financial institutions' credit lines that promote sustainable livestock and agroforestry activities. In practical terms, this means that technical assistance providers must include in their programs the financial considerations of potential improvements at the farm level (i.e., costs and benefits), and the credit lines available to finance these improvements. Then, this knowledge can be transferred to producers, including the requirements and timelines for applying for credits.
- **Governments can also support the availability of farm input and materials.** Public agencies can support the creation and development of nurseries, that are necessary for any scaling of silvopastoral and agroforestry systems. In this context, it is important to assess the specific needs in each region, as they may vary depending on ecosystem, location, type and size of the operation, and regulatory environment.

Governments can incentivize coordinated, collective action by facilitating an enabling environment and access to private finance for farmers through the VCM. A collective regional effort helps reduce transaction costs, build capacities, and expedite robust design and implementation at the national level.

Governments as Implementers

As direct project and program sponsors, governments can design, develop, and implement VCM activities. In some countries, public agencies – such as national park authorities (e.g., in the case of forestry projects) or municipalities (e.g., in the case of waste management projects) – already act as project proponents and use carbon finance to support public investments. Similarly, governments can directly support VCM implementation in the agricultural sector. The following section describes the role of governments in the context of programmatic implementation of VCM activities.

VCM agricultural projects are best implemented in a programmatic approach. A programmatic approach aggregates carbon mitigation activities across various farms (projects) that alone would be unable to produce sufficient carbon credits to cover the project's transaction costs. A programmatic approach enables the development of individual projects under an umbrella structure, leading to a portfolio of projects with fast growing, scaled-up emission reduction potential. Such an umbrella structure can support the inclusion of multiple subprojects over time, without the need to identify all of them from the onset. Subprojects can be added to the program as it develops, and the portfolio can grow over time. Individual agricultural projects in individual farms may join the program at a pace in which they are able to apply the program´s requirements.

Governments can also take a more proactive approach by linking VCM incentives to policies and acting as program managers. Governments can replace private project

developers and act as project aggregators and managers of jurisdictional or landscape programs. While carbon market programs cannot be used to implement existing policies because of additionality requirements in most VCM standards (i.e., existing policies would likely be implemented without the need for carbon finance), they can be used to scale and expand existing programs. For example, a mitigation component can be added to an existing adaptation program. Emission reduction or removal activities (e.g., incentives for improved pasture management) can also be added to programs that do not target climate change as a primary objective but focus on animal health and safety, or rural development. Under this implementation modality, the government agency in charge would develop a standardized baseline (i.e., a baseline scenario, emission factors, and/or additionality criteria applicable to all mitigation activities in a sector) calculated based on the policy implementation without the additional carbon component. If carbon is sequestered or emissions are reduced below the baseline, emission reduction credits can be issued to the host country government, which they may use to finance or co-finance more ambitious policy implementation. For farmers and private investors, the integration of VCM incentives into larger scale cooperative approaches has the advantage that investments are coordinated with public agencies, and consequently, the host country regulatory risk is significantly reduced.

Governments can also integrate VCM projects into landscape-level Article 6 programs. Article 6.4 can offer opportunities for countries to support agricultural activities. However, agricultural project methodologies are not yet approved and the decision on the inclusion of removal activities is pending which limits current agricultural potential under Article 6.4. In contrast, Article 6.2 of the Paris Agreement provides a platform for sectoral partnerships through jurisdictional programs that contribute to one or several NDCs, in addition to establishing partnership-specific mitigation goals. Embedding public-private partnerships into landscape-level programs allows for the integration of different investment incentives, relying, among others, on VCM, with the goal to create sustainable rural economies. Such programs can combine restoration and climate-smart agricultural programs into a "cooperative approach" under Article 6.2. Activities can be linked to different investment incentives and financing modalities (Figure 8).

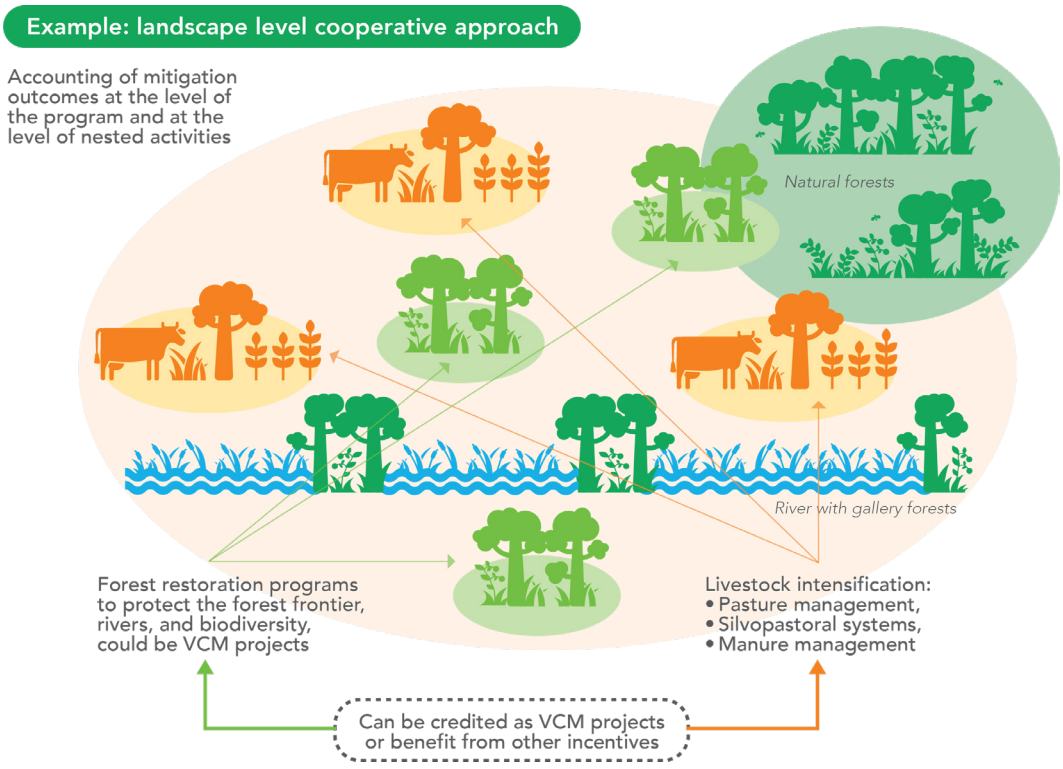


Figure 8. Model landscape approach

An Article 6.2 cooperative approach can define mitigation goals at the program level, establish an accounting approach, and define the criteria for authorized VCM activities. Private sector investments can be attracted and incentivized, among other means, through program elements that allow the grouping of VCM activities into aggregated programs. Governments can offer ITMOs to a portion of the generated mitigation outcomes, which, as a result, could be used for international offsetting purposes and keep the remaining percentage for national NDC accounting. Other mitigation outcomes can be used, depending on the associated claim, in the context of insetting, offsetting, or contribution claims.

Below table presents a summary of implications for governments of different aggregation models:

Table 10. Summary of implications for governments of different aggregation models

	PRIVATE AGGREGATON	PUBLIC PROGRAM MANAGER	A6.2 LANDSCAPE APPROACH
POLICY ALIGNMENT	Not guaranteed	Guaranteed	Guaranteed
GOVERNMENT INVOLVEMENT	Low	Medium	High
INSTITUTIONAL CAPACITIES	Low	Public agency needs to understand VCM rules and procedures	Government needs to understand how to use different carbon market modalities strategically and meet the requirements of Article 6.2 PA.
SCALE	LIMITED	HIGH, IF LINKED TO A POLICY	HIGH, IF LINKED TO A POLICY

6.2. Government Readiness

To effectively regulate, facilitate and participate in VCM activities, host government and government agencies need to be "market ready." Market readiness includes having the necessary technical skills, and policy and institutional frameworks that are required to effectively access and employ private and public financing for low-carbon development through market mechanisms. Several development partners offer Article 6 capacity building that seeks to enable countries to meet the Article 6 eligibility and operational requirements. While these trainings touch on VCM-related capacities (e.g., collecting data, ensuring safeguards, etc.), effective harnessing of VCM opportunities demands a few additional capacities:

- **Technical readiness:** Understanding the functioning of the VCM, being familiar with VCM standards, VCM methodologies, project cycles and VCM-related carbon accounting.
- **Policy readiness:** Identifying the goals for VCM engagement in the agricultural sector and deciding on the government's VCM strategy, including specific government roles and priorities.
- **Institutional and legal readiness:** Designating responsible institutions to oversee VCM activities and adopt laws that are needed for the smooth operation of the VCM, for government regulators and private participants alike.

A government VCM readiness program should include the development of a country-specific VCM strategy for the agricultural sector. Such a strategy would facilitate engagement with the VCM based on an assessment of risks and benefits in the context of countries' prior experiences and particular circumstances, consider existing finance and infrastructure, and support for national climate policy and finance priorities. The development of a VCM strategy would summarize the government's VCM goals in the agricultural sector, requiring consultation with relevant stakeholders to inform outcomes.

A program that supports government readiness could include the following components:

- Organize and consult around VCM goals for the agricultural sector
- Identify priority agricultural mitigation opportunities, conduct an opportunity (cost/benefit) assessment
- Assess knowledge, capacity and institutional gaps
- Develop a data collection and MRV system, formulate reporting requirements
- Define the link between the agricultural sector and Article 6 of the Paris Agreement
- Identify government responsibilities (regulation, facilitation, implementation)
- Develop a programmatic approach towards implementation of VCM activities
- Assess costs and budgetary implications

Governments could seek support from development partners in implementing such readiness programs and creating an enabling environment for the VCM. For instance, the IICA works to promote a more active and informed participation of the agricultural sector in national and international climate processes. In addition to building capacity for agricultural negotiators and engaging with high-level decision makers, IICA works to drive finance towards the sector to enable climate action. IICA supports ministries of agriculture to expand incentives and explore broader options for climate finance to enable greater adaptation and mitigation ambition in the sector. One of IICA's goals is to assist ministries of agriculture and other sectoral actors in the Americas to better understand whether, when, and how they can capitalize on carbon market opportunities to help achieve development and climate goals simultaneously.

7. SUMMARY AND OUTLOOK

The agriculture sector in LAC countries has significant mitigation potential and could play a key role in achieving the Paris Agreement goals. As the main economic sector in many LAC countries, the agricultural sector – particularly livestock and commercial crops like cocoa and coffee – holds important sustainable development opportunities and benefits. However, the sector needs significant investment to transition to more sustainable production practices. Green investment in food production systems in LAC countries is important to ensure the sector's economic growth and diversification, employment and poverty reduction, and food security and improved nutrition, while providing climate-resilient ecosystem services.

VCM investment can accelerate the transition to highly resilient, carbon dense, productive, and diverse agricultural production systems. High integrity VCM projects and programs can draw in significant amounts of investments, often in the form of foreign direct investment, to catalyze a change to well managed agricultural systems. The region has significant experience tapping into carbon finance opportunities, and local and international project developers and investors are ready to deploy more finance into the region should enabling conditions be further strengthened.

Improved pasture management and cocoa and coffee agroforestry systems hold carbon market investment potential and offer multiple sustainable development benefits. High-integrity carbon projects in these sectors can provide socioeconomic benefits including those related to food security (i.e., sufficient access to healthy and safe food sources), improved livelihoods (i.e., securing stable employment and improving farm productivity), environmental benefits (e.g., enhancing biodiversity), and beyond.

In most cases, the long-term socio-economic benefits of improved pasture management and agroforestry projects will outweigh the costs. However, the transition to sustainable agricultural systems requires upfront finance which is often prohibitive for the individual farmer. Government support and carbon finance can play a catalytic role, triggering a change in practices, but the eventual lock-on effect of the changes relates to the many concrete benefits that improved agricultural practices have for farmers and local actors.

In this process, governments play a central role and can engage with carbon markets as regulators, facilitators, and implementers. Policymakers can institute regulations and safeguards that influence climate change mitigation activities and clarify how such activities will be treated under Paris Agreement rules towards fulfilling NDCs. They can also adopt policies that create enabling environments for private sector engagement and create safeguards to direct carbon finance towards high-integrity projects and programs. Governments can ensure fair access to benefits for local communities, smallholders, and Indigenous Peoples by recognizing their traditional and customary land rights and

implementing land titling programs as a strategy for encouraging safeguards and maximizing carbon and biodiversity outcomes.

In preparing to engage with VCM in the agriculture sector, LAC countries should consider the following issues:

1. Governments are advised to record and assess the nature and context of carbon market projects that are already under implementation or planned in the agriculture sector – particularly livestock, cocoa, and coffee sub-sectors in the country. Understanding ongoing or future activities, applied methodologies, and certifying carbon standards is essential for policymakers who seek to use the carbon market to mobilize finance for additional mitigation action.
2. They should also consider how VCMs can complement or be linked to regulated carbon markets. Where a government is planning to achieve mitigation goals through regulated carbon pricing instruments (e.g., cap-and-trade programs or carbon taxes), it may contemplate whether specified quantities of emissions reductions can be delivered by purchasing carbon credits. The VCM can also help to access mitigation options that are not covered by carbon pricing policies.
3. It is important that governments decide whether – and to what extent – voluntary and regulated carbon market transactions should contribute to a country's NDC. This decision requires an assessment of the mitigation potential of existing and planned policies, including the identification of potential mitigation gaps. Carbon markets can also help countries to increase their ambition and generate emission reductions that go beyond existing NDCs. How carbon markets contribute to a country's NDC depends on the decisions a government makes about the types of approved mitigation activities and authorizations of ERR uses under Article 6 of the Paris Agreement.
4. It is also important for governments to assess and understand how carbon finance can contribute to implementing agriculture-related measures and targets in NDCs while supporting countries' sustainable development goals. It is also key that governments understand how carbon finance can reduce the burden of mobilizing budgets or donor funding. Once governments have established carbon finance needs, they can also map the types of international investors – both public and private – that might be interested in acquiring emission reductions or removals and the types of activities in which these actors typically invest.

To realize LAC's agricultural carbon market potential, collaboration remains the essential component. Government agencies and private sector partners must collaborate to overcome investment barriers , which include unclear land titles, lack of farmer aggregation, weak legal frameworks and limited law enforcement, and institutional weaknesses. It is, therefore, essential that public and private actors collaborate to strengthen the enabling environment and reduce risks for carbon markets to flourish, mobilizing transformational finance to help decarbonize the LAC agriculture sector.

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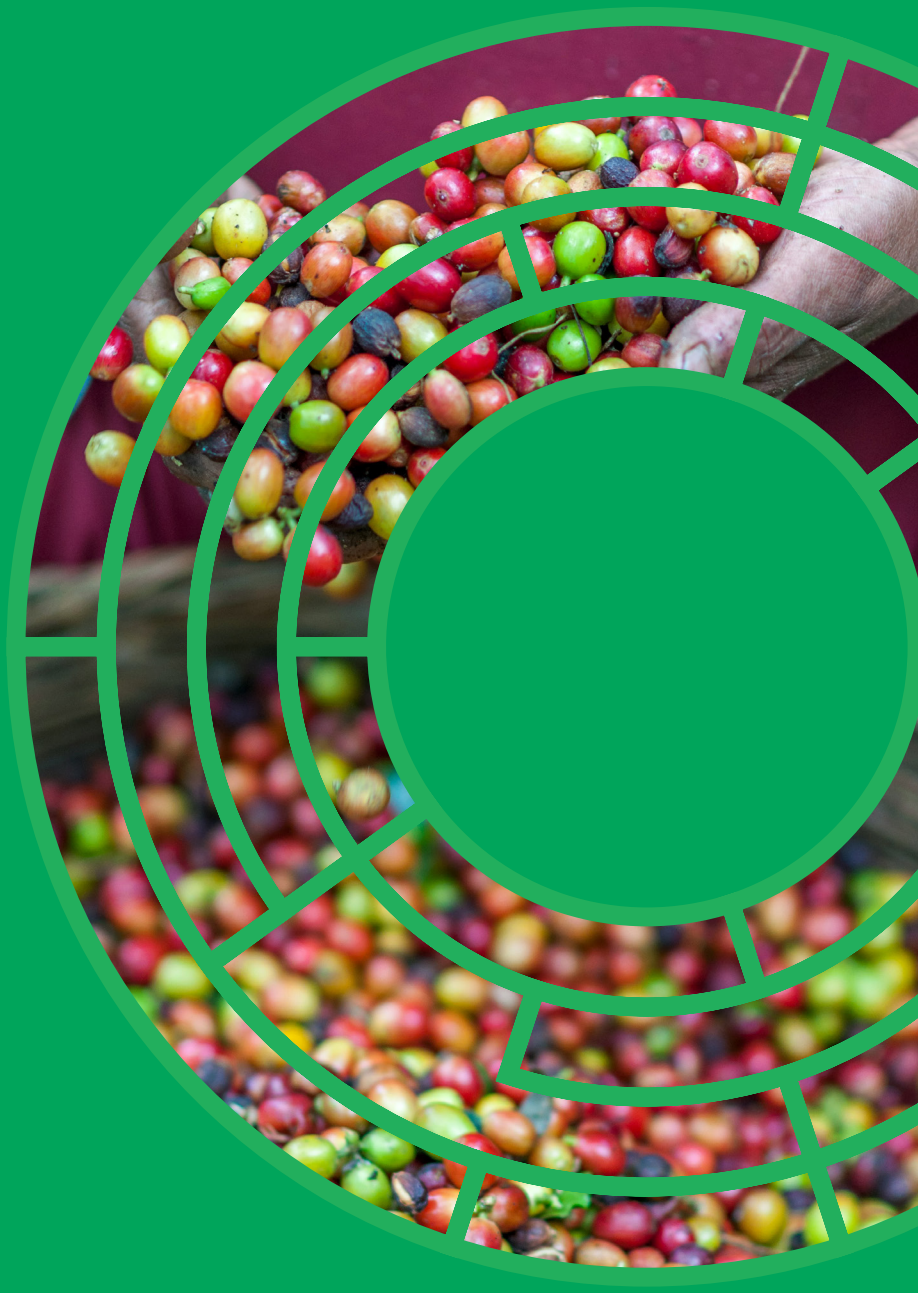

CARBON MARKET OPPORTUNITIES IN LIVESTOCK PRODUCTION, AND COCOA AND COFFEE AGROFORESTRY SYSTEMS

4 December 2023

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