

Overview of Carbon Credit Markets in the Latin America & Caribbean Region

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Acronyms

ACR	American Carbon Registry
AFOLU	Agriculture, Forestry, and Other Land Use
APA	Amerindian People's Association (Guyana)
ART-TREES	Architecture for REDD+ Transactions - The REDD+ Environmental Excellence Standard
BSP	Benefit Sharing Plan (Costa Rica)
CAF	Development Bank of Latin America and the Caribbean
CAR	Climate Action Reserve
CBAM	Carbon Border Adjustment Mechanism
CCER	Chinese Certified Emission Reduction
CCPs	Core Carbon Principles
CDM	Clean Development Mechanism
CERCARBONO	Certificadora de Carbono (Colombia)
CO2e	Carbon Dioxide Equivalent
CORSIA	Carbon Offsetting and Reduction Scheme for International Aviation
DCC	Dirección de Cambio Climático (in English, Climate Change Directorate - Costa Rica)
DDPLAC	Deep Decarbonization Pathways in Latin America Consortium
DMS	Data Management System
DNA	Designated National Authority

ERP	Emission Reduction Program (Costa Rica)
ETS	Emissions Trading System
FONAFIFO	Fondo Nacional de Financiamiento Forestal (in English, National Forest Financing Fund - Costa Rica)
FPIC	Free, Prior, and Informed Consent
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIZ	Gesellschaft für internationalen Zusammenarbeit (in English, German Agency for International Cooperation)
GtCO₂	Gigatonnes of Carbon Dioxide
IATA	International Air Transport Association
ICAO	International Civil Aviation Organization
ICAP	International Carbon Action Partnership
ICVCM	Integrity Council for the Voluntary Carbon Market
IDB	Inter-American Development Bank
IEA	International Energy Agency
INPE	National Institute for Space Research (Brazil)
IPCC	Intergovernmental Panel on Climate Change
IPLCs	Indigenous Peoples and Local Communities
IRENA	International Renewable Energy Agency
IT	Information Technology
ITMOs	Internationally Transferred Mitigation Outcomes
kg H₂	Kilogram of Hydrogen
LAC	Latin America and the Caribbean
LTS	Long-term Strategy
LULUCF	Land Use, Land-use Change and Forestry
MCCR	Mecanismo de Compensación de Costa Rica (in English, Costa Rican Offsetting Mechanism)
MDC	Mercado Doméstico de Carbono (in English, Domestic Carbon Market - Costa Rica)
MIRI	Information, Feedback, and Complaints Mechanism (Costa Rica)
MoE	Ministry of the Environment
MoF	Ministry of Finance
MoI	Ministry of the Interior
MoU	Memorandum of Understanding
MPPI	Indigenous Peoples Planning Framework (Costa Rica)
MPRI	Involuntary Resettlement Policy Framework (Costa Rica)
MRV	Measurement, Reporting, and Verification
MSME	Micro, Small and Medium Enterprises
Mt	Megatonne
MtCO₂e	Metric Tonnes of Carbon Dioxide Equivalent
N₂O	Nitrous Oxide
NbS	Nature-based Solution

NCMP	National Carbon Market of Panama
NDC	Nationally Determined Contribution
NTC	National Toshihos Council (Guyana)
NZU	New Zealand Unit
OTC	Over-the-counter
PMR	Partnership for Market Readiness (World Bank program)
PRODES	Satellite Monitoring of the Brazilian Amazon Forest Project
PV	Photovoltaic
REDD+	Reducing emissions from deforestation and forest degradation in developing countries (the "+" stands for additional forest-related activities that protect the climate, namely sustainable management of forests and the conservation and enhancement of forest carbon stocks)
RENAMI	Registro Nacional de Medidas de Mitigacion (in English, National Registry of Mitigation Measures - Peru)
RENARE	Registro Nacional de Reducción de las Emisiones de Gases de Efecto Invernadero (in English, National Registry of GHG Emission Reduction - Colombia)
RENE	National Emissions Registry (Mexico)
SINARE	National System for Reduction of Greenhouse Gas Emissions (Brazil)
SPAR6C	Supporting Preparedness for Article 6 Cooperation program
tCO₂e	Tonne of Carbon Dioxide Equivalent
UCCs	Unidades Costarricenses de Compensación (in English, Costa Rican Compensation Units)
UN	United Nations
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
USD	US Dollar
VCMI	Voluntary Carbon Markets Initiative
VCS	Verified Carbon Standard

Note: Unless otherwise noted, \$ denotes US Dollars throughout this report.

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Executive Summary

This note introduces the role carbon crediting can play in funding the climate transition in Latin America (LAC)'s Agriculture, Forests, and Other Land Use (AFOLU) sector. Carbon crediting is only one carbon pricing instrument among many, but it is one that can catalyze climate positive change in the land sector. In LAC, the AFOLU sector is a driver of economic growth that provides employment, helps to reduce poverty, and ensures food security and improved nutrition. LAC is the world's largest food net-exporting region, and agriculture accounts for more than 5 percent of GDP in around 20 of the region's countries.

Carbon credit markets have the potential to transform the AFOLU sector, provide much needed resources, and, if well designed and implemented, can deliver important co-benefits. The AFOLU sector is a major source of emissions in the region, a fact that distinguishes LAC from other regions where AFOLU emissions represent a lower share of the total emissions. In LAC, nearly half of 2020 emissions were from AFOLU, with 27 percent from agriculture and 21 percent from forestry and land use.¹ This means that for LAC countries to achieve their NDCs goals and net-zero ambitions, a transformation of the AFOLU sector will be required.² Estimates show that the region has some of the highest potential for afforestation and forest conservation of all world regions, at relatively low cost, providing an opportunity to serve a market increasingly interested in carbon credits that deliver additional co-benefits such as local employment, community development, and biodiversity protection.

¹ In LAC, the greatest GHG emissions source in the agriculture sector is the livestock value chain (approximately 88%), with methane emissions from enteric fermentation representing 44% of total livestock emissions, primarily from specialized beef systems (Morris et al., 2020). Moreover, agriculture is also the primary driver of emissions from forestry and land use, with agricultural activity and ranching responsible for 70% of habitat conversion, leading to deforestation three times the global rate (Morris et al., 2020).

² All countries in the LAC region have communicated an NDC under the Paris Agreement, which set out countries' adaptation and mitigation goals. Moreover, 15 (of 33) countries, representing approximately 64.4% of 2020 emissions in the region, have pledged to achieve carbon neutrality or net-zero (Climate Watch, 2023: <https://www.climatewatchdata.org/net-zero-tracker>. Last access May 2024). As explained in <https://eciu.net/analysis/infographics/our-climate-goals>, net zero goals can be of different sorts. Some refer to CO₂ or GHG net zero (net means to the difference between emissions and removals), while others refer to carbon neutrality. In both cases, residual emissions are often compensated with purchases of carbon offsets credits to reach net zero or carbon neutrality.

This note explores the status of carbon credit markets in LAC, assesses challenges and opportunities, and identifies priority actions going forward as countries start thinking about how to better leverage the potential of credit markets in the AFOLU sector.

Currents Status of Carbon Credit Markets in LAC

At the global level, carbon credit markets are experiencing renewed growth, and LAC is an important supplier of credits. Carbon credit supply has experienced a period of renewed growth led by independent crediting mechanisms issuances, with weaker growth in international and governmental crediting mechanisms.³ Voluntary demand has recently driven growth worldwide, but compliance demand (both international and domestic) is expected to grow as the Paris Agreement evolves and countries' climate ambitions increase. The LAC region is an important supplier of carbon credits to various crediting mechanisms, with approximately 22 percent of the region's credits retired in 2022 being used for compliance purposes under carbon taxes or Emissions Trading Systems (ETSs), and 78 percent for voluntary purposes.⁴ Many recent developments indicate that the region will continue expanding its participation in credit markets. Some independent analyses forecast significant further growth in the period to 2030, largely underpinned by voluntary demand, although purchases for compliance purposes will also increase.⁵ In 2022, 35 percent of credits transacted in voluntary markets were tagged to LAC, up from 9 percent in 2012, putting the region in second place after Asia in volume transacted. In 2022 Asia traded over 102.8 MtCO₂e while LAC transacted 72.3 MtCO₂e.

LAC's participation in voluntary markets has been increasing but prices have remained low, and supply concentrated in a few countries and project types. Even though 22 countries in LAC have at least some experience with carbon credits, supply is concentrated in just a few. The top five issuing countries (Brazil, Peru, Colombia, Chile, and Mexico) have generated nearly 85 percent of all credits, with Brazil alone responsible for nearly half of the total. Prices have remained considerably below the recommended range of \$40-80/tCO₂e in 2020 and \$50-100/tCO₂e in 2030 (see Figure E1).⁶ In terms of sectors, in the 2005-2023 period most Clean Development Mechanism (CDM) credits in the region were issued for activities in the renewable energy and waste management sectors (67 percent), with AFOLU credits representing only 7.6 percent. In contrast, the AFOLU sector represented 78.2 percent of credits issued through voluntary, non-compliance schemes.

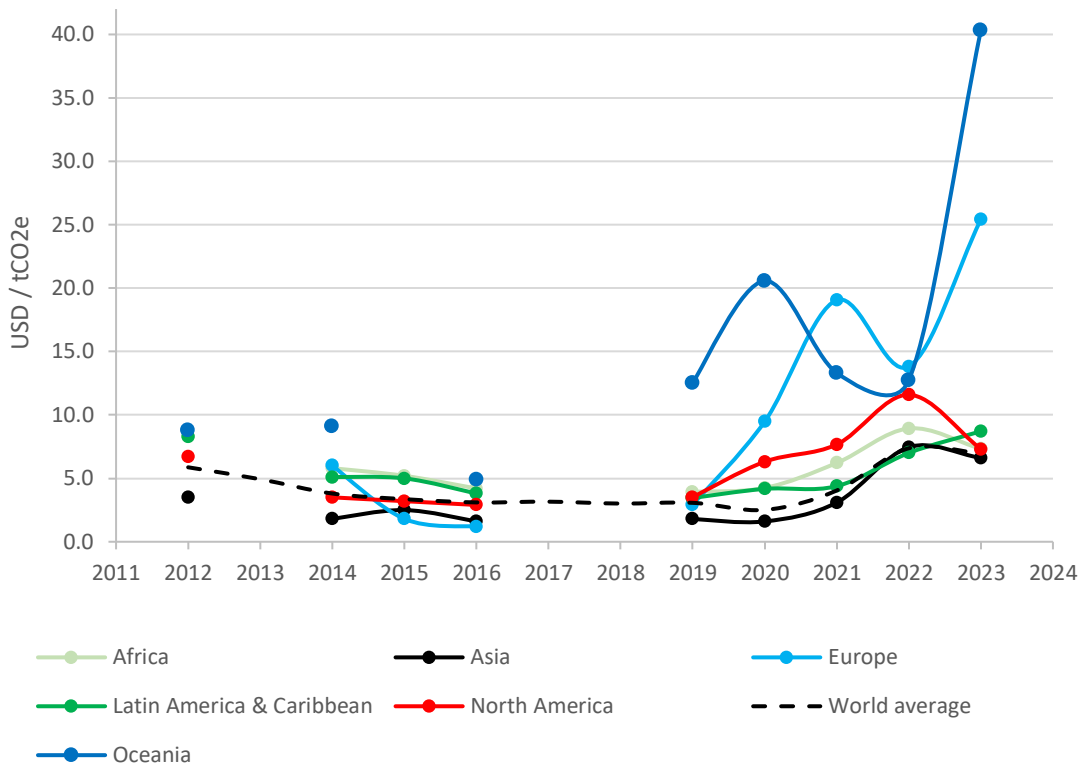
³ International crediting mechanisms are those internationally managed (the three mechanisms established under the Kyoto Protocol and those in Article 6 of the Paris Agreement, Governmental crediting mechanisms are those administered by one or more governments, and Independent crediting mechanisms include those administered by a nongovernmental organization, such as Verra and Gold Standard, for example. (World Bank, 2024)

⁴ World Bank, 2023d.

⁵ BloombergNEF, 2023.

⁶ The High-Level Commission on Carbon Prices found that a price of at least USD 40-80 by 2020 and USD 50-100 by 2030 is needed to achieve the Paris climate goals. High-Level Commission on Carbon Prices. 2017. Report of the High-Level Commission on Carbon Prices. Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO

Figure E1. Average voluntary carbon credits prices per region and globally



Source: World Bank staff elaboration based on, for regions: for 2021-2023, Table 11 in Ecosystem Marketplace (2023); for 2019-2020, Table 7 in Ecosystem Marketplace (2021); for 2016, figure 8 in Ecosystem Marketplace (2017); for 2015, Tables 3-6 in Ecosystem Marketplace (2016); for 2014, several tables in Ecosystem Marketplace (2015); for 2012, Tables 16, 18, 20, 22, 24-26 in Ecosystem Marketplace (2013); and, for world average from 2021-2013: Table 1 in Ecosystem Marketplace (2023); for 2019-2020 in Ecosystem Marketplace (2021), for the rest, Tables in the Introduction section of Ecosystem Marketplace (2019)

Notes: a weighted average is used when Europe is reported separated in EU and non-EU. All prices are “over the counter” (when transaction is direct between seller and buyer).

The way forward: How to support development in LAC by leveraging carbon credit markets

AFOLU credit markets can complement other policy instruments that are designed to achieve national and global climate and biodiversity objectives. The region has low-cost options for the development of AFOLU crediting projects and programs, and several countries in the region have experience in carbon crediting through the CDM, REDD+ and engagement in voluntary carbon markets. However, there are many technical, financial, and institutional hurdles to be tackled, and relatively low carbon prices limit the activities for which carbon crediting is attractive. Incentives for carbon crediting should be well planned

and considered in the context of a portfolio of environmental policy instruments (e.g. standards, taxes, result-based funds, information dissemination schemes, etc.).⁷

Countries should consider the role of carbon crediting in their planning for Nationally Determined Contributions (NDCs), Long-Term Strategy (LTS), and other commitments. For governments in LAC to be able to use carbon crediting strategically, and in a way that is in line with their national plans and development priorities, crediting must be considered as part of broader climate policy planning. This includes the consideration of carbon crediting in the context of Article 6 of the Paris Agreement, with or without authorizing of credits with corresponding adjustments. Such credits will not be counted against the NDCs of the country that authorizes them. For the authorization of credits there are several options that are not mutually exclusive and can be used in combination:

1. **Set a “positive list” that identifies activities that are automatically eligible for authorization.** Countries can adopt positive lists for credits that would be allowed to be used by other countries or private companies against their commitments. In some cases, countries may use marginal abatement cost curve analyses to give priority to high-cost mitigation options on the list.
2. **Limit authorization to a certain percentage or amount of credits such that the host country can claim part of the mitigation towards its own NDCs.** This would allow activities to sell a portion of credits with the right to account them against other countries’ NDCs while another portion could be counted against the host country’s NDCs.
3. **Levy a fee on carbon credits that can then be invested in additional mitigation.** Historic examples include China and Vietnam, which retained a portion of revenues from domestic CDM projects to finance other environmental measures.

Laying the groundwork to leverage carbon credit markets as an instrument to support a low carbon transition will require actions along three lines: strengthening institutions, promoting investment to encourage project development and enhance integrity through adequate information systems, and fostering innovation to support the growth of high-quality carbon credits. This note provides some priority actions needed along these three lines, previewed below.

Build better institutions to leverage benefits for the economy, the planet, and people

A stable governance and regulatory environment, with transparent rules for project approval and authorization, effective communication, and efficient administration supports investment into carbon crediting activities. The institutional structures and decision-making processes necessary to manage a country’s participation in and engagement with carbon crediting could include:⁸

- Oversight level: a steering group exercises overall authority, making decisions, deciding policy, and facilitating coordination between ministries.⁹
- Administrative level: administrator handles day-to-day operational matters, dealing with stakeholder queries, collecting fees and processing requests.

⁷ Goulder, Lawrence H., and Ian WH Parry. "Instrument choice in environmental policy." *Review of environmental economics and policy* (2008).

⁸ Prag et al., 2012.

⁹ Spalding-Fecher et al., 2022

- Expert advisory level: a technical committee or advisory group provides input or technical expertise, for instance on crediting methodologies or MRV procedures, when necessary.

Countries in LAC already have governance structures from the CDM, and in some cases compliance instruments, on which they can and should build. To scale up crediting activity and participation in Article 6, these structures will need to be further developed. Appropriate governance structures will vary by country, depending on existing arrangements, available resources, and the model chosen for carbon market participation. However, there are several common features that will need to be considered. Governments must ensure that governance of carbon crediting activities is integrated within any existing governance structures, and that it includes cross-ministerial coordination. In all cases governments must consider how the administration of the system will be funded, and whether a system of fees for services by the administrator is needed to ensure its financial sustainability or if funds would come from the government's general budget.

The adoption of legal frameworks for carbon crediting markets, particularly for carbon rights in land-use projects, can help address investment risks. Given the diversity of national contexts, there is no one-size-fits-all approach to an appropriate legal framework. However, legislation could be advantageous, especially for forest and land use projects, where implementation can be hindered by a lack of clarity over the rights to land and carbon, and where governments may seek direct involvement in carbon markets. Governments may also want to take regulatory measures to protect the rights of indigenous peoples and local communities (IPLCs) and ensure that national assertions of ecosystem service rights do not override or undermine the rights IPLCs. Another advantage in setting a clear regulatory framework for carbon credits is that where there are well-established laws on land titling—including forested land—landowners and communities can directly receive the revenues and benefits from carbon rights, ensuring the realization of co-benefits.

The case for a domestic crediting mechanism is strongest where there is significant and predictable local demand, which in practice is often driven by a compliance instrument. When such a compliance instrument is in place, the potential associated savings (e.g., from reducing administrative fees and streamlining processes) may outweigh the costs of operating the mechanism. Alternatively, a regional crediting mechanism—operating in multiple countries and collectively governed—could be considered given its potential for greater scale and sharing of administrative costs. Reliance on internationally recognized crediting standards helps to ensure the environmental integrity of carbon credits. Doing so will also increase the likelihood of such credits being purchased by international buyers. The benchmarks offered by several initiatives focused on improving integrity in the voluntary carbon market (VCM)¹⁰ can help countries to identify carbon crediting approaches that have greater environmental integrity.

Building human capacity across all stakeholders is necessary, including in local and indigenous communities. Successful carbon markets involve different actors possessing the appropriate capacities: government regulators; project developers; project operators; carbon crediting programs; validation and verification bodies; retail traders; brokers; investors and financial sector actors; engineering and geological service providers; local consultancies; third-party infrastructure providers; and end buyers. The development of local capabilities allows more services to be delivered by local companies, thereby

¹⁰ Examples include the Integrity Council for the Voluntary Carbon Market (ICVCM), the Voluntary Carbon Markets Integrity Initiative (VCMI), the Carbon Credit Quality Initiative (CCQI), as well as agencies that rate the quality of individual carbon crediting projects (e.g. BeZero Carbon, Calyx Global, Sylvera).

reducing reliance on international firms and building capacity to export services to other regions. There are already several firms originating in LAC that are taking that path. For example, MGM Innova Group or Coraliae.¹¹

The lack of human capacity is an important bottleneck across many elements of the crediting value chain, slowing down processes and increasing costs. There are different levels of capacity requirements. At a minimum, governments that seek active involvement in carbon crediting markets need sufficient knowledge and resources to carry out core tasks, such as developing an overall strategy, establishing regulations, and implementing daily operations. Most governments in LAC will need to enhance capacity to implement these measures. It is important that knowledge is shared beyond the ministry of environment (typically responsible for carbon crediting), to other interested departments such as ministries of finance, national planning, or justice. Further, capacity-building initiatives are crucial to staff and train the teams that draft and operationalize the regulations necessary for crediting.¹² Finally, it is also important to build capacities among private sector actors and enhance understanding of carbon markets in local and indigenous communities. This will reduce implementation risks, as well as equip IPLCs with the tools to effectively engage in carbon transactions and negotiate with project developers.

Invest in digital infrastructure to support efficiency, transparency and financial integrity of the emerging market

The specific infrastructure needs will depend on several factors, including whether the country operates its own domestic crediting mechanism and the extent to which actors seek authorizations for correspondingly adjusted credits.¹³ Elements of a digital infrastructure include:¹⁴

- Register: database that only records information on individual units, such as the location of the project and a unique identification number
- Transaction Registry: includes the basic register functionality of the register but goes beyond it by supporting transfers between user accounts and linkages to other registries. Trading or exchange registries offer a centralized marketplace and hence provide deepened market liquidity, improved price discovery, and lower transaction costs.

There are different circumstances in which countries may choose to implement their own registry, especially where they are operating a carbon pricing compliance instrument.¹⁵ Depending on their size and level of activity in carbon markets, countries could choose to have only a simple register and

¹¹ <https://consulting.mgminnovagroup.com/servicios/>, <https://www.coraliae.com/>, <https://pachama.com/> respectively.

¹² Several LAC countries have experience with capacity-building activities for compliance instruments. With support from the World Bank, Colombia developed a capacity-building strategy for its ETS that was designed to ensure that information was generated and appropriately shared, trust was built, and buy-in from various stakeholder groups was secured (adelphi, 2020). In Mexico, MEXICO2 has been working with subnational governments to build capacity on markets for carbon credits. The PMR and GIZ have also implemented several capacity-building initiatives in Mexico, providing support on the development of communications and policy coordination strategies.

¹³ "Making a corresponding adjustment means that when Parties transfer a mitigation outcome internationally to be counted toward another Party's mitigation pledge, this mitigation outcome must be 'un-counted' by the Party that agreed to transfer it." (<https://climatefocus.com/publications/article-6-corresponding-adjustments/>).

¹⁴ TSVCM, 2021.

¹⁵ Countries can rather than building a new registry from scratch draw on other experiences from the region: for example, Costa Rica National Climate Change Metrics System was deliberately designed to be open source, so that the code could be adapted by other developing countries (World Bank, 2020d).

complement it by leveraging an international transaction registry, built and maintained by the UNFCCC, for example. Governments will be able to open a national account in this international transaction registry, which will have all the functionality required for meeting Article 6 participation requirements. This option avoids the costs associated with operating a national transaction registry and may be particularly relevant for small countries with scarce resources. There are some cases where LAC countries could benefit from a domestic public platform for trading carbon credits, particularly where they serve a compliance demand or there is an active local market in carbon credits. The rollout of national exchanges, such as Panama's planned platform, will provide a useful example for other countries in the region on operating an exchange platform. In other countries' circumstances, when domestic transaction registries are not developed, credits will still be able to be transacted via international registries, especially when generated through independent or international mechanisms.

Coherence between national greenhouse gas (GHG) inventory and crediting activity is important.¹⁶

Inventories are the basis for assessing the effectiveness of mitigation policies and tracking progress against national targets. As such they are also relevant to carbon crediting efforts. Governments in LAC should therefore consider whether emission reductions from crediting activities, particularly those authorized to be used for compliance by other countries (i.e., those with corresponding adjustments), will be captured in their inventories when considering their strategy and approach towards authorization. If the inventory is not sufficiently granular, then there is a risk that emission reductions achieved by carbon crediting projects may not be fully or correctly captured. This can decrease the possibilities for achieving a country's NDC targets.

Focus on innovation in project design and to ensure high-quality carbon credits

It would be beneficial for countries to consider innovative project types, focusing on those that can generate high-quality carbon credits. LAC countries could benefit from innovative land or ecosystem approaches such as direct air capture, biochar, enhanced weathering, and blue carbon, building on the region's vast renewable energy potential, agricultural production, and rich ecosystems. Technical innovation and careful analysis will be needed to address challenges related to measurement, reporting, and verification (MRV) and to ensure permanence and protect biodiversity and energy security.

Countries should capitalize on the opportunities of digital MRV and share that knowledge with regional neighbors. Knowledge-sharing activities can enable countries to leapfrog challenges their neighbors have already faced by facilitating regulatory alignment, disseminating research and findings to support decision making, and expediting the diffusion of technological advancements and lessons learned. Advances in digital MRV—in particular, the use of data collected from satellites and drones, artificial intelligence, and machine learning models—provide a key area of innovation and opportunity in LAC. Automated data collection and reporting could improve data accuracy, reduce costs, and shorten processing times associated with MRV. A digital MRV system that relies on artificial intelligence and machine learning models can be applied to data collected from satellites and drones, to identify areas of deforestation and estimate carbon stocks. Automated data collection can also enable the enforcement of liability in cases of reversals. The main advantage of this approach is the ability to monitor large tracts of land without the need for physical inspections. Beyond reducing transaction costs for crediting activities and enabling

¹⁶ <https://climatefocus.com/wp-content/uploads/2023/11/Double-Claiming-and-Corresponding-Adjustments.pdf>

enforcement of liability in cases of reversals, such systems can be key in supporting interventions to address illegal deforestation, as in the case of Brazil.

Introduction

The impacts of climate change increase the financing needs of the Latin America and Caribbean Region (LAC). With the impacts of climate change becoming increasingly evident, a growing concern among countries in the region is the significant financing required as they strive to meet their mitigation targets and adaptation needs. Indeed, the expenditure needed to meet climate goals as a percentage yearly gross domestic product for countries in the region is relatively higher than the world average.^{17,18} The Inter-American Development Bank estimates that regional decarbonization in line with the Paris Agreement goals will involve infrastructure investment of 2-8 percent of GDP until 2030 (\$133-559 billion in 2030).¹⁹ For example, Brazil's additional investment needs and total economic costs for climate action are estimated at about 0.5 percent of GDP for 2022-2050; for Colombia costs stand even higher at 1.5 percent of GDP for 2023-2030 and 1.1 percent for 2031-2050.²⁰ Finance from carbon credit markets—the focus of

¹⁷ Cardenas and Orozco, 2022. The Challenges of Climate Mitigation In Latin America and the Caribbean: Some proposals for action. UNDP Latin America and the Caribbean. *Policy Documents Series. UNDP LAC PDS*, (40).

¹⁸ A similar message comes out from the adaptation gap report, where LAC is the second region with the highest estimated adaptation costs for 2030, after East Asia & Pacific. United Nations Environment Programme (2023). *Adaptation Gap Report 2023: Underfinanced. Underprepared. Inadequate investment and planning on climate adaptation leaves world exposed.* Nairobi. <https://doi.org/10.59117/20.500.11822/43796>

¹⁹ Tall et al. (2021) estimate that LAC needs an estimated USD 18.1 billion above current spending each year to respond to the impacts of climate change.

²⁰ Additional investment needs and economic costs for resilient and low-carbon development in Brazil apply to the following sectors: power, transport, forest landscapes, and industry. Calculations for Colombia assume that additional financing needs (% of GDP) = public sector (climate transition costs - resources from revenue shifts and net spending reductions) + private sector (additional climate investment).

this note—is currently only a small fraction of the region’s total investment needs; in 2022, investments in carbon credit projects in LAC amounted to approximately \$1.1 billion.²¹

Putting a price on carbon enables the raising of funds for climate action.^{22,23} Both carbon taxes and carbon trading mechanisms assign a price to carbon. Governments can raise resources from carbon taxes, auctioning carbon permits, or imposing fees on carbon credit transactions. Private actors can in turn derive income from selling carbon permits or carbon credits. But carbon pricing is only one tool within a broader portfolio to finance a low carbon transition.²⁴ Policy mixes of carbon pricing and other instruments (emission rate regulations, voluntary carbon footprint programs,²⁵ clean technology subsidies, etc.) can be combined in such a way as to create positive synergies among them.²⁶ Other important sources of funding could include, for example, the removal of fossil fuel subsidies, the issuance of green bonds, or options of results-based climate financing (RBCF), under which money is paid when climate goals are achieved.^{27,28}

Carbon taxes directly set a price on the carbon content of some goods (e.g., fossil fuels). By contrast, in carbon markets, interaction of demand and supply determine the price of carbon (see Box 1 for the difference between both). Based on carbon prices, market participants (e.g., firms or government agencies) can decide whether to continue (net) emitting and pay the price for carbon, or to reduce (net) emissions and avoid the additional cost implied either by the imposition of a tax or by the market prices. In this way, these instruments incentivize emission reductions in a least-cost manner across a broad range of actors in the economy.²⁹

²¹ Trove Research (2023a). *South American Carbon Markets Webinar*. <https://trove-research.com/webinar/save-the-date-south-american-carbon-markets-webinar/>

²² Parry, I. W., Black, S., & Zhunussova, K. (2022). Carbon Taxes or Emissions Trading Systems?: Instrument Choice and Design. *Staff Climate Notes*, 2022(006).

²³ Vona, F. (2021). Managing the distributional effects of environmental and climate policies: The narrow path for a triple dividend. OECD.

²⁴ Peace, Janet; Besley, Daniel James; Rhoades, Erika L.; Rastogi, Namrata Patodia; Prasad, Neeraj. *Report of the High-Level Commission on Carbon Pricing and Competitiveness (English)*. Washington, D.C. : World Bank Group. <http://documents.worldbank.org/curated/en/715631581657071426/Report-of-the-High-Level-Commission-on-Carbon-Pricing-and-Competitiveness>

²⁵ Several countries (e.g., Ecuador, Chile, Peru, and Panama) have also established voluntary carbon footprint programs, through which local companies can calculate their emissions (Rescalvo, 2022). As part of the process of recognition within the system, participants are encouraged to offset their emissions using credits generated from local projects. This approach can serve as one model to build local demand for credits generated within LAC.

²⁶ Sometimes different carbon pricing schemes are combined. For example, Colombia has a carbon tax and carbon credits can be used to comply with tax obligations. This approach can also serve as one model to build local demand for domestically created carbon credits.

²⁷ World Bank Group; Frankfurt School of Finance and Management. 2017. Results-Based Climate Finance in Practice: Delivering Climate Finance for Low-Carbon Development. © World Bank, Washington, DC. <http://hdl.handle.net/10986/26644> License: [CC BY 3.0 IGO](https://creativecommons.org/licenses/by/3.0/).

²⁸ An example of that type of RBCF is the recent World Bank Development Policy Loan to Uruguay which ties a reduction in the interest rate of the loan to a verifiable decrease in the intensity of methane gas emissions from livestock production with respect to the country compromise to the Paris Agreement. <https://www.worldbank.org/en/news/press-release/2023/11/17/banco-mundial-uruguay-recibe-un-prestamo-pionero-que-premia-el-cumplimiento-de-ambiciosas-metas-ambientales>

²⁹ World Bank, 2023a.

Box 1. A primer on carbon taxes and carbon trading systems

In addition to **carbon taxes**, there are two types of carbon trading systems:

- **Cap-and-trade:** a limit (cap) on emissions is set, and emission permits are either auctioned off or distributed for free according to specific criteria. Market participants can trade these permits among themselves.
- **Baseline-and-credit:** there is no fixed limit on emissions, but polluters that reduce their emissions below levels expected under a “business as usual” model earn “credits” that they can then sell to other participants.

While carbon taxes and cap-and-trade schemes are regulated compliance instruments, crediting schemes (i.e., “baseline-and-credit”) can be of a compliance or voluntary nature. Some emissions trading or tax schemes allow carbon credits to be used to meet compliance obligations.

The supply of carbon credits comes from:

- **Carbon credit schemes set at the international level** (e.g., the Kyoto Clean Development Mechanism (CDM) and cooperative approaches defined in Article 6 of the Paris Agreement*).
- **Carbon credits generated through independent mechanisms** (e.g., American Carbon Registry, Climate Action Reserve, Gold Standard or Verified Carbon Standard -Verra).

On the demand side there are two types of key players:

- **Intermediate demand:** brokers or traders who hold credits for onward sale.
- **End demand:** person, organization or country that retires the credit, either to meet *an international** or domestic compliance obligation, to offset emissions voluntarily*, or that purchases carbon credits without using them as offsets. Either international or independent schemes can be used to meet voluntary demand for carbon credits.

Carbon credits can be generated through three types of activities:

- **Avoidance:** action that prevents a carbon-emitting activity (future possible impact) from happening (e.g., avoided deforestation)***
- **Reduction:** activity that decreases the amount of greenhouse gas emissions (e.g., reduce the methane that is generated by livestock).
- **Removal:** process of removing carbon from the atmosphere and locking it away (e.g., by reforestation).

Note that carbon credits monetize emission avoidance, reduction, and removal, while carbon taxes and cap-and-trade mechanisms assign a price to emissions, not to their avoidance, reduction, or removal.

Notes:

* Article 6.2 creates the basis for trading in GHG emission reductions and removals (also known as “mitigation outcomes” or ITMOs) across countries. Article 6.4 establishes a trading mechanism for GHG emission reductions under the supervision of the UNFCCC; Article 6.8 recognizes non-market approaches, such as cooperation through finance, technology transfer, and capacity building, to promote mitigation and adaptation.

** This includes international credits demanded by airlines to meet offsetting requirements under the Carbon Offsetting and Reduction Scheme for International Aviation (CORSIA). At present, the mechanism is voluntary, but from 2027 through 2035, it will be mandatory for all states that in 2018 had an individual share of international aviation activities in revenue tonne kilometer or RTK (i.e., a metric tonne of revenue load is carried in one km) above 0.5 per cent of total RTKs or whose cumulative share in the list of states from the highest to the lowest amount of RTKs reaches 90 per cent of total RTKs, except Least Developed Countries (LDCs), Small Island Developing States (SIDS) and Landlocked Developing Countries (LLDCs), unless they volunteer to participate in this phase.

*** To which extent carbon credits can also be used through avoidance of future emissions (e.g., by conserving forests or other ecosystems) is contested (see discussion in <https://carbonmarketwatch.org/2022/11/02/cop27-faq-article-6-of-the-paris-agreement-explained/>). For activities such as reduced emissions from deforestation, the imminent threat of deforestation determines whether an activity reduced emissions or avoids them. The avoidance of emissions is currently not eligible under Article 6.4 of the Paris Agreement.

Among the main carbon pricing instruments, this note focuses on carbon crediting in the Agriculture, Forests, and Other Land Use (AFOLU) sector in Latin America. For LAC, the AFOLU sector is a driver of economic growth that provides employment, helps to reduce poverty, and ensures food security and

improved nutrition. LAC is the world's largest food net-exporting region, and agriculture accounts for more than 5 percent of GDP in around 20 of the region's countries.³⁰

Despite this promise, the AFOLU sector is also a major source of emissions in the region, a fact that distinguishes LAC from other regions where AFOLU emissions are not as high. In LAC, nearly half of 2020 emissions were from AFOLU, with 27 percent from agriculture and 21 percent from forestry and land use.³¹ These are significantly above the global averages of 12 percent and 3 percent, respectively.³² Conversely, the proportion of emissions from the energy sector is small and lower than the global average. This means that for LAC countries to achieve their NDC goals and net-zero ambitions, a transformation of the AFOLU sector will be required.³³ Estimates show that the region has some of the highest potential for afforestation and forest conservation of all world regions, at relatively low cost.³⁴ Countries in South and Central America, such as Brazil, Colombia, and Panama, have an estimated 250 million hectares available for immediate reforestation.³⁵ Carbon credit markets provide an opportunity to catalyze efforts to transition the AFOLU sector by attracting finance for public or private projects or programs.

In what follows, this note explores the status of carbon credit markets in LAC and assesses challenges and opportunities. It closes by identifying priority actions going forward as countries start thinking about how to better leverage the potential of credit markets in the AFOLU sector.

Currents Status of Carbon Credit Markets in LAC

After ten years of low activity following the early years of high demand for CDM credits, over the last five years, carbon credit markets have experienced a period of renewed growth led by independent crediting mechanisms. The UNFCCC estimates that the Kyoto CDM^{36,37} helped catalyze more than \$300 billion of investment in climate and sustainable development projects in developing countries from 2001

³⁰ Yarlagadda, B., Wild, T., Zhao, X., Clarke, L., Cui, R., Khan, Z., ... & Lamontagne, J. (2023). Trade and Climate Mitigation Interactions Create Agro-Economic Opportunities With Social and Environmental Trade-Offs in Latin America and the Caribbean. *Earth's Future*, 11(4), e2022EF003063.

³¹ In LAC, the greatest GHG emissions source in the agriculture sector is the livestock value chain (approximately 88%), with methane emissions from enteric fermentation representing 44% of total livestock emissions, primarily from specialized beef systems (Morris et al., 2020). Moreover, agriculture is also the primary driver of emissions from forestry and land use, with agricultural activity and ranching responsible for 70% of habitat conversion, leading to deforestation three times the global rate (Morris et al., 2020).

³² Climate Watch, 2023.

³³ All countries in the LAC region have communicated an NDC under the Paris Agreement, which set out countries' adaptation and mitigation goals. Moreover, 15 (of 33) countries, representing approximately 64.4% of 2020 emissions in the region, have pledged to achieve carbon neutrality or net-zero (Climate Watch, 2023: <https://www.climatewatchdata.org/net-zero-tracker>. Last access June 2024). As explained in <https://eciu.net/analysis/infographics/our-climate-goals>, net zero goals can be of different sorts. Some refer to CO₂ or GHG net zero (net means to the difference between emissions and removals), while others refer to carbon neutrality (in such a case, emissions would be compensated with purchases of carbon offsets credits to reach net zero).

³⁴ Grafton et al., 2021.

³⁵ Cárdenas & Orozco, 2022.

³⁶ The Clean Development Mechanism (CDM) [the flexible mechanisms introduced in the article 12 of the Kyoto Protocol]. The mechanism allowed a party with emission reduction commitments listed in Annex B of the Kyoto Protocol (developed countries and economies in transition from previous Soviet Union) to implement abatement projects in a developing country and, upon verification, to receive certified emission reductions (CERs) for the abatement. The party obtaining the credits could use them to obtain compliance with its national (if allowed) or Kyoto Protocol emission reduction objectives (Millock, 2013).

³⁷ K. Millock, (2013) Clean Development Mechanism, Editor(s): Jason F. Shogren, Encyclopedia of Energy, Natural Resource, and Environmental Economics, Elsevier, 2013, Pages 15-21.

to 2018,³⁸ but the CDM participation in the carbon credits market faded soon after. Subsequent years were marked by low levels of transactions, while crediting through independent mechanisms increased (Figure 1). However, independent mechanism credits accounted for only \$2 billion in 2022, which is much lower than the financing raised by the CDM at its peak. In 2022, the volume of carbon credits issued decreased, and the composition changed. Credits issued by independent mechanisms dropped 22 percent with respect to 2021, while the supply of CDM credits grew again. That latter increase seems to be linked to the decision taken at the CMA3 (the 3rd session of the Conference of the Parties serving as the Meeting of the Paris Agreement) that some CDM credits could be used to meet countries' first NDC targets.³⁹ **Voluntary demand has become the main driver of market growth worldwide, but demand is expected to grow as the Paris Agreement evolves and climate ambition increases.** Of the credits retired in 2022, approximately 43 million were used for compliance purposes under carbon taxes or emission trading systems (ETs), with the remaining 153 million retired for voluntary purposes.⁴⁰ Some independent analyses forecast significant further growth in the period to 2030, largely underpinned by voluntary demand, although purchases for compliance purposes will also increase.⁴¹ The projections for the global market value in 2030 vary between \$5-50 billion,⁴² \$15-47 billion,⁴³ and \$10-40 billion.⁴⁴ The extent of the credit market growth, however, is uncertain due to the reliance in part on voluntary demand, which has not yet been tested at the forecasted scale nor in a higher-price environment.^{45,46} However, using Article

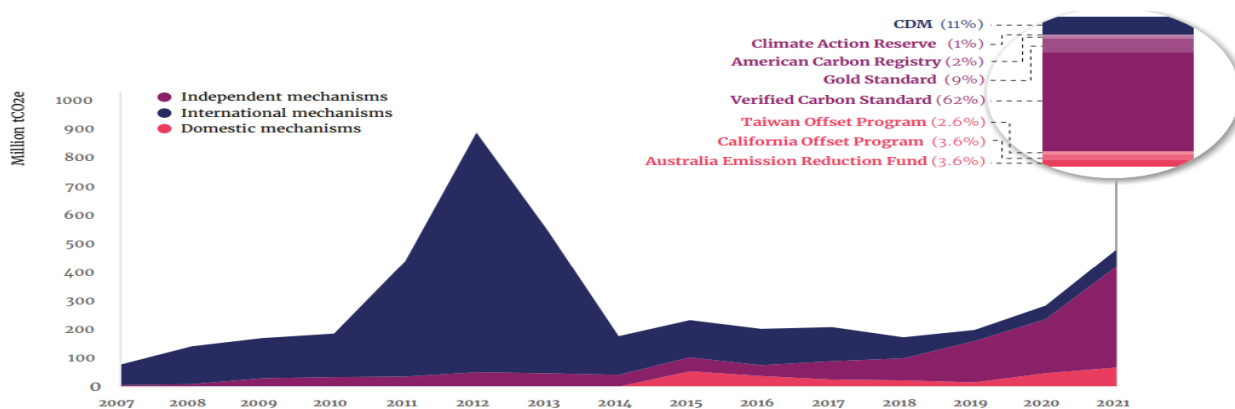
³⁸ UNFCCC, 2018.

³⁹ Within the Conference of the Parties of Paris Agreement (CMA), specifically decision 3/CMA.3, annex, chapter XI.A, and decision 7/CMA.4, annex I. refer to the transition of CDM to art. 6.4

6 is expected to lead to significant credit market activity and, as a result, increased financial flows to developing countries, while lowering the overall cost of meeting emissions reduction goals globally.⁴⁷

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Figure 1 – Evolution of global volume of issuances by crediting mechanism category



Source: Figure 9 in The World Bank. 2022. "State and Trends of Carbon Pricing 2022" (May).

Note: There is no similar historical trend figure that updates the information to 2022-2024. However, according to The World Bank. 2023. "State and Trends of Carbon Pricing 2023", CDM credits account for 32 percent of credits issued, increasing substantially their participation, while VCS (one of the independent sources of supply) certificates are 42 percent of issuances for that year.

⁴⁸ World Bank, 2023d.

⁴⁹ BloombergNEF, 2023.

⁵⁰ Citi GPS, 2023.

⁵¹ Bloomberg, 2023.

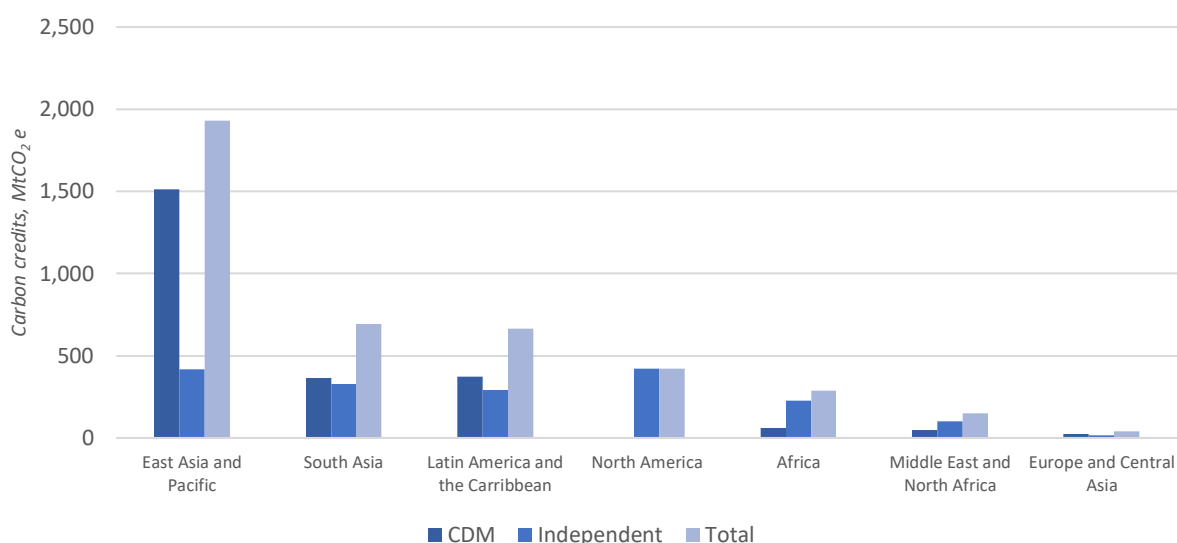
⁵² Trove Research, 2021.

⁵³ Dooks, 2022.

⁵⁴ Trove Research, 2021.

⁵⁵ Edmonds et al., 2023.

Figure 2 – Carbon credit issuance by region for international compliance (CDM) and independent schemes, 2005-2023



Source: Authors' own elaboration based on data from (UNFCCC, 2023b; University of California, 2023)

Government regulation of carbon pricing has been expanding in the LAC region. Five countries, along with six subnational jurisdictions, have now implemented carbon taxes and/or ETS covering approximately 17 percent of the region's emissions.⁵⁶ Additionally, one country already has a pilot ETS and three other countries are currently preparing to introduce it (Table 1). The first carbon tax in LAC was adopted by Mexico in 2014. Since then, carbon taxes have been integrated into wider tax reform processes to fund government-backed climate measures, cut inefficient subsidies, and reduce tax distortions in several LAC countries, including Argentina, Chile, Colombia, and Uruguay.⁵⁷ The first ETS in the region was introduced in 2020 with the launch of Mexico's Pilot⁵⁸ ETS. Three countries, including Brazil, Colombia, and Chile (see Table 1) have ETS under design.

⁵⁶ World Bank, 2023d.

⁵⁷ World Bank, 2023d.

⁵⁸ Costa Rica is also envisaging the creation of a carbon credits framework that upgrades the scheme under which the CDM worked (<https://documents1.worldbank.org/curated/en/469421617604271877/pdf/Partnership-for-Market-Readiness-Costa-Rica-Program-The-Costa-Rican-Offset-Mechanism-MCCR.pdf>).

The number of credit mechanisms is increasing in the region. Colombia was the first jurisdiction in LAC to have a compliance carbon crediting mechanism (called “the non-causation mechanism”), which it established in 2017. This mechanism allows the avoidance of 50 percent of the carbon tax through the purchase of eligible carbon credits.⁵⁹ This brought some dynamism to carbon transactions in the country; over 75 percent of carbon exchanges in Colombia have been used.⁶⁰ Two other countries have carbon crediting mechanisms: Chile’s went into effect in October 2023 and Mexico’s is under development.⁶¹ Finally, the ETS bill in Brazil provides for domestically sourced offsets in the AFOLU sector. In general, crediting mechanisms in LAC aim to supply domestic compliance schemes and the regulations define the eligible types of credits. For example, the Chile carbon tax admits credits from just three sources: CDMs and the VCS and Gold standards.⁶²

Table 1 – Compliance Taxes and Trading Systems Initiatives in LAC

Jurisdiction	CPI	Introduced	Coverage	Price (April 2023) (\$/tCO ₂ e)
<i>In force</i>				
México	Tax	2014	Sale or import of fossil fuels, except natural gas	Between 0.41 and 4, depending on fuel
Chile*, **	Tax	2017	Emissions from installations with a carbon intensity of 25,000 tCO ₂ or more	5
Colombia*, **	Tax	2017	Carbon content of liquid and gas fossil fuels; coal	5
Argentina	Tax	2018	Production, distribution and import of covered fossil fuels	3
Uruguay	Tax	2021	Carbon content of gasoline	155.86
Mexico*, **	ETS	2020	Energy and industry	NA***
Zacatecas (México)	Tax	2017	Emissions from all sectors and all fossil fuels; stationary sources	13.8
State of México (México)	Tax	2022	Stationary sources	2.37
Querétaro (Mexico)	Tax	2022	Substances generated in production processes, subject to reporting; stationary sources	32.07
Yucatán (Mexico)	Tax	2022	Substances generated in production processes; stationary sources	15.46
Durango (Mexico)	Tax	2022	Stationary sources	9.9
Guanajuato (Mexico)	Tax	2023	Stationary sources	13.8
<i>Approved and under development</i>				
Tamaulipas (Mexico)	Tax	2024		
San Luis Potosí (Mexico)	Tax	2024		
Colima (Mexico)	Tax	NA		
Brazil****	ETS	NA		
Colombia	ETS	NA		
Chile	ETS	NA		

Source: Author’s own elaboration with data from World Bank, 2023d; State and Trends of Carbon Pricing, 2024.

⁵⁹ https://www.dian.gov.co/normatividad/Documents/122_000890_CONTRIBUYENTES.pdf

⁶⁰ Rodríguez González, Á. L. (2023). Efectividad del impuesto al carbono y mecanismo de no causación para mitigar el cambio climático en Colombia.

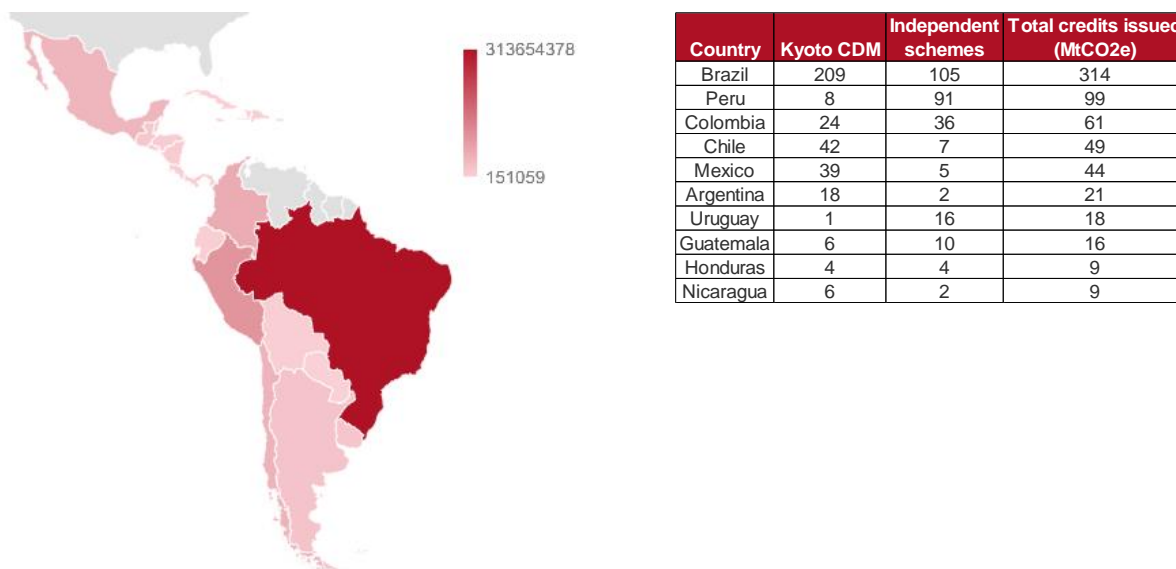
⁶¹ https://carbonpricingdashboard.worldbank.org/carbon_crediting

⁶² World Bank, 2024.

Note: * Allow use of carbon credits. **Also have a national carbon credit program: Colombia (2020), Chile (2022), Mexico (under development).
 *** During the pilot phase of the Mexican ETS, the program will have no economic impact on the covered entities. Covered entities receive free allowances corresponding to their previous emissions and receive no financial penalties for failure to surrender allowances, thus no price signal has been set yet. **** Under consideration at the Congress (approved in Senate and need to pass the other Chamber); it would allow the use of carbon credits.

The total supply of carbon credits in LAC is concentrated in a few countries and among just a few types of projects. Even though 22 countries in LAC have at least some experiences with carbon credits, supply is concentrated in just a few. The top five issuing countries (Brazil, Peru, Colombia, Chile, and Mexico) have generated nearly 85 percent of all credits, with Brazil alone responsible for nearly half of the total. Conversely, Caribbean countries—most of which are small island states—have generated just 1.5 percent of credits from the region, with many countries not hosting any crediting activities (Figure 3). The limited contribution to credit supply from small countries is not surprising considering their overall low emissions. Further, because the fixed costs of developing carbon projects are high, economies of scale are often needed to reach positive benefit cost ratios. In terms of sectors, in the 2005-2023 period most CDM credits in the region were issued within the renewable energy and waste management sectors (67 percent),⁶³ with AFOLU credits— representing only 7.6 percent. In contrast, the AFOLU sector represented 78.2 percent of credits issued through independent schemes (Figure 4).⁶³

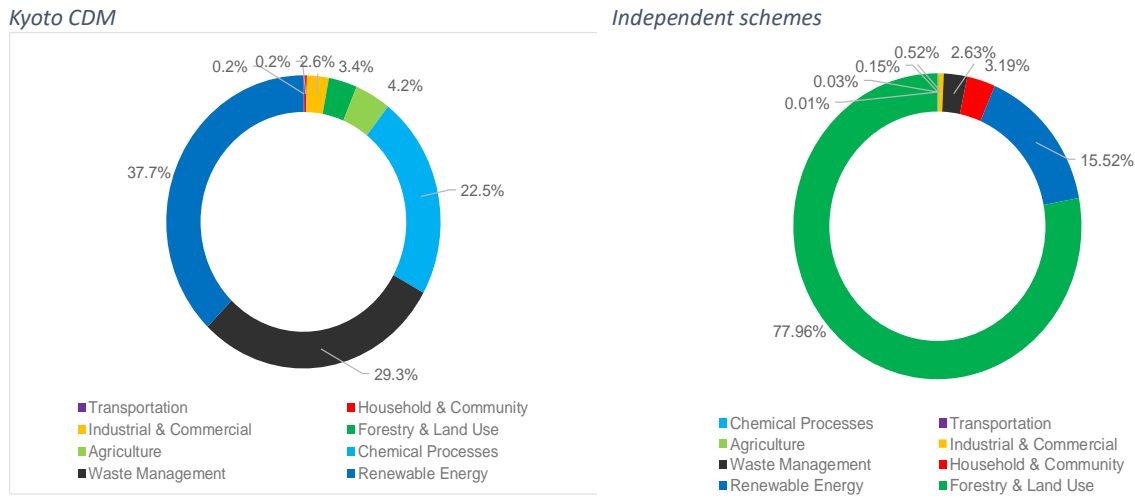
Figure 3 – Issuance by country in LAC, with breakdown of top ten total international credits issuing countries (2005-2023)



Source: Authors' own elaboration based on data from (UNFCCC, 2023b; University of California, 2023)

⁶³ Project category definitions available at: <https://gspp.berkeley.edu/assets/uploads/page/VROD-ScopesTypes-v8.pdf>

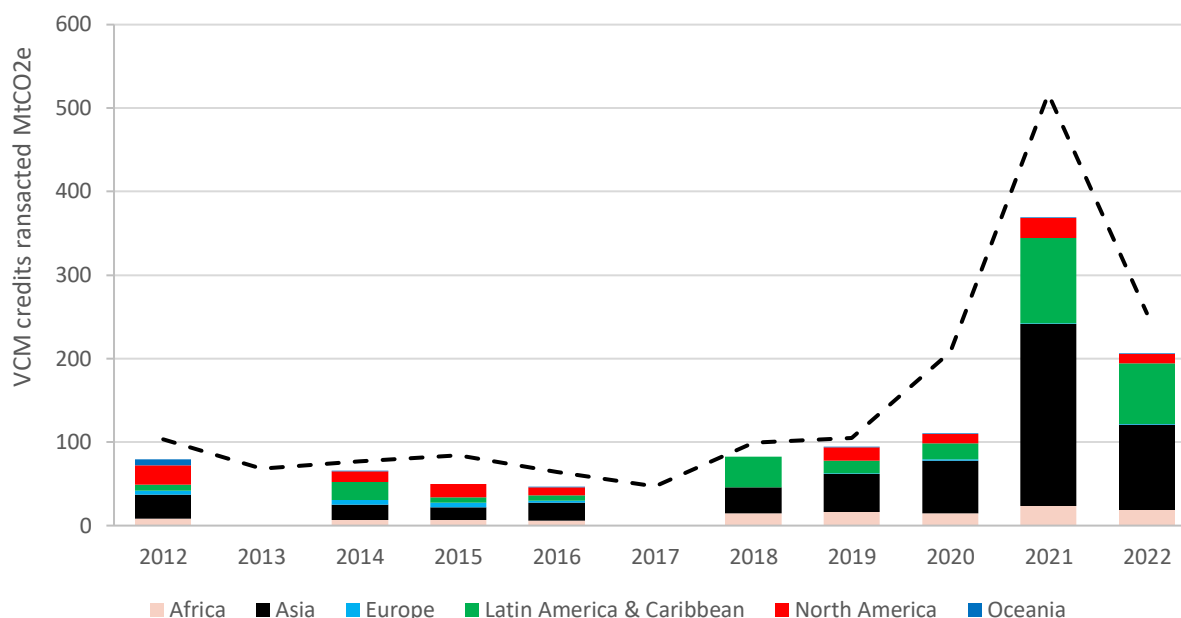
Figure 4 - Credit issuance by project category in LAC (2005-2023)



Source: Authors' own elaboration based on data from (UNFCCC, 2023b; University of California, 2023)

LAC participation in voluntary markets has also been increasing. In 2012, LAC volumes of transacted credits in voluntary markets accounted for 9 percent of the total of credits tagged to a region, according to Ecosystem Marketplace reports. In 2022, the share had increased to about 35 percent (Figure 5). A historical overview of voluntary carbon credits by geographical region shows that in 2021 and 2022, the LAC region was in second place, after Asia, in terms of volume transacted. In 2022 Asia traded over 102.8 MtCO₂e while LAC transacted 72.3 MtCO₂e, representing 35 percent of total credits traded that year.

Figure 5. Volumes of carbon credits traded in voluntary markets per region and globally



Source: World Bank staff elaboration based on, for regions: for 2021-2023, Table 11 in *Ecosystem Marketplace (2023)*; for 2019-2020, Table 7 in *Ecosystem Marketplace (2021)*; for 2016, figure 8 in *Ecosystem Marketplace (2017)*; for 2015, Tables 3-6 in *Ecosystem Marketplace (2016)*; for 2014, several tables in *Ecosystem Marketplace (2015)*; for 2012, Tables 16, 18, 20, 22, 24-26 in *Ecosystem Marketplace (2013)*; and, for total credits issued for the whole period: from Figure 1 in *Ecosystem Marketplace (2023)*. Notes: data for 2018 is only available for 3 regions and not all in *Ecosystem Marketplace (2019)*; a weighted average is used when Europe is reported separated in EU and non-EU.

The LAC region is an important supplier of carbon credits and it is likely to continue to play a key role.

Many countries in LAC already have experience in carbon crediting, beginning with the CDM and now including increased activity from the voluntary demand of private actors. LAC was the third-largest regional supplier of carbon credits in the 2005-2023 period, having issued around 666 million credits, equivalent to just under 16 percent of total credits issued globally (Figure 2).⁶⁴ For example, McLaren⁶⁵ and Microsoft have bought removal credits from Brazil.⁶⁶ The McLaren Formula 1 Racing Company aims to achieve net-zero by 2040, and 10 percent of that goal would be achieved through carbon offsets. With this strategy in mind, in November 2023 the company signed a deal with Mombak Gestora de Recursos Ltda., a carbon removal startup based in Brazil and working to rebuild the Amazon rainforest by developing

⁶⁴ Data on credit issuances and retirements in this section reflects major independent crediting mechanisms and the CDM. Data on independent crediting mechanisms is from Version 8 of the Berkeley Carbon Trading Project’s *Voluntary Registry Offsets Database* and covers carbon crediting projects listed by four mechanisms: American Carbon Registry (ACR), Climate Action Reserve (CAR), Gold Standard, and Verra (VCS). Available at: <https://gspp.berkeley.edu/research-and-impact/centers/cepp/projects/berkeley-carbon-trading-project/offsets-database>. Data on the CDM projects comes from the UNFCCC CDM’s *Database for Project Activities and Program of Activities*. Available at: <https://cdm.unfccc.int/Projects/projsearch.html>. Data is correct as of May 2023.

⁶⁵ <https://carbonherald.com/mclaren-racing-acquires-carbon-credits-in-brazil-uk-and-us-as-part-of-net-zero-move/>

⁶⁶ <https://www.bloomberg.com/news/articles/2023-12-05/microsoft-goes-big-in-brazil-s-voluntary-carbon-market-with-amazon-project>

this type of project. Mombak would deliver McLaren removals from 2023 through 2025 at an average price of more than \$50 per metric ton, a significant premium over the traditional carbon credit market. Similarly, Microsoft agreed to buy from Mombak 1.5 million carbon removal credits over the next decade, as part of its plan to achieve carbon negativity by 2030. This would involve planting over 30 million native trees and reforesting 70,000 acres, an area equivalent to five Manhattans.⁶⁷

In addition, several countries in the region (Costa Rica, Chile, the Dominican Republic, and Guatemala) are receiving results-based carbon finance through the World Bank's Forest Carbon Partnership Facility (FCPF) program.⁶⁸ At COP28, the World Bank announced its ambition to build on and expand efforts under the FCPF program for the creation of high integrity carbon credits in 15 countries, including the four in Latin America mentioned above. By the end of 2024, these countries are expected to generate over 24 million credits and as many as 126 million by 2028. Estimates suggest these credits could earn up to \$2.5 billion, with much of that going back to communities and countries.⁶⁹ Other regional efforts on forest finance include those of the World Bank's BioCarbon Fund Initiative for Sustainable Forest Landscapes (ISFL) in Colombia⁷⁰ and Mexico. Like the FCPF, ISFL is a multilateral fund that receives money from donor governments to assign results-based payments to reward communities and stakeholders in a selected groups of countries for reducing carbon emissions through the adoption of sustainable land use practices.⁷¹

Low carbon market prices result in limited price incentives for AFOLU mitigation programs. The High-Level Commission on Carbon Prices recommended carbon prices within the range \$40-80/tCO₂e in 2020 and \$50-100/tCO₂e in 2030, as consistent with limiting global temperature increases to under 2°C.⁷² Except in Uruguay, carbon prices (i.e., taxes and carbon permits) in LAC are considerably below the suggested ranges (Table 1).⁷³ There are indications that stronger price signals will be implemented for compliance markets across the region; for example, in the Mexican state of Querétaro, a carbon price of \$32/tCO₂e has been imposed as a tax, a price level higher than that in many developing countries.⁷⁴ This is good news since for mitigation to occur, market prices must be commensurate with their marginal abatement costs. Information on carbon prices within credit markets is limited. According to Ecosystem Marketplace, based on surveys of voluntary market participants, the average prices for credits in LAC ranged between \$3.45-8.71 from 2019 to 2023. For 2023 this was considerably below the price for credits originating in Europe and Oceania (Figure 6). Volumes coming from Latin America and the Caribbean in

⁶⁷ <https://impakter.com/microsofts-new-investment-in-carbon-removal-a-landmark-deal-to-eliminate-1-5-million-tons-of-carbon/>

⁶⁸ <https://www.bancomundial.org/es/news/press-release/2021/10/12/el-banco-mundial-y-guatemala-firman-acuerdo-para-reducir-las-emisiones-de-carbono-y-conservar-los-bo>

⁶⁹ <https://www.worldbank.org/en/news/press-release/2023/12/01/world-bank-carbon-credits-to-boost-international-carbon-markets#:~:text=The%2015%20countries%E2%80%94Chile%2C%20Costa,has%20supported%20pilot%20programs%20since>

⁷⁰ <https://www.biocarbonfund-isfl.org/result-stories/colombia-launches-20-million-sustainable-forest-landscapes-program-world-bank>

⁷¹ <https://www.biocarbonfund-isfl.org/>

⁷² High-Level Commission on Carbon Prices, 2017 and Pathak & et al., 2022

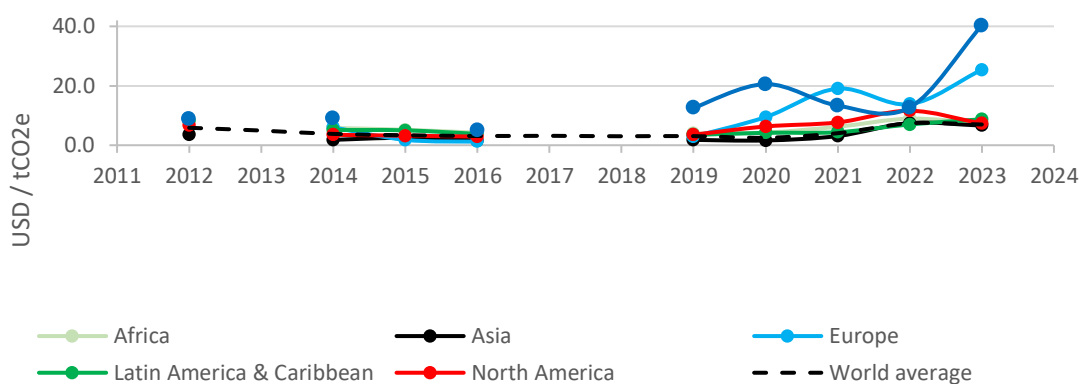
⁷³ As mentioned above in the note, carbon taxes and ETs are not the only instruments providing a price signal in the markets. Indirect carbon pricing—such as fuel excise taxes and fuel subsidy reforms—comprise the largest share of the global carbon price to date. Recently developed methodologies for calculating a total carbon price applicable to a sector or to an economy can facilitate discussions on the price level required to achieve climate commitments (Agnolucci et al., 2023; OECD, 2022).

⁷⁴ World Bank 2023d.

the Forestry and Land Use Category were sold in 2021 (up to August) at an average price of \$4.30 per ton, slightly over the average for a carbon credit (\$3.74).⁷⁵

⁷⁵ *Forest Trends' Ecosystem Marketplace (2021a)*

Figure 6. Average voluntary carbon credits prices per region and globally



Source: World Bank staff elaboration based on, for regions: for 2021-2023, Table 11 in *Ecosystem Marketplace (2023)*; for 2019-2020, Table 7 in *Ecosystem Marketplace (2021)*; for 2016, figure 8 in *Ecosystem Marketplace (2017)*; for 2015, Tables 3-6 in *Ecosystem Marketplace (2016)*; for 2014, several tables in *Ecosystem Marketplace (2015)*; for 2012, Tables 16, 18, 20, 22, 24-26 in *Ecosystem Marketplace (2013)*; and, for world average from 2021-2013: Table 1 in *Ecosystem Marketplace (2023)*; for 2019-2020 in *Ecosystem Marketplace (2021)*, for the rest, Tables in the Introduction section of *Ecosystem Marketplace (2019)*

Notes: a weighted average is used when Europe is reported separated in EU and non-EU. All prices are “over the counter” (when transaction is direct between seller and buyer).

Buyers have shown preferences for other characteristics of credits, beyond the sector to which they correspond, which could be beneficial for LAC. Recent volumes transacted for nature-based solution (NBS) credits and technology-based credits are comparable between 2021 and 2023, with a slight advantage for the latter. However, prices for NBS credits were over twice as high, showing a high premium for NBS credits (Table 2).⁷⁶ Carbon removals are reaching higher prices than emission reductions. As shown in Table 2, prices for removals or carbon sequestration prices are three times those of emission reductions in the same period. Furthermore, the market seems to be assigning an important value to the non-carbon benefits of credits, including the achievement of Sustainable Development Goals. Credits from projects with co-benefit certifications, i.e., those associated with verifiable efforts toward achievement of SDGs have 80 percent premiums over credits from projects that do not have such co-benefits (Table 2).⁷⁷

⁷⁶ Nature-based credits include Agriculture and Forestry and Land Use projects (e.g., Sustainable Agriculture Land Management, Afforestation/Reforestation/Revegetation, Agroforestry, Improved Forest Management), Blue Carbon (e.g., Mangroves, Seagrasses, etc.), among others. Usual technology-based solutions are related to Energy Efficiency, Fuel Switching, Household / Community Devices, Renewables, Waste Disposal, etc.

⁷⁷ Market prices also reflect ‘who is buying’ with a premium paid when the transaction is made with end users. Sellers receive a 30 to 40 percent premium when transacting credits directly with end users. This can be explained at least in part by the fact that when intermediaries buy credits, they take part of the risk that would otherwise fall on the seller and are therefore willing to pay a lower price. While the average credit price paid by end users in 2023 was USD/tCO₂e 8.35, it was USD/tCO₂e 5.96 for credits bought by intermediaries (Ecosystem Marketplace, 2023).

Table 2. Voluntary carbon credits volumes and prices according to their characteristics

Type of credit	2021		2022		2023*
	Volume (MtCO _{2e})	Price (\$/tCO _{2e})	Volume (MtCO _{2e})	Price (\$/tCO _{2e})	Price (\$/tCO _{2e})
Nature based solution	243	5.8	117	10.17	10.61
Technology based solution	270	2.37	130	4.76	4.66
Removals	18	7.84	12.7	11.8	14.78
Reductions	268	2.37	128.4	4.76	4.69
Both removals and reductions	192.5	5.56	67.1	10.66	10.04
No co-benefit	97.1	3.37	66.2	5.94	6.07
Has co-benefit	163.1	5.02	55.4	10.6	10.08
No SDG	128	3.42	77.9	6.23	6.35
Has SDG	132.2	5.36	43.7	11.58	8.76

Source: World Bank staff reproduction of Table 5, 6, and 8 in *Ecosystem Marketplace (2023)* for 2021-2023.

Note: n.a. is not available, * is estimated, and SDG stands for Sustainable Development Goal. Prices are “over the counter” (when transaction is direct between seller and buyer).

AFOLU credit trades have increased in volume in the last few years. AFOLU credits accounted for approximately 30 percent of total credits emitted between 2015 and 2020 (Figure 7A). In recent years, AFOLU credits have increased in volume, with 48 percent of all credits explicitly associated to AFOLU sectors in 2021-2022. Insecurities over REDD+ projects led to a decline of AFOLU credits in 2022 and 2023. During that period, the category with the greatest increase was household device credits (including clean cookstoves, biodigester systems, and efficient lighting).⁷⁸ Moreover, despite the agricultural sector being a major source of emissions in the region, credits from the agricultural sector represent only around 2.4 percent of the total credits emitted to date in LAC. These have been mainly from projects involving manure treatment (see Table A.1 in the Appendix for a description of the main carbon crediting AFOLU project types to date). The distribution of project categories also varies across countries. In Brazil, supply has been reasonably balanced across the main project categories; in Peru and Colombia, forestry and land use⁷⁹ constitute by far the largest source of supply; and in Chile and Mexico the percentage from land use activities is smaller. Forestry and land use credit prices have trended upward since 2018, and in 2022 they particularly performed well, as that year saw a decline in carbon credit prices for all other sectors, except for waste disposal (Figure 7B). A growing market and rising prices suggest an opportunity for forest-abundant countries in the region. Not only was forestry and land use the largest and most high-value category in both 2021 and 2022, but projects in Latin America and the Caribbean were the largest source of forestry and land use credits in 2022 (47 percent by transaction volume).⁸⁰ There is a caveat, however, given a recent decrease in the rate of growth of this type of issuance, possibly attributable to reduced

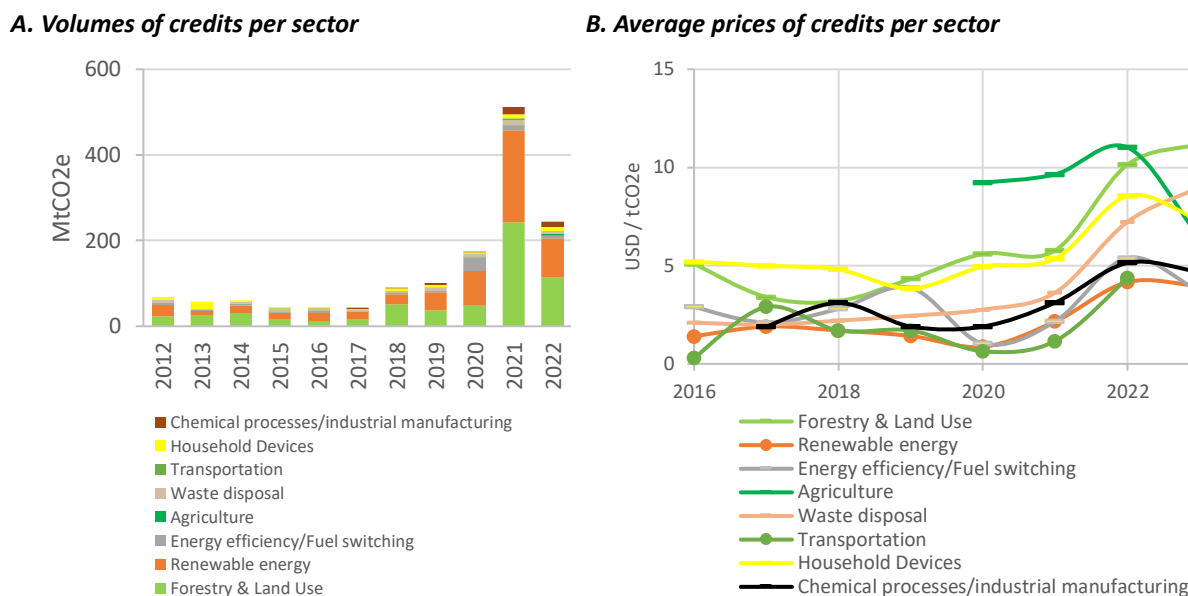
⁷⁸ World Bank (2024). *State and Trends in Carbon Pricing 2024*.

⁷⁹ This means Land Use, Land Use Change and Forestry (LULUCF), AFOLU without agriculture.

⁸⁰ See page 15 in *Ecosystems Marketplace (2023)*.

market confidence following criticisms about the integrity of such credits in recent years.⁸¹ This underscores the importance of taking steps to ensure that carbon credits are verifiably high-quality, as is flagged throughout this note and discussed further in the next section.

Figure 7. Voluntary market carbon credits: Volumes and prices per sector



Source: World Bank staff elaboration based on, for regions: for 2021-2023, Table 3 in Ecosystem Marketplace (2023); for 2019-2020, Table 4 in Ecosystem Marketplace (2021); for 2017-2018, Table 1 in Ecosystem Marketplace (2019); for 2016, Table 2 in Ecosystem Marketplace (2017); for 2015, Annex 4 in Ecosystem Marketplace (2016); for 2014, Figure 5 in Ecosystem Marketplace (2015); for 2013, Figure 10 in Ecosystem Marketplace (2014); for 2012, Figure 23 in Ecosystem Marketplace (2013).

Note: Include Livestock methane whenever Agriculture sector not listed explicitly and Landfill methane when Waste disposal sector not listed separately. Prices are “over the counter” (when transaction is direct between seller and buyer).

Indigenous peoples and local communities (IPLCs) have started to benefit from carbon credits in LAC. In such cases, project developers directly cooperate with IPLCs, sharing a percentage of profits from carbon credit sales. In Colombia this type of agreement has flourished. A recent assessment of REDD+ programs in Colombia suggests there are 51 registered projects focused on the reduction of greenhouse gas emissions from deforestation and forest degradation in collaboration with indigenous people and local communities.⁸² These programs foster local community participation in project design while ensuring the recognition of their knowledge and rights. While there are successful examples of projects involving IPLCs, there are also examples where rights of IPLCs have not been recognized or carbon projects led to conflicts with or within IPLC communities. A notorious case is the one brought to Colombia’s Constitutional Court in April 2023. This came after a legal action was filed by the indigenous authorities of Pirá Paraná claiming

⁸¹ West, T. A., Wunder, S., Sills, E. O., Börner, J., Rifai, S. W., Neidermeier, A. N., ... & Kontoleon, A. (2023). Action needed to make carbon offsets from forest conservation work for climate change mitigation. *Science*, 381(6660), 873-877.

⁸² Díaz, Juan Manuel & Ruiz-Nieto, Omar. Diagnóstico de proyectos REDD+ en la Amazonia colombiana. Bogotá, Instituto Amazónico de Investigaciones Científicas SINCHI. 2023.

they had not authorized the project.⁸³ Despite such setbacks, the advantages of carbon credit developers working together with communities are clear. These include providing rural populations with additional incomes and building long-term economic sustainability. Limiting the participation of representatives of indigenous populations, rural communities, and other local actors in the formulation, execution, and marketing of carbon credits, on the other hand, introduces the risk that the benefits received by communities that greatly contribute to preserving the natural capital needed for the creation of carbon credits will be reduced.

LAC is also preparing its involvement in international credit markets under Article 6 of the Paris Agreement; several countries in the region have signed pilot agreements and designated authorities to be the responsible entities. Worldwide as of March 2024, 81 bilateral agreements have been signed between nine different buyers and 46 host countries (including a total of 141 pilot projects) under Article 6.2. These agreements set the basis for trading in GHG emissions reduction or removal (referenced in the context of Article 6 as “mitigation outcomes”).⁸⁴ These 46 host countries include several in LAC: Chile, Colombia, Costa Rica, Dominica, the Dominican Republic, Mexico, Paraguay, Peru, and Uruguay. LAC countries signed 15 of those bilateral agreements (i.e., around 18 percent), but there are only eight pilot projects under way in the region (i.e., less than 1 percent of the total). Moreover, as of April 2024, only 74 countries had communicated their Designated National Authority (DNA) to the UNFCCC secretariat, which is a necessary step to operate under the credit mechanism of Article 6.4. Thirteen of these countries (approximately 18 percent) are in LAC.⁸⁵

Ongoing challenges must be overcome to leverage the potential of carbon credit markets in the region

AFOLU crediting faces several design, technical, and methodological challenges. First, accurately measuring emissions from land use change and biological agricultural processes (i.e., nitrous oxide from fertilizer use, emissions from manure, and methane emissions from ruminant animals) can be difficult and expensive.⁸⁶ This is particularly true for soil carbon sequestration, where monitoring emissions through soil sampling is currently the most accurate method.⁸⁷ There is still more work to do in terms of measurement. Researchers have identified reductions from land use projects as high risk for not being reflected in GHG inventories, due to the different ways in which countries account for sector emissions, as well as sampling bias and constraints in data availability.⁸⁸ Second, constructing a reasonable baseline scenario against which the credits will be generated is challenging. If the baseline scenario is incorrect—for instance, if a project assumes a higher rate of deforestation than would have in fact otherwise

⁸³ See <https://recursos.elclip.org/amazonia-en-riesgo/Auto+sala+seleccio%CC%81n+Corte+Constitucional+2023.pdf> (referred to in <https://es.mongabay.com/2023/05/colombia-corte-constitucional-examinara-por-primera-vez-un-conflicto-por-bonos-de-carbono/>, among others).

⁸⁴ The first approval of an Internationally Transferred Mitigation Outcomes (art 6.2 of the Paris Agreement) occurred in December 2023 (<https://unepccc.org/article-6-pipeline/> accessed on March 30, 2024). The buyers within bilateral agreement differ for each LAC host, but overall they are Japan, Singapore, Sweden, Switzerland and UAE.

⁸⁵ Those countries are: Argentina, Bahamas, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, Ecuador, Guatemala, Nicaragua, Panama, Peru and Uruguay.

⁸⁶ Guan, K., Jin, Z., Peng, B., Tang, J., DeLucia, E. H., West, P. C., ... & Yang, S. J. (2023). A scalable framework for quantifying field-level agricultural carbon outcomes. *Earth-Science Reviews*, 243, 104462.

⁸⁷ Wongpiyabovorn, O., Plastina, A., & Crespi, J. M. (2023). Challenges to voluntary Ag carbon markets. *Applied Economic Perspectives and Policy*, 45(2), 1154–1167.

⁸⁸ Schneider, L., Weber, F., Füssler, J., Moosmann, L., & Böttcher, H. (2022). Visibility of carbon market approaches in greenhouse gas inventories. *Carbon Management*, 13(1), 279–293.

occurred—then the project will overestimate the avoided emissions, and the credits will not represent real emission reductions. This has been at the center of recent controversies over the incorrect attribution of avoided deforestation measures and the overall monitoring and verification challenges of credits.⁸⁹ Third, AFOLU projects are often subject to “leakage.” For example, deforestation avoided in one area can encourage higher deforestation elsewhere, leading to a reduced or even zero net effect on both emission and deforestation reduction.⁹⁰ Fourth, projects that involve biological sequestration of carbon are at high risk of reversals (or “non-permanence”), whereby sequestered carbon is later re-emitted. This can occur through forest fires, severe weather events, or the discontinuation of low-carbon tillage practices on farms.^{91,92} So far, this risk has been dealt with primarily by setting aside a portion of the credits to compensate for any future reversals in so-called “buffers.” However, with a changing climate increasing the extent and frequency of forest fires, current approaches may not fully address the risk of reversal.⁹³

Generating emission reduction credits (ERCs) from land-based projects requires a good understanding of the specific activities and actions that can lead to the creation of an asset based on emissions reductions and removals. It is also important to understand the potential avenues for ERC monetization as well as the implications and requirements of different options. This includes the necessary institutional and regulatory frameworks and decision points. The readiness for monetization of ERCs also requires a robust ERC asset creation infrastructure. This infrastructure consists of, in large part, measurement, reporting and verification (MRV) systems, which are one of the key pieces to unlock climate/carbon finance because they provide “evidence” of the environmental integrity of the ERCs generated and sold (and potentially transferred) to the buyers. Emission reduction credits need to have a real mitigation impact and need to be measured, reported, and verified through a system that is easy to prove and defensible against claims of greenwashing and double counting (see Box 2 below for additional details).

Box 2. Generating emissions reduction credits from land-based projects (AFOLU activities)

Key elements and steps in the carbon credit creation process:

- **Standards and methodological framework:** Sets out the methodological principles needed to guide the quantification of the GHG mitigation impact of projects and MRV procedures. The specific AFOLU activities to be implemented under the project will be guided by the standards and methodologies used to quantify emissions reduction from REDD+ activities and carbon sequestration from land-based removal activities.
- **Validation:** An independent evaluation of the project activity proposed to generate ERCs against applicable rules and requirements of the standards and applicable methodology. At the end of this process, the project activity may be registered (by a carbon standard, or a similar step by the host country).

⁸⁹ The Guardian. (2023, January 18). *Revealed: more than 90% of rainforest carbon offsets by biggest certifier are worthless, analysis shows.*

⁹⁰ Streck, C. (2021). REDD+ and leakage: debunking myths and promoting integrated solutions. *Climate Policy*, 21(6), 843–852. <https://doi.org/10.1080/14693062.2021.1920363>

⁹¹ Schwartz, N. B., Aide, T. M., Graesser, J., Grau, H. R., & Uriarte, M. (2020). Reversals of Reforestation Across Latin America Limit Climate Mitigation Potential of Tropical Forests. *Frontiers in Forests and Global Change*, 3, Article 85.

⁹² Ritter, T., & Treacle, J. (January 2020). *Why carbon markets won't work for agriculture.* Institute for Agriculture and Trade Policy (IATP); National Family Farm Coalition (NFFC).

⁹³ Badgley, G., Chay, F., Chegwidden, O. S., Hamman, J. J., Freeman, J., & Cullenward, D. (2022). California’s forest carbon offsets buffer pool is severely undercapitalized. *Frontiers in Forests and Global Change*, 5, Article 930426.

- **Registration:** A project activity, after successful validation, may be registered in the host country's registry (if it has one), the carbon standard's registry, or other registry selected by the host country/project developer.
- **Monitoring and reporting:** Project developers need to regularly monitor and periodically report on the performance of the project activity and associated emission reductions and removals (i.e., by measuring changes in above-ground and below-ground biomass), according to the applicable methodology. Baseline setting and monitoring of activities for measuring biomass could be supported by digital systems, such as remote sensing and machine learning techniques, to allow for scalability and aggregation of quantified results across projects.
- **Verification:** Periodic assessment of monitored and reported emission reductions and removals that have occurred as a result of the registered project activity. It can be described as an audit of emission reductions and removals reported, ensuring that procedures specified in the respective methodology were followed.
- **Issuance:** A specified quantity of serialized, verified ERCs is "issued" to project participants' accounts (located in a registry). Once an ERC has been issued it is ready for transaction.
- **Labelling:** Standards may choose to "label" the ER units to indicate compliance with the Paris Agreement or other uses and to highlight key attributes. Such labeling is intended to make a distinction among different use cases by transparently listing the ER unit's characteristics.

Source: Author's elaboration

There are also important operational barriers to scaling AFOLU crediting that impose a limit on the coverage of this sector in carbon taxes and permit trading. Climate-smart agricultural practices can involve upfront investment costs and incur short-term opportunity costs through reduced production. Revenues from carbon credits are often earned only after the carbon has been independently verified at periodic intervals.⁹⁴ While this gap—between upfront costs and delayed revenues, from both carbon credits and increased land productivity—is faced by all projects, soil carbon activities have the additional challenge of relatively low rates of sequestration per unit of area. Moreover, soil carbon sequestration requires long-term changes to farming practices that may not be attractive to tenant farmers,⁹⁵ and so the generation of credits from short-term rented land should not be expected. Finally, some projects may only be viable for large-scale operations, where greater amounts of sequestered carbon will lower the per-unit transaction costs associated with monitoring, reporting, and verification. For instance, instead of carbon credit projects being concentrated in a small number of agents as is the case for the energy and industrial sectors, AFOLU sectors are often characterized by the presence of many (often small) actors. For example, in LAC over 50 percent of food is produced by smallholder farmers.⁹⁶

These technical and operational barriers limit the volume of credit issuance, but also the inclusion of AFOLU within carbon pricing mechanisms. Indeed, the coverage of AFOLU sectors in compliance carbon tax and permits is limited, with higher participation of the sector in carbon credit markets. Except for in New Zealand, compliance instruments have tended to focus mainly on energy and industrial sector

⁹⁴ Sellers can negotiate upfront payments, provided the credit generation risk is not too high, but such upfront payments will also always lead to an additional price discount.

⁹⁵ Henderson, B., Lankoski, J., Flynn, E., Sykes, A., Payen, F., & MacLeod, M. (January 2022). *Soil Carbon Sequestration by Agriculture: Policy Options* (No. 174). OECD Food, Agriculture and Fisheries; Scotland's Rural College.

⁹⁶ Morris, M., Sebastian, A. R., Perego, V. M. E., Nash, J. D., Diaz-Bonilla, E., Pineiro, V., Laborde, D., Chambers, T. T., Prabhala, P., Arias, J., Salvo, C. P. de, & Centurion, M. E. (2020). *Future Foodscapes: Re-imagining Agriculture in Latin America and the Caribbean* (English). World Bank Group.

emissions,⁹⁷ which are relatively easier to monitor and are concentrated among a smaller number of entities.

Many countries in the region still lack a legal framework for carbon credits, which could support a more efficient and liquid market. Voluntary carbon crediting can continue even if there is no legal framework for carbon credits, especially for buyers who do not require government authorization, but a legal framework can contribute to supporting the growth of a better-functioning market. A legal framework can define who has the right to benefit from carbon crediting activities and how the credits will be treated for accounting and taxation purposes (e.g., in Colombia, carbon credits are treated as intangible assets, whereas in Australia they are recognized as financial instruments).^{98,99} Such a legal framework could also help reduce risks of displacement and resource access loss for IPLCs. When these populations do not gain an equitable portion of the benefits, it can erode the community consent necessary for the success of the project and pave the way for environmentally harmful activities, such as illegal logging.¹⁰⁰ Some LAC countries, including Costa Rica, Panama, the Bahamas, Paraguay and Ecuador, identify carbon crediting frameworks as a way to achieve climate goals.¹⁰¹

Lack of a clear definition of land and carbon rights poses a challenge for market development. LAC countries are still lagging in providing greater clarity on carbon rights, especially when carbon rights are not linked to land titles or land titles are insecure.¹⁰² This is particularly important for the AFOLU sector. The lack of clear title to the benefits of carbon projects could inadvertently alienate traditional land stewards.¹⁰³ Another challenge is that issues related to insecure land tenure can weaken the financial incentive to implement carbon credits activities and become a barrier to implementation.¹⁰⁴ Colombia and Costa Rica are two countries that have managed to make progress on the linkage between property rights and carbon rights. In these two countries, carbon rights are related to the entity, person or community with the rights to land, including IPLCs, who can participate in carbon markets.¹⁰⁵

Article 6 crediting will require new processes, procedures, and capacity that go beyond establishing a “Designated National Authority” (DNA) and may be difficult to establish for several countries in the region. Given broad regional participation in the CDM, early on many countries had DNAs responsible for crediting. Under the CDM, participating countries were required to nominate a DNA tasked with approving CDM projects hosted in the country. In many cases, the DNA is the ministry of environment or an agency under its auspices. Provided that CDM DNAs are still operational, this means many countries already have

⁹⁷ ICAP. (2023). *Emissions Trading Worldwide: Status Report 2023*. ICAP.

⁹⁸ Hedley, A., & Hillis, B. (2023, August 16). *Voluntary carbon market trading: Key risks and mitigations*. Reed Smith LLP. Energy Transition 2022.

⁹⁹ adelphi & Gold Standard. (2023). *Implementing Article 6: An Overview of Preparations in Selected Countries*.

¹⁰⁰ Rights and Resources Initiative. (2021). *Status of Legal Recognition of Indigenous Peoples’, Local Communities’ and Afro-descendant Peoples’ Rights to Carbon Stored in Tropical Lands and Forests*.

¹⁰¹ Guyana has issued many ART-TREES credits for its jurisdictional REDD+ program, with some units already sold to a voluntary corporate buyer. The ART-TREES standard seeks to issue credits at jurisdictional level, to national and subnational governments.

¹⁰² Streck, C. (2020). Who Owns REDD+? Carbon Markets, Carbon Rights and Entitlements to REDD+ Finance. *Forests*, 11(9), 959.

¹⁰³ Rights and Resources Initiative. (2021). *Status of Legal Recognition of Indigenous Peoples’, Local Communities’ and Afro-descendant Peoples’ Rights to Carbon Stored in Tropical Lands and Forests*.

¹⁰⁴ Clifford Chance. (2022, August 10). *Enabling the voluntary carbon market in the context of the Paris Agreement*. Clifford Chance.

¹⁰⁵ Rights and Resources Initiative. (2021). *Status of Legal Recognition of Indigenous Peoples’, Local Communities’ and Afro-descendant Peoples’ Rights to Carbon Stored in Tropical Lands and Forests and <https://asocarbono.org/wp-content/uploads/2024/02/documento-concepto-juridico-derecho-de-carbono-en-Colombia.pdf>*

at least one institution formally responsible for carbon crediting.¹⁰⁶ However, since the 2012 market downturn, knowledge previously contained within DNAs might have been lost because of job mobility by public employees. Institutions and capacities will have to be strengthened and re-built, and new processes and procedures will have to be developed.

Some efforts are underway, but much more is needed to strengthen governance structures and establish administrative arrangements. A few countries in the region are developing governance structures to participate in Article 6. In 2022, Peru released draft regulations for the implementation of RENAMI which establish the institutional responsibilities of the Ministry of Environment and the General Directorate of Climate Change and Desertification, as well as various processes and procedures, such as requests for authorization and registration on RENAMI.¹⁰⁷ Countries receive support from external partners, for instance in Colombia, which is receiving support to set up institutional arrangements through the *Supporting Preparedness for Article 6 Cooperation* program.¹⁰⁸ More broadly, it appears that efforts are in the very early stages, or have not yet begun, in many LAC countries, with only eight pilot projects in LAC as mentioned earlier. As countries establish governance structures and administrative processes in the coming years, there will be more in-region examples for other countries to draw on. These will necessarily vary significantly, with the countries that operate multiple carbon pricing instruments—such as Colombia, Chile, and Mexico—requiring more complex governance arrangements than those with much more limited involvement in carbon markets.

Human capital at all levels is a key element for the development and implementation of high-quality carbon crediting projects. The resources and capacity for carbon crediting are currently insufficient in many governments in the region, with too few officials (often with limited subject matter knowledge) in charge of the regulation of carbon market transactions and implementation of carbon crediting strategies.

Several countries in the region are already implementing—or planning for—carbon credits registers¹⁰⁹ or transaction registries, but fully implemented initiatives are few.¹¹⁰ Countries are focusing on putting in place registers and, so far, no country has a full transaction registry. However, the lack of a transaction registry will only be a challenge for countries that expect to implement a domestic crediting mechanism or ETS, which will require that carbon credits or emissions allowances be created, transferred between accounts, and ultimately retired securely. Registers or carbon data management platforms are typically designed to capture information on mitigation activities taking place within the country, including carbon crediting projects. There are several examples in the region. Peru’s RENAMI platform provides information on projects implemented through independent crediting mechanisms, such as the implementing entity and expected annual emission reductions and removals, as well as details on credits authorized for corresponding adjustments under Article 6 (i.e., those credits that will not be accounted for international compliance by the country that authorizes them).¹¹¹ Similar systems to capture information on

¹⁰⁶ adelphi & Gold Standard. (2023). *Implementing Article 6: An Overview of Preparations in Selected Countries*.

¹⁰⁷ adelphi & Gold Standard. (2023). *Implementing Article 6: An Overview of Preparations in Selected Countries*.

¹⁰⁸ adelphi & Gold Standard. (2023). *Implementing Article 6: An Overview of Preparations in Selected Countries*.

¹⁰⁹ Database that only records information on individual units, such as the location of the project and unique identification number

¹¹⁰ Includes the basic register functionality of the register but goes beyond it: it can support transfers between user accounts and be linked to other registries. Trading through an exchange offers a centralized marketplace for standardized products, offering deepened market liquidity, improved price discovery, and lower transaction costs.

¹¹¹ adelphi & Gold Standard. (2023). *Implementing Article 6: An Overview of Preparations in Selected Countries*.

implemented measures are in operation or planned in several other countries, including Argentina, Chile, Colombia, Costa Rica, the Dominican Republic, and Panama.^{112,113,114,115} Panama is establishing the Panama Carbon Exchange as a key component of the National Carbon Market. The online platform will be open to project developers, both domestic and international, to sell credits either to local companies or to international buyers.¹¹⁶ Also in Panama, in 2023 it was announced that national stock exchange company, Latinex, would administer the new carbon exchange (*Dirección Nacional de Cambio Climático*). Countries that lack a registry can leverage the infrastructure maintained by independent crediting mechanisms, combined with either national registers or the infrastructure provided by the UNFCCC, to meet any reporting requirements under Article 6. There are also open-source solutions available to countries, such as from the UNDP or the World Bank (the PMI - Climate Warehouse program).

MRV systems in AFOLU are particularly important for the LAC region, and progress has been made in estimating emissions from the sector, but there is still scope for improvement. While the application of artificial intelligence and digital technologies is still limited in carbon credit markets, falling technology costs and wider adoption could facilitate the implementation of more forestry projects in LAC.¹¹⁷ For example, the Chilean National Forest Corporation is working with the open-source, not-for-profit platform Open Surface on a digital MRV system for the country's forests. The system uses artificial intelligence to assess historical satellite data. In Brazil, for example, the pioneering use of near-real-time forest monitoring greatly increased the capacity of law enforcement to apply binding and costly penalties to offenders.¹¹⁸ Today, Brazil has one of the most advanced systems for monitoring forest cover and land use.¹¹⁹ The Satellite Monitoring of the Brazilian Amazon Forest (PRODES) project, run by the National Institute for Space Research (INPE), uses satellite images to identify clear-cut deforestation and provides a year-to-year snapshot of deforestation rates. This is complemented by other systems operated by INPE, including the Real Time Deforestation Detection System, which measures annual forest degradation and the status of land use in identified deforested areas.¹²⁰ A few other pilot activities of this kind are also taking place in the region.

¹¹² adelphi & Gold Standard. (2023). *Implementing Article 6: An Overview of Preparations in Selected Countries*.

¹¹³ Government of Colombia. (2022, March 19). *RENARE, la plataforma para registrar las reducciones de gases efecto invernadero en Colombia - Ministerio de Ambiente y Desarrollo Sostenible*. Ministerio de Ambiente y Desarrollo Sostenible [Press release].

¹¹⁴ Meza, A. (2020). *Costa Rica Implementation Status Report: PMR project implementation status report*. Partnership for Market Readiness.

¹¹⁵ UNDP. (2019). *Presentan plataforma pública para registrar las iniciativas de cambio climático: Programa De Las Naciones Unidas Para El Desarrollo*. United Nations Development Programme.

¹¹⁶ World Bank. (February 2023e). *Project Information Document/ Identification/ Concept Stage (PID) (PIDC270417)*. Panama Partnership for Market Implementation.

¹¹⁷ Belenky, L. G., Iyadomi, K., David Carevis, S. E., & Gadde, H. (June 2022). *Digital Monitoring, Reporting, and Verification Systems and Their Application in Future Carbon Markets (English)*. World Bank.

¹¹⁸ Gandour, C. (2021). *Public Policies for the Protection of the Amazon Forest: What Works and How to Improve*. Amazon 2030.

¹¹⁹ Bourscheit, A. (2022, February 15). Prodes and Deter: get to know these strategic systems in the fight against deforestation in the Amazon. *InfoAmazonia*.

¹²⁰ Ministry of the Environment Brazil. (2016). *ENREDD+: national strategy for reducing emissions from deforestation and forest degradation, and the role of conservation of forest carbon stocks, sustainable management of forests and enhancement of forest carbon stocks*. Ministry of the Environment. - Brasília: MMA.

The way forward: Priorities to leverage carbon credit markets for development in LAC

AFOLU credit markets can only be one part of the solution for LAC

Carbon credit markets hold promise for AFOLU in LAC but do not come without challenges. On the positive side, the region has low-cost options for the development of AFOLU credits and several countries in the region have some experience in these types of mechanisms through the CDM and independent certifications. Demand for carbon credits is expected to rise, after several years of muted activity following the phasing out of the CDM and a reawakening of the market driven mainly by voluntary credits, within which forestry and land use activities predominate. On the negative side, there are many technical, financial, human capital capacity and institutional hurdles to be tackled, and relatively low prices make only low-marginal-cost projects fit for crediting (see Table 2). Designing complementary instruments will be important (e.g. standards, taxes, result-based funds, information dissemination schemes, etc), as will be integrating carbon pricing instruments as part of broader policy and financing packages to financing NDC and LTS.¹²¹

Link climate commitments with credit mechanisms

Countries should consider the role of AFOLU carbon crediting in planning related to NDCs, LTSs, and other commitments. Despite progress on several fronts, LAC countries have yet to clearly define the role that carbon crediting could and should play in their decarbonization strategies. For governments in LAC to be able to use carbon crediting strategically, in a way that is in line with their national plans and development priorities, crediting must be considered as part of broader climate policy planning. For authorization of credits with corresponding adjustments, there are several options that are not mutually exclusive and can be used in combination:

- Instead of assessing projects on a case-by-case basis, set a “positive list” that identifies activities that are eligible for authorization and exclude the lowest-cost projects that are either earmarked for reaching the country’s climate targets or have to do with security or sovereignty issues.^{122,123} This approach reduces private sector investment risks. An example is India, where the positive list includes higher-cost options, such as carbon capture and storage and green hydrogen, which the country also considers important areas for technology transfer.¹²⁴
- Give limited “authorization” such that the host country can claim part of the mitigation toward its own NDCs.
- Implement a fee on authorized credits to create a pool of funds to invest in additional mitigation, if necessary (“pooling funds”). Use these funds to cover agencies’ administrative costs or for other goals (examples are China and Vietnam, which retained a portion of revenues from domestic CDM

¹²¹ Goulder, Lawrence H., and Ian WH Parry. "Instrument choice in environmental policy." *Review of environmental economics and policy* (2008).

¹²² Kohli, A., Füssler, J., Broekhoff, D., & Schneider, L. (May 2020). *Practical strategies to avoid overselling: Final Report*. Carbon Limits AS.

¹²³ Warnecke, C., Höhne, N., Tewari, R., Day, T., & Kachi, A. (April 2018). *Opportunities and safeguards for ambition raising through Article 6: The perspective of countries transferring mitigation outcomes*. NewClimate Institute.

¹²⁴ Ministry of Environment, Forest and Climate Change India. (2023, February 17). *Activities finalised to be considered for trading of carbon credits under Article 6.2 mechanism to facilitate transfer of emerging technologies and mobilise international finance in India* [Press release].

projects to finance other environmental measures, and more recently, Ghana and Kenya set similar rules).^{125,126}

These kinds of implementation plans, especially positive lists, can help the country benefit from carbon crediting. With sufficient transparency over which policies and measures will be enacted to meet the country's targets, project developers will be able to better target mitigation opportunities that are additional to national efforts, even if these are not explicitly identified by the government. The process of compiling the positive list will vary according to the country's NDCs. In some cases, countries may use marginal abatement cost curve analyses to give priority to high-cost mitigation options in the list. However, a balance must be found. While this strategy would address the risk of overselling,¹²⁷ if the activities are too expensive, they may not be competitive on international markets.

Take advantage of the potential for triple benefits

Forestry and land use credits can offer valuable co-benefits when implemented well, through solid and trustful benefit-sharing mechanisms. Afforestation and forest conservation have benefits beyond avoided emissions, often referred to as co-benefits. These can include local employment, community development, and biodiversity protection. Forests also enhance resilience to the impacts of a changing climate. They do this directly through provisioning services (e.g., wood, fuel, and fodder), regulating services (e.g., of water or soil erosion), and supporting services (e.g., nutrient cycling).¹²⁸ Furthermore, for some buyers, these co-benefits (particularly those related to biodiversity and community impacts) are a major motivating factor for the purchase of forestry carbon credits.¹²⁹ Creating carbon credits from forestry activities can provide an additional source of revenue to finance local adaptation measures. Adequate community involvement, including from IPLCs, along the project cycle not only solidifies projects' authenticity but also boosts the chances of early identification and mitigation of potential risks. One way to make sure this happens is through "benefit sharing arrangements" that can explicitly include in the carbon crediting project the type of benefit, the beneficiaries, the proportions of benefits, the distribution mechanism, etc. Many recent examples can help countries define how these benefit sharing arrangements can ideally be structured.¹³⁰ One such example is the CommuniTree Carbon Program in Nicaragua. This afforestation/reforestation project under the Plan Vivo Standard provides direct payments for ecosystem services under the project (i.e. to the project implementers, based on their performance) and to the community for nursery expenses, grafted fruit trees, and fuel-efficient cookstoves. Transparency in these types of agreements is key to ensuring that they are solid and trustworthy.

Stronger institutions are needed to leverage benefits for the economy, the planet, and the people

Adopt legal frameworks for carbon crediting markets, in particular for carbon rights in land-use projects

¹²⁵ Ghanaian Environmental Protection Agency. (2022). *Ghana's Framework on international carbon markets and non-market approaches: Operational guideline for Article 6.2 cooperative approach in Ghana*. Government of Ghana.

¹²⁶ Carbon Pulse (2023, July 25). UPDATE – Kenya lawmakers propose new fees and taxes for carbon projects - media.

¹²⁷ Countries are aware of that risk. Recently, Honduras has imposed a moratorium on carbon credit issuance until national regulation have been established (adelphi & Gold Standard, 2023; Chingono, 2023).

¹²⁸ Chandrasekharan Behr, D., Russell, A., Locatelli, B., & Pramova, E. (2015). *How Forests Enhance Resilience to Climate Change: What We Know about Forests and Adaptation*. Program on Forests (PROFOR).

¹²⁹ Goldstein, A. (March 2016). *Not So Niche: Co-benefits at the Intersection of Forest Carbon and Sustainable Development*. Forest Trends Ecosystem Marketplace

¹³⁰ <https://carbonmarketwatch.org/wp-content/uploads/2023/11/Assessing-transparency-and-integrity-of-benefit-sharing-arrangements-related-to-voluntary-carbon-market-projects.pdf>

Countries in LAC will benefit from adopting legal frameworks that specifically address carbon crediting.

Given the diversity of national contexts, there is no one-size-fits-all approach for an appropriate legal framework across LAC countries. For countries that do not foresee deep involvement in carbon crediting, it may be possible to continue with minimal, or no, explicit regulation of carbon credits. However, legislation could be advantageous, especially for forestry and land use projects where implementation could be hindered by a lack of clarity over the rights to carbon. It is also essential to ensure that national assertions of ecosystem service rights do not override or diminish IPLC rights. Another advantage in setting a clear regulatory framework for carbon credits is that where there are well-established laws on land titling—including forested land—landowners and communities can directly receive the revenues and benefits from carbon rights.

Establish good governance structures to make crediting efficient

A stable governance and regulatory environment, with transparent rules for project approval and authorization, effective communication, and efficient administration, would support investment into carbon crediting projects. The institutional structures and decision-making processes necessary to manage the country's participation in and engagement with carbon crediting¹³¹ could include:

- Oversight level: a steering group exercises overall authority, making decisions, deciding policy, and facilitating coordination between ministries¹³²
- Administrative level: administrator handles day-to-day operational matters, dealing with stakeholder queries, collecting fees and processing requests
- Expert advisory level: a technical committee or advisory group provides input or technical expertise, for instance on crediting methodologies or MRV procedures, when necessary

Countries in LAC already have governance structures from the CDM, and in some cases compliance instruments, on which they can and should build. To scale up crediting activity and participation in Article 6, these structures will need to be further developed. Appropriate governance structures will vary by country, depending on existing arrangements, available resources, and the model chosen for carbon market participation. However, several common features will need to be considered. Governments must ensure that governance of carbon crediting activities is integrated within any existing governance structures, and that it includes cross-ministerial coordination. In all cases governments must consider how the administration of the system will be funded, and whether a system of fees for services by the administrator is needed to ensure its financial sustainability or if funds would come from the government general budget.

In carbon credit schemes, always try to secure the integrity of credits

A domestic crediting mechanism can stimulate significant and predictable local demand for domestic carbon credits. When such an instrument is in place, the potential associated savings (e.g., from reducing administrative fees and streamlining processes) may outweigh the costs of operating the mechanism. Alternatively, a regional mechanism—operating in multiple countries and collectively governed—could be considered given its potential for greater scale and sharing of administrative costs. Internationally

¹³¹ Prag, A., Briner, G., & Hood, C. (2012). *Making Markets: Unpacking Design and Governance of Carbon Market Mechanisms* (OECD/IEA Climate Change Expert Group Papers). OECD; IEA.

¹³² Spalding-Fecher, R., Macias, P., & Guzmán Barraza, D. (2022). *Guidance on Governance Models for Host Country Engagement in Article 6*. Global Green Growth Institute.

recognized carbon crediting programs help to ensure the environmental integrity of carbon credits, which—in the absence of or in complement to local demand—will increase the likelihood of such credits being purchased by international buyers. The benchmarks of several initiatives that aim to improve integrity in the voluntary carbon market (VCM), such as the Integrity Council for the Voluntary Carbon Market (ICVCM), the Voluntary Carbon Markets Integrity Initiative (VCMI), the Carbon Credit Quality Initiative (CCQI), as well as agencies that rate the quality of individual carbon crediting projects (e.g. BeZero Carbon, Calyx Global, Sylvera), can be considered to ensure greater integrity of carbon credit supply.

Ensure that human capital is built and nurtured

Building human capacity to effectively participate in carbon credit markets, including in local and indigenous communities, is necessary. Successful carbon markets involve different actors possessing the appropriate capacities: government regulator; project developers; project operators; carbon crediting mechanisms; validation and verification bodies; retail traders; brokers; investors and financial sector actors; engineering and geological services providers; local consultancies; third-party infrastructure providers; and end buyers. The development of local capabilities allows more services to be delivered by local companies, thereby reducing reliance on international firms.

Most governments in LAC will need to enhance capacity to implement these measures. At a minimum, governments need sufficient knowledge and resources to carry out core tasks, such as developing an overall strategy, establishing regulations, and implementing day to day operations. It is important that knowledge is shared beyond the ministry of environment, typically responsible for developing carbon markets and pricing, to other interested departments, such as ministries of finance. Beyond governments, there are a range of actors on which a well-functioning market is built—such as project developers or verifiers. To a large extent, the increased activity and capacity of these other actors will be market-driven, with services expanding to meet demand. However, governments could still take steps to support private sector and community capacity building in their countries. While capacity-building programs—e.g., financed by the UNDP, GIZ and the World Bank—have supported many countries in the region, further capacity-building initiatives are crucial to staff and train the teams that draft and operationalize the regulations necessary for crediting.¹³³ Many government-level capacity-building programs have primarily targeted environment and energy ministries, often not reaching other relevant areas, such as ministries of finance and agriculture. Finally, it is also important to build capacities and understanding of carbon markets in local and indigenous communities. This will foster understanding and reduce implementation risks, as well as equip IPLCs with the tools to effectively negotiate with project developers.

Invest in digital infrastructure to support the efficiency of the emerging market

Ensure access to carbon registration mechanisms that respond to tracking needs

The necessary trading infrastructure will depend on the expected market size and nature of transactions. Countries will have to establish a transaction or credit tracking and trading infrastructure that meets their

¹³³ Several LAC countries have experience with capacity-building activities for compliance instruments. With support from the World Bank, Colombia developed a capacity-building strategy for its ETS that was designed to ensure that information was generated and appropriately shared, trust was built, and buy-in from various stakeholder groups was secured (adelphi, 2020). In Mexico, MEXICO2 has been working with subnational governments to build capacity on markets for carbon credits. The PMR and GIZ have also implemented several capacity-building initiatives in Mexico, providing support on the development of communications and policy coordination strategies.

specific needs. Key pieces of digital infrastructure include both the register and transaction registry.¹³⁴ Countries can choose to have only a register and to use the new international registry which will be built and maintained by the UNFCCC, in which all countries can have a national account,¹³⁵ or those of independent schemes. Even without engaging in Article 6 transfers, a registry would enhance transparency, reduce the risk of overlapping claims across projects, strengthen host country NDC planning, and assist with reporting under the Paris Agreement. There are different circumstances in which countries may choose to implement their own registry, especially where they are operating an ETS or other carbon pricing instruments with links to credit markets.¹³⁶ For other countries, centralized infrastructure provided by the UNFCCC secretariat may be sufficient for their requirements. Governments will be able to open a national account in this international registry, which will have all the functionality required for meeting Article 6 participation requirements. This option avoids the costs associated with operating a national registry and may be particularly relevant for small countries with scarce resources. There are some cases where LAC countries could benefit from a domestic public platform for trading carbon credits, particularly where they serve a compliance demand or there is sufficient supply or demand locally. The rollout of national exchanges, such as Panama's planned platform, will provide a useful example for other countries in the region on operating an exchange platform. In other countries' circumstances, when domestic transaction registries are not developed, credits will still be able to be sold via international exchanges if they are issued to international (private or public) registries.

Coherence between a national GHG inventory and crediting activity will be important. Inventories are the basis for assessing the effectiveness of mitigation policies and tracking progress against national targets. As such they are also relevant to carbon crediting efforts. Governments in LAC should therefore consider whether emission reductions from crediting activities, particularly those authorized to be used for compliance in other countries, will be captured in their inventories when considering their strategy and approach towards authorization. If the inventory is not sufficiently granular, then there is a risk that emission reductions achieved by carbon crediting projects may not be fully or correctly captured. This can decrease the possibilities for achieving a country's NDC targets.¹³⁷

Focus on innovation in project design and to ensure high-quality carbon credits

Countries should consider new project types, focusing on those that can generate high-quality carbon credits. LAC countries could benefit from innovative land and ecosystem approaches such as direct air capture, biochar, enhanced weathering, and blue carbon, building on the region's vast renewable energy potential, agricultural production, and rich ecosystems. Technical innovation and careful analysis will be needed to address challenges related to MRV and to ensure permanence and protect biodiversity. More broadly, carbon credits may play a more lasting role, including in LAC, to support both nature-based and

¹³⁴ TSVM. (January 2021). *Taskforce on scaling voluntary carbon markets*.

¹³⁵ World Bank. (2022b). *Infrastructure to Meet Reporting Requirements under Article 6*. World Bank.

¹³⁶ Those countries should first consider whether existing infrastructure can be adopted, rather than building a new registry from scratch. This saves both time and money. There are examples to draw on from the region: for example, Costa Rica National Climate Change Metrics System was deliberately designed to be open source, so that the code could be adapted by other developing countries (World Bank, 2020d).

¹³⁷ LAC countries would benefit from improving measurement of soil carbon stocks for soil carbon sequestration considering there is still scope for increasing credit supply in this sector (Smith, Pete, et al. 2020 "How to measure, report and verify soil carbon change to realize the potential of soil carbon sequestration for atmospheric greenhouse gas removal." *Global Change Biology* 26.1 (2020): 219-241; Bai, Yongfei, and M. Francesca Cotrufo. 2022. "Grassland soil carbon sequestration: Current understanding, challenges, and solutions." *Science* 377.6606 (2022): 603-608).

engineered removals, especially in the land use systems. This includes various forms of engineered carbon dioxide removal, such as direct air carbon capture and storage and biochar, as well as nature-based sequestration activities.¹³⁸ One example of the latter is blue carbon activities, which could be particularly relevant for Caribbean countries.¹³⁹ The coastal vegetated wetlands (mangroves, tidal marshes, and seagrasses) seem to be the most established blue carbon activities for their potential as a sink and because they are within countries' boundaries and so policies are the most feasible. That said, there are other potential activities (such as marine sediment and marine fauna) for which there is less certainty on the mitigation potential and/or it is more difficult to manage them because they are in international waters.¹⁴⁰

Expand opportunities offered by digital MRV

Countries should capitalize on the opportunities of digital MRV and share that knowledge with regional neighbors. Knowledge-sharing activities can enable countries to leapfrog challenges their neighbors have already faced by facilitating regulatory alignment, disseminating research and findings to support decision making, and expediting the diffusion of technological advancements and lessons learned. Advances in digital MRV—in particular, the use of data collected from satellites and drones, artificial intelligence, and machine learning models—provide a key area of innovation and opportunity in LAC. Automated data collection and reporting could improve data accuracy, reduce costs, and shorten processing times associated with MRV. A digital MRV system that relies on artificial intelligence and machine learning models can be applied to data collected from satellites and drones, to identify areas of deforestation and estimate carbon stocks. Automated data collection can also enable the enforcement of liability in cases of reversals. The main advantage of this approach is the ability to monitor large tracts of land without the need for physical inspections. Beyond reducing transaction costs for crediting activities and enabling enforcement of liability in cases of reversals, such systems can be key in supporting interventions to address illegal deforestation as in the case of Brazil. LAC countries stand to benefit greatly from regional cooperation as carbon service providers.

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¹³⁸ Direct air capture (DAC) refers to technologies that extract CO₂ emissions directly from the atmosphere (as opposed to capture that takes place at the point of emissions). The CO₂ emissions can then be permanently stored in geological formations or used for other purposes (IEA 2023a). Biological charcoal (biochar) refers to a carbon sequestration method by means of pyrolysis or gasification of organic material in low-oxygen conditions from plant waste; the resulting char can be mixed in the soil, acting as a fertilizer.

¹³⁹ A recent study (Shayka et al., 2023) estimated that 33-55% of global seagrass area is in the Caribbean, storing around 1.3 GtCO₂. The Bahamas, which has the most seagrass in the region, is already preparing to monetize the country's blue carbon, with the Carbon Credit Trading Act 2022 providing for a domestic market in blue carbon credits (Act No. 15 of 2022, 2022).

¹⁴⁰ Howard, J., Sutton-Grier, A. E., Smart, L. S., Lopes, C. C., Hamilton, J., Kleypas, J., ... & Landis, E. (2023). Blue carbon pathways for climate mitigation: Known, emerging and unlikely. *Marine Policy*, 156, 105788.

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Appendix

Table A.1 - Generating AFOLU credits—main carbon crediting project types to date

Project type	Description
Agriculture	
Manure treatment	Implementing techniques to capture and manage methane emissions from livestock manure, such as anaerobic digesters or composting
Cattle rotation	Rotating grazing areas to optimize land use, promote pasture health, and reduce methane emissions
Methane avoidance/recovery	Implementing measures to minimize methane emissions from rice cultivation, manure management, or other agricultural practices
Reduced N2O emissions in fertilizer use	Implementing practices to optimize fertilizer use and reduce N2O emissions, such as precision agriculture or improved nutrient management
Soil carbon sequestration	Adopting agricultural practices that enhance carbon storage in soils, such as conservation agriculture, agroforestry, or cover cropping
Forestry and land use	
Afforestation	Planting trees on land that has not been forested for a long time or converting non-forested land into forested areas
Reforestation	Restoring or replanting trees in areas that were previously forested but have been cleared
Improved forestry management	Implementing sustainable forest management practices, such as reducing deforestation rates, promoting selective logging, and enhancing forest health and productivity
Avoiding Conversion	Measures to prevent the conversion of forests into non-forest land uses, such as agriculture or urbanization

Source: (Stubbs et al., 2021)