Decoding Results-based Climate Finance in the Agriculture and Food Sector

Final report

unique land use

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Client
World Bank

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Acronyms

ABCF	activity based climate finance
ABMS	activity baseline and monitoring system
AFOLU	agriculture, forest and other land use
BAU	business-as-usual
CCDR	Climate Change Development Report
CDM	Clean Development Mechanism
CIF	Climate Investment Funds
COMACO	Community Markets for Conservation (Zambia)
CRGE	Climate Resilient Green Economy Strategy (Ethiopia)
CSA	Climate Smart Agriculture
CSAIP	Climate Smart Agriculture Investment Plan
ERC	emission reduction credit
ERPA	emission reduction purchase agreement
ETS	emission trading scheme
FGM	farmer group monitoring
GCF	Green Climate Fund
GHG	greenhouse gas
GP	global practice
IDA	International Development Association
IPCC	Intergovernmental Panel on Climate Change
IPF	investment project financing
ISFL	Initiative for Sustainable Forest Landscapes
ITMOs	internationally transferred mitigation outcomes
KACP	Kenya Agriculture Carbon Project
LFSDP	Livestock and Fisheries Sector Development Project (Ethiopia)
MKD	Mekong Delta (Vietnam)
MRV	measurement, reporting and verification
N_2O	Nitrous oxide
NDB	national development bank
NDC	nationally determined contribution
OFLP	Oromia Forest Landscape Program (Ethiopia)
PAD	project appraisal document
PCN	project concept note
PFM	permanent farm monitoring
PforR	program for results
PIN	project idea note
PO	producer organization
RBCF	results based climate finance
REDD+	Reducing emissions from deforestation and forest degradation
SALM	sustainable agriculture land management
SCALE	Scaling Climate Action by Lowering Emissions
SLL	sustainability linked loan
SLM	sustainable land management
SMART	Strengthening Markets for Agriculture and Rural Transformation program (Pakistan)
SOC	soil organic carbon
TA	technical assistance
tCO_2e	tonnes of carbon dioxide equivalent
USDA	United States Department of Agriculture
VnSAT	Vietnam Sustainable Agricultural Transformation Project (Vietnam)
ZIFLP	Zambia Integrated Forest Landscapes Project (Zambia)

1. Results-based climate finance in the agriculture context

The Paris Agreement aims to "strengthen the global response to the threat of climate change, in the context of sustainable development and efforts to eradicate poverty" by

- keeping global warming well below 2°C above pre-industrial levels and pursuing efforts to stay below 1.5°C;
- fostering adaptation, resilience and low-carbon development "without threatening food production"; and
- making finance flows consistent with a pathway toward low-carbon, climate-resilient development.[1]

Aligning financing flows with the objectives of the Paris Agreement and integrating climate and development are pillars of the World Bank Group's Climate Change Action Plan 2021– 2025.

The climate trust funds managed by the World Bank also aim to support progress towards a net reduction of GHG emissions in developing countries in line with the Paris Agreement, in a manner consistent with the World Bank's mission to end extreme poverty and boost shared prosperity. Scaling Climate Action by Lowering Emissions (SCALE) is a multi-donor fund that will use Results-based Climate Finance (RBCF) to catalyze transformative climate action (see Box 1). Working together with World Bank operations, RBCF can provide additional revenue streams to client countries to support sustainable policy action or incentivize stronger climate action. Agriculture and food systems are relevant to two of SCALE's three investment pillars: greenhouse gas (GHG) mitigation in agricultural production, including carbon sequestration, is a core focus of Natural Climate Solutions (investment pillar 1); and Fiscal and Financial Solutions (investment pillar 3) could support, for example, repurposing agricultural subsidies in line with low-emission agricultural development pathways, or aligning financial institutions' services with the needs for food system transformation.

Box 1: SCALE overview

Scaling Climate Action by Lowering Emissions (SCALE)		
• Umbrella trust fund for all RBCF within the World Bank • Offers contributors strategic approaches for their RBCF • Offers access to RBCF for program host countries		
SCALE investment pillars		
Natural Climate Solutions (e.g., agriculture, forest, and other land use (AFOLU), blue carbon)	**Sustainable Infrastructure Solutions** (e.g., energy, industry, buildings, transport, water and waste management)	**Fiscal and Financial Solutions** (e.g. policies that catalyze additional private and public funding flows)

This note is aims to build awareness of RBCF among Agriculture and Food Global Practice (GP) staff. It clarifies the requirements for developing RBCF investments in the agriculture and food sector, and

[1] UNFCCC. 2015. "Paris Agreement." FCCC/CP/2015/10/Add.1. Paris: United Nations Framework Convention on Climate Change. http://unfccc.int/paris_agreement/items/9485.php. Art. 2.

shares experience from existing RBCF initiatives managed by the Bank[2] to indicate where high potential may be found for RBCF in the agriculture and food sector, and how these opportunities may be developed.

Section 1.1 gives an overview of RBCF, explaining how SCALE fits into the climate finance and carbon finance landscape, and outlines the generic requirements for developing RBCF programs. Section 2 highlights the main agriculture mitigation options relevant to RBCF (Section 2.1) and draws on practical examples to illustrate how various issues particular to RBCF in the agriculture context can be addressed from an operational perspective (Section 2.2). Section 3 summarizes key elements to be considered and integrated into the program development cycle for RBCF programs in the agriculture and food sector.

1.1. Results-based climate finance and SCALE

With RBCF, investors pay a government, a private firm, or a local community for achieving, reporting on and independently verifying a set of pre-agreed performance targets in line with a country's NDC. The performance targets include mitigation outcomes and may include other indicators of progress towards agreed decarbonization goals. As a climate finance instrument (Table 1), RBCF can complement both the finance provided through World Bank operations and activity-based climate finance (ABCF) instruments offered by other climate funds, such as the Green Climate Fund (GCF) and the Climate Investment Funds (CIF).

Table 1 RBCF, activity-based climate finance and carbon finance

Type of finance	Description
Activity-based climate finance	Typically provided as upfront finance in the form of grants, concessional or market-rate debt, equity or guarantees. Examples of activity-based finance sources include the Climate Investments Funds (CIFs) and the Green Climate Fund (GCF), which support countries to implement their NDC commitments.
Results-based climate finance	Funds disbursed upon achievement of pre-agreed results or emission reductions that have been verified to comply with a methodology for quantifying emission reductions. Sources such as SCALE provide financing for emission reductions for programs aligned with NDCs.
Carbon finance	Carbon markets require transfer of ownership of carbon assets through a compliance market or the voluntary market. Different markets may have different obligations related to the country's NDC.

By monetizing the value of emission reductions or other milestones achieved, RBCF can provide an additional revenue stream to enhance the financial viability of agriculture mitigation actions. In particular, RBCF may be attractive in situations where carbon markets cannot be accessed or are unable to provide the incentives needed to achieve mitigation at scale. For client countries, the additional revenue can be used to strengthen the sustainability of policies or measures, or could incentivize governments and other actors to take stronger climate action. For example, revenues can be used to fund the operation costs of extension services of other mechanisms that result in practice change and GHG emission reductions at farm level. The process of developing and negotiating results-based payments could support governments to clarify the costs of implementing low-emission

[2] E.g. BioCarbon Fund (https://www.biocarbonfund.org/), Initiative for Sustainable Forest Landscapes (https://www.biocarbonfund-isfl.org/) and Transformative Carbon Asset Facility (https://tcafwb.org/), among others.

policies or measures at different scales, and support countries to increase their level of ambition. A secured commitment to RBCF payments can also be used by the host country to leverage upfront investments from other sources. Payments can be linked to interim milestones, so that RBCF revenue streams match the financing needs of transformative climate action.

In the evolving context since the Paris Agreement (Box 2), the mitigation outcomes of RBCF programs supported by SCALE can be used by client countries in different ways. Program mitigation outcomes may count towards the client country's own nationally determined contribution (NDC). The value of RBCF transactions may be greater, however, if mitigation outcomes are verified and internationally transferred mitigation outcomes (ITMOs) are transferred, and after corresponding adjustments can count towards another country's NDC. SCALE may also support the development of domestic carbon markets, in which case mitigation outcomes would be transacted between market actors in line with the client country's domestic carbon market rules. Transactions through domestic or international voluntary carbon markets may also be relevant, for example to leverage private finance, or where demonstration projects can contribute to building the case for agriculture's role in national carbon market mechanisms.

Box 2: Climate and carbon finance mechanisms in the Paris Agreement

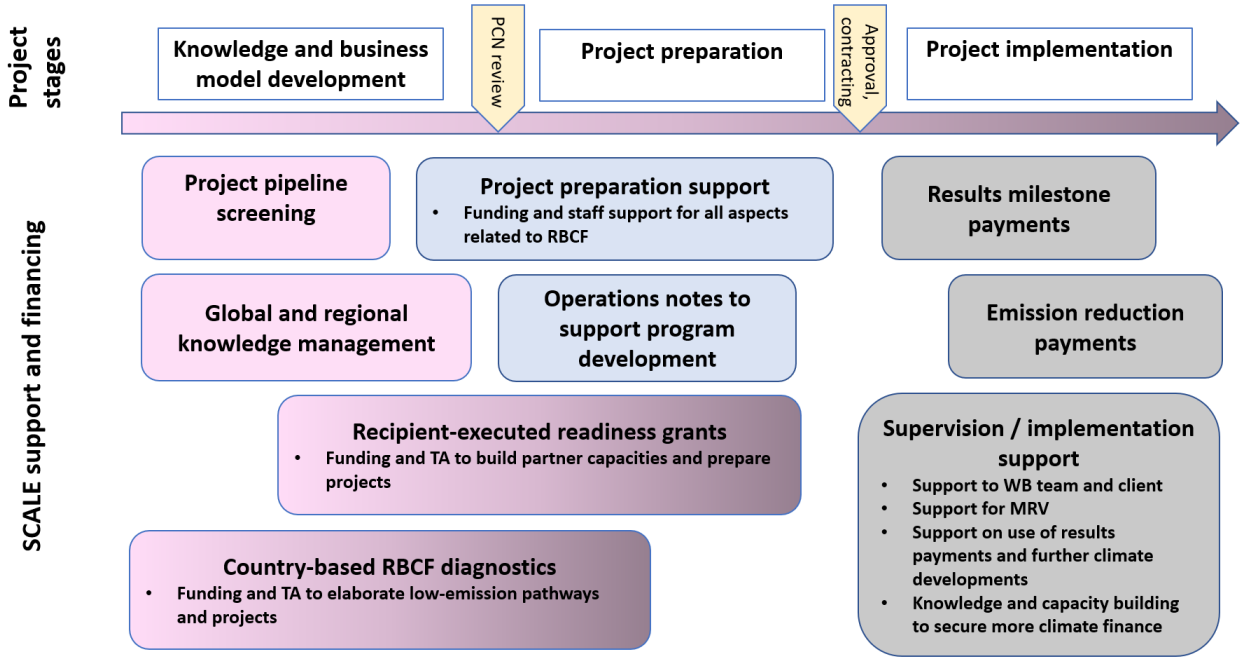
All parties to the Paris Agreement shall pursue emission reduction targets set out in their NDCs. A portion of developing countries' targets are conditional on receiving international finance, technology and capacity building. Mitigation outcomes of activities funded with climate finance provided by developed countries may contribute to the host country's NDC.

Article 6 established two further financing mechanisms. Under Article 6.2, two countries may agree to transfer mitigation outcomes achieved by climate finance flows between parties (e.g., if party A finances party B to implement a mitigation action), with corresponding adjustments to avoid double counting. Article 6.4 established a mechanism for GHG mitigation as a successor to the former Clean Development Mechanism (CDM) through which mitigation projects can be financed and certified emission reductions sold on the international carbon market.

Negotiations are ongoing concerning the approvals and registration required for international transactions on the voluntary market in order avoid double counting. Emission reductions generated through World Bank programs, including SCALE, will be registered in the Carbon Assets Tracking System (CATS) until international rules are fully agreed and countries have put operational systems in place to ensure that double counting is avoided and corresponding adjustments are made.

In addition to directly supporting mitigation actions, SCALE will support development of the enabling environment for mitigation actions, including methodologies for quantifying mitigation outcomes and capacities for developing and implementing mitigation programs, and will support program preparation (Figure 1). SCALE's operations will be fully integrated with World Bank business unit operations to maximize the leveraging power offered by the World Bank and its lending operations while streamlining the project development process by embedding SCALE program development within the World Bank project cycle. The generic process of developing an RBCF program (Box 3) can run in parallel to the investment project financing (IPF), program for results (PforR) or other Bank operation project cycle, so that design of the Bank operation and RBCF program are mutually supportive.

Figure 1 SCALE support and financing available through the project cycle

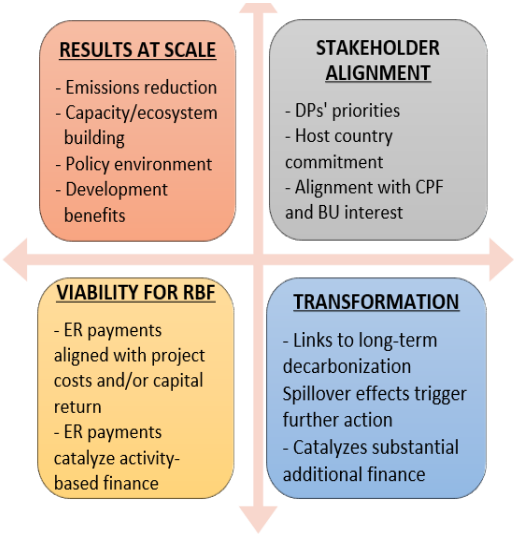


Box 3: Aligning SCALE program cycle with Bank operations project cycle

Program identification	Alongside the Bank operation concept note, task teams work with the client to develop an initial project concept note (PCN). SCALE staff can introduce to the client and the task team about SCALE project criteria and procedures, and provide guidance on aligning project development with SCALE's requirements.
Program design	Alongside PAD development, key elements of RBCF program are designed, e.g., crediting thresholds, GHG quantification methodology and MRV systems, estimated emission reductions, expected use of revenues, etc.
Program preparation	The RBCF program design will undergo third party validation. An emission reduction purchase agreement (ERPA) will be drafted and negotiated, and other relevant RBCF elements, such as how to register and account for emission reductions, may be addressed.
Program implementation	RBCF-specific elements of program implementation include measurement, reporting and verification of emission reductions and disbursement of milestone- or emission reduction linked payments.
Issuance and use of ERCs	Depending on the type and use of emission reductions, credits may be approved, issued and registered, as appropriate.

SCALE aims to catalyze transformative climate actions with payments for independently verified emission reductions in support of developing countries' efforts to implement ambitious NDCs and further raise ambition. Generic criteria for SCALE programs are described in the paragraphs that follow, and issues related to their implementation in the agriculture sector are discussed in Section 2.2 below.

Figure 2 SCALE funding allocation principles



Alignment with ambitious NDCs and long-term decarbonization strategies. SCALE programs should be fully aligned with ambitious implementing country NDCs as well as domestic policy objectives and sectoral priorities. SCALE support should aim to incentivize countries to go well beyond business-as-usual, to increase their mitigation targets and/or to enhance the implementation of mitigation policies and measures beyond what they would achieve with their own efforts.

Transformation with lasting impacts. SCALE programs should demonstrate transformation, leading to large-scale, sustainable impacts that shift or accelerate the trajectory toward a low-emission agriculture development pathway. Design and implementation of SCALE programs should ensure transformative impacts and sustainability of program impacts after SCALE support ends.

Sustainable development, social inclusion, gender equity, and safeguard standards. SCALE programs should be consistent with the World Bank's Country Partnership Framework and the country's Sustainable Development Goal implementation plans and will follow the World Bank Operational Policies and Procedures, including on social inclusion, gender equality, and environmental and social safeguard policies.

Environmental integrity. SCALE will only support programs whose emission reductions show strong environmental integrity, including avoiding double counting and applying robust measurement, reporting and verification (MRV) systems.

Readiness for implementation. SCALE programs should have undergone some capacity building and readiness work and be ready for implementation after ERPA signature. Preferably, emission reductions should be generated within two years of ERPA signing.

2. Identifying RBCF opportunities in agriculture

2.1. A global perspective

Agricultural production directly contributes about 13% of all GHG emissions, but when land conversion and other food system processes are taken into account, the contribution of the food system is about one third of total global emissions.[3] The main sources of GHG emissions in agricultural production in developing countries are **livestock** (63%)**, rice cultivation** (13%)**, synthetic fertilizers and other nutrients** (11%)**, on-farm energy use** (6%) and **biomass burning** (4%). Agricultural production also drives **land use change**, which is a major source of emissions from deforestation, as well as loss of carbon in cropland soils and woody vegetation outside forests. While GHG emissions from land use, land use change and forestry have begun to stabilize, on-farm agricultural production emissions have continued to grow at about 1% per year and are now larger than emissions from forests and other land use.[4] Post farm-gate food system emissions (including emissions from food transport, processing and manufacturing, storage, retail, consumption, and waste disposal) are now equal to about half of total on-farm emissions, and have been growing at a faster rate than on-farm emissions.[5]

Recent global analysis has suggested there is significant mitigation potential at costs below $100/t$CO_2$e through supply and demand side strategies in the food system (Table 2).[6] The main supply side strategies are **soil improvement with biochar**,[7] **agroforestry**, **cropland and grassland soil carbon sequestration**, **nutrient management**, **rice management**, and **livestock** and **manure management**. The distribution of this mitigation potential below $100/t$CO_2$e varies among regions and countries grouped by income level:

- 65% of the mitigation potential for measures that reduce agricultural emissions (i.e., livestock, manure management, rice management, nutrient management) is in **East Asia and the Pacific** and **South Asia**;
- More than 60% of carbon sequestration, food loss reduction and dietary change mitigation potentials are in **East Asia and the Pacific**, **Europe and Central Asia** and **Latin America and the Caribbean**.

[3] Nabuurs G., et al. (2022) Agriculture, forestry and other land uses (AFOLU). In IPCC, 2022*: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Ch. 7; Tubiello, F. et al. (2022) Pre- and post-production processes increasingly dominate greenhouse gas emissions from agri-food systems. *Earth System Science Data*, 14(4): 1795-1809.
[4] Tubiello, F. et al. (2015) The contribution of agriculture, forestry and other land use activities to global warming, 1990–2012. *Global Change Biology*, 21(7): 2655-2660.
[5] Tubiello, F. et al. (2022) Pre- and post-production processes increasingly dominate greenhouse gas emissions from agri-food systems. *Earth System Science Data*, 14(4): 1795-1809.
[6] See Roe, S. et al. (2021) Land-based measures to mitigate climate change: Potential and feasibility by country. *Global Change Biology*, 27(23): 6025-6058. Note also that renewable energy, energy efficiency and refrigeration options in food supply chains were not included in this analysis.
[7] Biochar is indicated in global modelling assessments as having large potential. This is mostly based on experimental and small-scale pilots. Commercial biochar supply chains are relatively underdeveloped in many developing countries, so the short-term feasible potential of this option may be much less than indicated in global modelling.

- The largest proportion of mitigation potential below $100/tCO$_2$e is in upper-middle income countries (45%), followed by lower-middle (26%) and high-income countries (23%). Only 6% is in low-income countries.

However, much of this mitigation potential will not be achievable. For both supply and demand side measures, more than 60% of the global economic potential is in countries likely to have a challenging implementation environment in terms of governance and institutions, and agricultural performance and capacities, leaving **less than 40% of global economic mitigation potential in countries with a favorable implementation environment** (Table 3). Furthermore, $100/tCO$_2$e is a relatively high threshold for economic mitigation potential, and agricultural mitigation at this cost would not currently be justifiable in many contexts. *Source: Calculated from Roe et al. (2021)* Land-based measures to mitigate climate change: Potential and feasibility by country. *Global Change Biology*, 27(23): 6025-6058

Figure 3 indicates that mitigation strategies with the largest proportions available at <$20/tCO$_2$e are **cropland** and **rice management**, and **livestock management**.

Table 2 Mitigation potential of supply and demand side strategies at economic costs below $100/tCO$_2$e

Mitigation strategies	Mitigation potential (MtCO$_2$e per year)	Mitigation potential per unit (MtCO$_2$e per year per head livestock or per ha of land)	Regions
Supply side			
Livestock (enteric fermentation)	98	0.1	All regions
Manure management	92	0.8	E Asia & Pacific (29%) Europe & C Asia (10%) N America (58%)
Rice management	171	1.6	E Asia & Pacific (50%) S Asia (37%)
Nutrient management	223	0.4	E Asia & Pacific (50%) Europe & C Asia (10%) S Asia (23%)
Crop soil C sequestration	922	0.7	All regions
Grassland soil C sequestration	892	0.8	All regions
Agroforestry	1121	1.5	All regions
Biochar	1815	2.5	All regions, except SSA
Demand side			
Reduced food loss	452	-	All regions
Dietary change	1434	-	All regions
Total	**7,220**	**-**	**-**

Source: Calculated from Roe et al. (2021) Land-based measures to mitigate climate change: Potential and feasibility by country. *Global Change Biology*, 27(23): 6025-6058

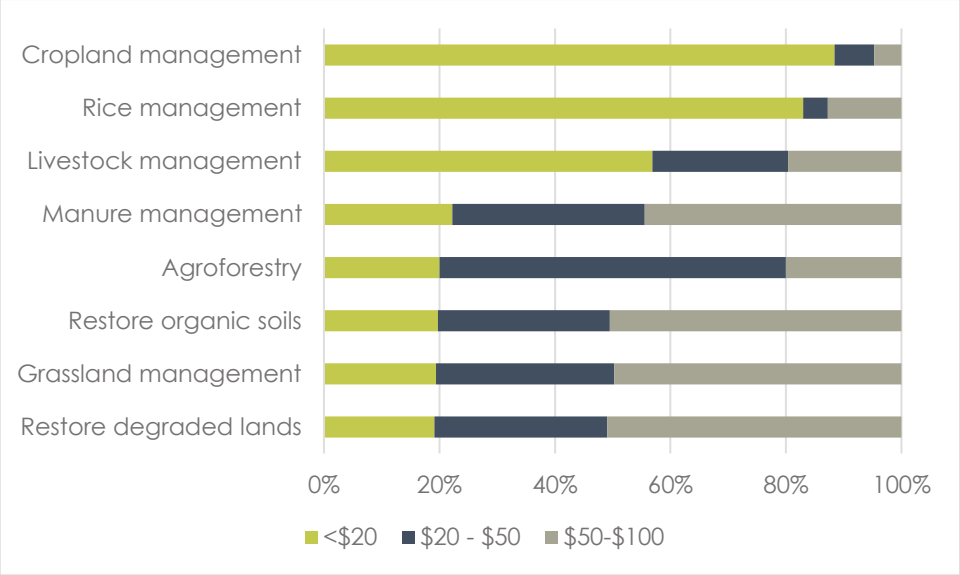
Table 3 Economic mitigation potential of supply and demand side strategies located in countries with a favorable implementation environment by income group

World Bank income categories	Total economic potential in countries with a favourable implementation environment (MtCO$_2$e per year)	Percent of global economic potential located in countries with a favourable implementation environment
Low	199.5	3%
Lower-middle	656.9	9%
Upper-middle	668.6	9%
High	1094.2	15%

Grand Total	**2619.3**	**37%**

Source: Calculated from Roe et al. (2021) Land-based measures to mitigate climate change: Potential and feasibility by country. *Global Change Biology*, 27(23): 6025-6058

Figure 3 Proportions of global economic mitigation potential of supply side strategies viable at different economic costs



Source: Adapted from Smith, P. et al. (2014) Agriculture, forestry and other land use. In IPCC, AR5 Climate Change 2014: Mitigation of Climate Change, Ch. 11, Figure 11.13.

It is well known that agricultural mitigation at scale can face a number of challenges, as reflected in the fact that agriculture accounts for less than 3% of voluntary carbon market projects in the land use sector and less than 2% of total voluntary market transaction volumes,[8] and only about 2.5% of climate finance, which is an order of magnitude below the sector's potential contribution to GHG mitigation.[9] Constraints that RBCF initiatives may need to address include: [10]

- **Financial constraints:** In addition to the scale of financing, accessibility of finance is a major challenge, as financial inclusion is limited for many smallholders. Large upfront investment costs and slow returns are also common features of climate-smart agriculture investments.
- **Non-financial barriers:** These include insecure land tenure rights, institutional capacity gaps, significant variability in biophysical conditions between different locations, high transaction costs of monitoring large numbers of producers, and low capacities for agricultural statistics in many countries.

These constraints are commonly addressed in World Bank IPF operations. **There will be stronger potential for linking with RBCF where prior Bank operations have demonstrated effective solutions to overcoming these challenges**.

Despite these challenges, recent developments in the agriculture and climate change sectors also indicate opportunities for RBCF in agriculture and ways to overcome barriers to mitigation in the sector.

[8] Forest Trends (2021) State of the voluntary carbon markets 2021. Forest Trends, Washington D.C.
[9] Buchner, B. et al. (2015) Global Landscape of Climate Finance 2015. Climate Policy Initiative, San Francisco.
[10] Nabuurs G., et al. (2022) Agriculture, forestry and other land uses (AFOLU). In IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change*, Ch. 7.

First, relatively low mitigation potential per unit area (Table 2) highlights the need to base RBCF initiatives on feasible approaches for practice change at scale. In particular, GHG accounting for the recent portfolio of Bank IPF projects suggests that, while the vast majority of projects potentially reduce net GHG emissions when compared with a 'without project' scenario, about half of projects have annual emission reductions less than 60,000 tCO_2e (i.e., a common definition for 'small-scale' carbon finance projects), and only 10% have emission reductions greater than 100,000 tCO_2e per year. Small scale initiatives may be appropriate for carbon markets, where many transactions are 'over the counter' and smaller in scale. For RBCF at large scale, emission reductions from Bank IPF operations will be insufficient, and **the key will be to link Bank operations to support development and implementation of large-scale initiatives of the host government or private sector**. **Large-scale mitigation effects have been demonstrated from different scaling mechanisms in the agriculture sector in developing countries** (Box 4).

Box 4: Agricultural GHG mitigation through different mechanisms

GHG mitigation has been achieved in some countries at scale through different mechanisms:

Regulatory mechanisms: In the early 2000s, Brazil deployed various regulatory measures to slow deforestation, including enforcement of regulations on land use change in the legal Amazon area. Empirical evidence showed that regulations reduced deforestation and GHG emissions, but reversals later occurred when enforcement was not consistent.

Incentive mechanisms: China's Sloping Land Conversion Program provided support and incentive payments to enable farmers to convert marginal arable land to forests. The program had clear impacts on forest cover and carbon stocks, soil erosion and other ecosystem services as well as rural off-farm incomes.

Public welfare programs: Ethiopia's Productive Safety Net Program primarily aimed to reduce poverty by financing rural labor inputs on public works, such as soil and water conservation measures, restoration of degraded lands and sustainable land management. The program is estimated to have reduced emission by up to 3.4 million tCO_2e per year.

Targeted credit lines: Brazil's Low-Carbon Agriculture Plan, implemented through the Central Bank of Brazil, supports agricultural technology adoption with extension support and credit loans to farmers for activities such as restoration of degraded pastures, agroforestry systems, adoption of no-tillage methods and animal waste treatment technologies. One study estimated that the program reduced agricultural emissions by 169 $MtCO_2$ between 2010 and 2020.

Extension-led approaches: In recent years, China has begun to tackle excessive use of nitrogen fertilizer, a major source of N_2O emissions. Soil nutrient testing stations were established in 2005, which provided soil nutrient testing services and fertilizer recommendations to farmers. The program was credited with significant reductions in GHG emissions from fertilizer use. More recently, a farmer decision support system, Nutrient Expert, has been rolled out to provide farmers with crop-targeted advice on fertility management, and has enabled millions of farmers to improve nitrogen use efficiency, and increase yields and profits.

Source: Nabuurs et al. (2022) Agriculture, forestry and other land uses (AFOLU). In IPCC, 2022: Climate Change 2022: Mitigation of Climate Change. Contribution of Working Group III to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change, Ch. 7.

Second, **the prominence of agriculture mitigation in the NDCs has given new attention and impetus to agriculture mitigation**. Table 4 indicates that about 35% of the total global mitigation potential below $100/tCO2e is in countries that have prioritized the corresponding measures in their NDC. However, the vast majority of countries that prioritized the main agricultural mitigation measures are countries with potentially challenging implementation environments. Only about 17% of global mitigation potential below $100/tCO2e is in countries that have prioritized the agricultural mitigation measures in their NDC ***and*** that have a favorable implementation environment. In general, integration of agricultural policies and measures in climate policy has been slow due in part concerns about potential trade-offs with food security and livelihoods, difficulties in coordinating diffuse and diverse activities and stakeholders, political interests and capacity gaps.[11] So, although the agri-food sector is prioritized for mitigation in the majority of developing countries' NDCs, few have specified implementation mechanisms. **Opportunities for RBCF will be higher where NDC commitments have been based on existing agriculture development initiatives with demonstrated potential. SCALE program development may also play key roles in strengthening the enabling environment and building capacities for RBCF pipeline development**. In addition, an increasing number of agri-food companies have set targets for emission reductions in their operations, and these are gradually being extended to their supply chains.[12] Corporate initiatives to reduce supply chain emissions can also provide opportunities for RBCF at scale, for example where precision agriculture relying on digital technologies can provide an existing basis for MRV of emission reductions.

Table 4 Mitigation potential in countries prioritizing agricultural mitigation strategies in their NDCs

	Livestock	Manure management	Rice management	Crop & nutrient management	Grassland management	Agroforestry
Mitigation potential <$100/tCO2e in countries with NDC (MtCO2e per year)	42.8	74.2	66.8	581.4	329.4	131.5
% of global mitigation potential <$100/tCO2e	43.5%	80.8%	39.0%	50.8%	36.9%	11.7%
Mitigation potential <$100/tCO2e in countries with NDC priority ***and*** a favorable implementation environment (MtCO2e per year)	27.2	53.3	36.4	213.4	166.8	83.6
% of global mitigation potential <$100/tCO2e	27.7%	58.0%	21.3%	18.6%	18.7%	7.5%

Sources: Calculated from Roe et al. (2021) for mitigation potential and implementation environment, and Rose et al. (2021, https://ccafs.cgiar.org/resources/tools/agriculture-in-the-ndcs-data-maps-2021)for NDC prioritization.

Third, while agriculture accounts for a very small percentage of carbon market transactions, **there has been increasing innovation in agricultural GHG quantification methodologies and monitoring**

[11] Leahy, S. et al. (2020) Challenges and Prospects for Agricultural Greenhouse Gas Mitigation Pathways Consistent With the Paris Agreement. *Front. Sustain. Food Syst.,* 4, https://doi.org/10.3389/fsufs.2020.00069

[12] E.g., https://www.wbcsd.org/Pathways/Food-Agriculture, https://ukcop26.org/agricultural-commodity-companies-corporate-statement-of-purpose/

systems, including making use of new opportunities provided by digitization. GHG quantification methodologies exist for most of the main agriculture and food system mitigation options (Table 5). Together with IPCC guidelines on GHG quantification for national GHG inventories and other guidance targeting policies and companies,[13] these methodologies can be used as the basis for GHG quantification methods in RBCF initiatives. However, carbon market methodologies designed to meet the requirements of different standards and specific implementation conditions may need to be adjusted to be applicable to RBCF initiatives at scale.[14]

Table 5 Overview of GHG quantification methodologies for agri-food sector mitigation options

Mitigation option	No. of CDM methodologies[1]	No. of national / sub-national standard methodologies [2]	No. of voluntary market standard methodologies[3]
Enteric fermentation	1	6	2
Manure management	3	5	
Rice management	1	1	3
Nutrient management	2	1	1
Irrigation energy use	2	-	-
Cropland soil carbon sequestration	-	2	3
Grassland soil carbon sequestration		2	3
Agroforestry	4	1	2
Biochar	-	-	1
Food loss and waste	-	-	1
Dietary change	-	-	-
Agri-food processing energy use and refrigeration	>7	>5	3

[1]See CDM Methodologies; [2]Estimated from schemes in Australia, Alberta, China, California; [3]Estimated from Verra, Gold Standard, ACR.

2.2. Identifying high potential RBCF opportunities in the agriculture sector

World Bank agriculture and food sector operations commonly relate to all aspects of on-farm production, the agricultural production environment, as well as agriculture and food value chains. These investment areas are closely related to the main agriculture and food system GHG emission reduction options highlighted in Section 2.1.[15] The results from global modeling summarized in the previous section necessarily rely on limited available data and simplifying assumptions, and may not be an accurate guide to feasibility in any specific context. However, the general findings are consistent

[13] E.g. 2006 IPCC Guidelines, 2019 Refinement to the IPCC Guidelines, WRI GHG Protocols, ICAT policy assessment guides, Science Based Targets Initiative Forest, Land and Agriculture methods.
[14] See also SCALE Methodological Framework, which sets out basic requirements for MRV of policy, programmatic, sectoral and jurisdictional mitigation initiatives.
[15] Among the mitigation options highlighted in Section 2.1, soil amendment with biochar has not commonly featured in World Bank IPF operations, and biochar commercialization is generally at a nascent stage in most developing countries. Shifting diets to foods with low carbon footprints has not to date been a major focus of AGF sector operations.

with experience from agricultural carbon initiatives, which can provide guidance on identifying high potential RBCF opportunities. The remaining sections of this note draw on existing experience to highlight key issues and options to consider in linking agriculture and food sector operations to RBCF, focusing on alignment with NDCs; strategies for scaling; baselines and crediting thresholds; measurement, reporting and verification; and financing and the use of mitigation outcomes.

Box 5 highlights key questions for screening potential projects. If not all conditions are in place prior to preparing a SCALE program, it will be important to consider whether putting the required elements in place can be done within a reasonable timeframe and at feasible cost. Considerable analytics may be needed before a strong an intervention is ready to be developed into an RBCF investment, as indicated by the case study in Box 6.

Box 5: General guidance on screening potential agriculture and food interventions

1. Policy alignment: Are the interventions to be promoted in line with the country's agriculture sector policies and mechanisms as well as climate change policies and commitments, such as the NDC? Clear alignment is preferable, but a strong case can also be made if the SCALE program could contribute to further developing agri-food sector or climate plans and targets.

2. Interventions: Are there proven practices or technologies and delivery mechanisms? In general, there should be an existing evidence base for the interventions to be promoted.

3. GHG effects: Are the GHG effects of the proposed actions clear? Ideally, there would be existing GHG quantification methodologies or methodologies that could be adapted to the project's circumstances. Since agri-food sector methodologies are relatively few, developing a new methodology could be a key activity in the SCALE program development phase. Similarly, preparatory activities could strengthen monitoring systems to enable SCALE program MRV.

4. Incentives: Are there clear drivers of adoption for farmers or other value chain actors? The value of agricultural production per unit area is generally significantly higher than the value of emission reductions, so the primary drivers of adoption should depend on the effects of adoption on production (e.g., cost savings, or increased productivity or profitability). Ideally, evidence on drivers of adoption already exists, but could also be collected as part of SCALE program preparation.

5. Scaling potential: Is there potential to achieve significant scale? Transaction costs of developing, monitoring and verifying emission reduction credits (ERCs) can be high, and achieving scale increases the returns to these investments. The minimum scale to target depends to a great extent on whether the program targets contributions to the host country's NDC, Article 6.2 or 6.4 mechanisms or voluntary carbon markets.

Box 6: Screening a potential rice mitigation project in Viet Nam

Mitigation of CH_4 and N_2O emissions from rice cultivation features prominently in Viet Nam's NDC and sectoral mitigation plans. Agriculture sector plans promote diverse measures to promote yield gains and reduced GHG emissions, including alternate wetting and drying, reduced fertilizer and pesticide use, and improved crop residue management. Sectoral plans include targets for the scale of adoption of improved practices to be achieved by 2025 and 2030. Preliminary assessment

of the potential for a large-scale RBCF program drew on considerable existing analytics to assess, among other things, the following:

• **Emission reductions per unit area:** This information was critical for initial estimates of program scale in terms of hectares (and thus numbers of farmers to reach) and emission reductions. A range of figures were identified in a previous review conducted for a prior Bank operation in Viet Nam, and conservative values selected for the pre-PIN document.

• **Implementation costs:** A prior Bank operation had invested in establishment of farmer organisations and infrastructure for production and marketing as well as promotion of low-emission rice cultivation techniques on a pilot scale. This information was used to estimate an indicative investment budget for the pre-PIN.

• **Adoption rates and barriers to adoption:** Evaluation reports for the prior Bank operation provided lessons on key elements to enable adoption, information on adoption rates and financial returns for farmers, and academic studies in the project region were used to identify barriers faced by non-adopting households to indicate measures that might be required to achieve broader uptake in a large-scale program.

• **GHG quantification methodologies and MRV systems:** Relevant carbon market GHG quantification methodologies reviewed, and data needs assessed in relation to existing national MRV systems, to outline potential directions for development of a robust MRV system for the program.

In the case of Viet Nam, much of these analytics already existing due to the prior Bank operation and other stakeholders' activities in support of low-emission rice cultivation, but some were available only because of dedicated studies.[16] In the absence of available information, studies would have had to be conducted to provide a sufficient evidence-base for the program.

2.2.1. Alignment with ambitious NDCs

Countries vary considerably in the extent to which agricultural policies and measures have been integrated into climate plans and NDCs. Countries with ambitious NDCs and clear agriculture sector priorities and pathways may provide good conditions for developing RBCF programs (Box 7). SCALE can also support capacity building and analysis to strengthen agriculture-climate policy integration and enhance the ambition of NDCs (Box 8).

Box 7: Ambitious NDCs with clear agriculture priorities and pathways

Ethiopia's initial NDC (2015) was based on the country's Climate Resilient Green Economy (CRGE) Strategy, developed in 2010. The CRGE Strategy set out four main intervention areas for achieving mitigation in the livestock sector (Table 6). The initial NDC projected emission reductions of 48 $MtCO_2e$ in 2030 compared to a BAU scenario. The IDA-financed Livestock and Fisheries Sector Development Project (LFSDP) aligned its interventions with these policy priorities. Working in 58 of the country's 832 local government districts, the LFSDP supports micro-projects such as poultry and

[16] E.g., World Bank (2022) Spearheading Vietnam's Green Agricultural Transformation: moving to low-carbon rice. World Bank, Washington D.C.

small ruminant production by vulnerable households and improvements in the productivity of smallholder dairy cattle, as well as enhancing the enabling environment through strengthening advisory services and national capacities for sector monitoring and planning.

Table 6 Livestock sector intervention areas in Ethiopia's Climate Resilient Green Economy (CRGE) strategy

Intervention areas	General description	Abatement levers modelled
Enhancing and intensification of animal mix diversification	▪ Increase meat supply from poultry and other low emitting animals	▪ Increased poultry supply
Value chain efficiency improvements (pastoralists and farmers)	▪ Increase productivity per head through improved breeding, feeding, health, marketing etc.	▪ Dairy-oriented aggregation (smallholder) ▪ Dairy-oriented aggregation (commercial) ▪ Feedlot programme (smallholder) ▪ Feedlot programme (commercial) ▪ Pastoralist programme
Mechanization (small scale and large scale)	▪ Introduce tractors and small tools through small scale mechanization programs	▪ Large-scale mechanisation ▪ Small-scale mechanisation
Rangeland and pasture management	▪ Increase productivity of pasture and improve rangeland management	▪ Rangeland and pasture management

Source: Adapted from FDRE (2011) Climate Resilient Green Economy Strategy. Addis Ababa.

One LFSDP results framework indicator tracks change in the GHG intensity of livestock production (kg CO_2e / kg protein produced). Using technical assistance (TA) funds from outside the project budget, a project-specific methodology to quantify change in emission intensity was developed, and preliminary results suggested significant reductions in emission intensity due to project activities. RBCF could potentially build on those interventions proven to have high feasibility, significant mitigation effects and other co-benefits, and link with a follow-on phase of the LFSDP to expand the number of beneficiary households and enable Ethiopia to exceed its targets based on domestic resources.

Box 8: Support for policy development

Kenya's NDC seeks to address the country's adaptation and mitigation objectives in the agriculture sector by aligning sector priorities with the Kenya Climate Smart Agriculture Strategy. The Strategy's Implementation Framework prioritizes actions that "aim at building resilience and associated mitigation co-benefits to address issues related to soil health and land degradation" and "building of synergies in adaptation and mitigation measures." Analysis to support updating of the National Climate Change Action Plan identified sustainable land management (SLM, including soil nutrient management, conservation agriculture, agroforestry and Climate Smart Agriculture) as a priority for adaptation, but analysis of mitigation potential identified lack of data and information to support evidence-based decision making as key constraints to further elaboration of actions with mitigation co-benefits and target setting. Specifically, agroforestry was highlighted as likely having the highest mitigation potential, but data on the current extent of agroforestry is insufficient to set reliable baselines, although low-cost methods for monitoring using Collect Earth are now available. For SLM, insufficient data on the mitigation effects of specific practices was identified as a constraint. However, Kenya hosts the BioCarbon Fund supported Kenya Soil Carbon Project, which has quantified emission reductions from SLM in one region of the country, and the World Bank has supported climate-smart

agriculture projects covering all counties of the country, which may also be able provide a rich source of evidence.

RBCF could leverage evidence from these and other SLM initiatives in the country to expand adoption of agroforestry and SLM practices. Improving the evidence-base during RBCF project preparation for these measures in terms of baselines, with-intervention adoption rates and mitigation effects could also support improved assessment of mitigation potential at national scale and contribute to enhanced ambition in Kenya's future NDCs.

RBCF payments aim to incentivize countries to go beyond what they are able to do with their own resources. NDCs typically contain unconditional commitments (i.e., what a country proposes to achieve with domestic resources) and commitments that are conditional on receiving international finance, technology and capacity building support. RBCF baseline and crediting thresholds may be set to reward countries for exceeding existing unconditional commitments. SCALE program development may also help build the capacities and infrastructure needed to enable countries to clarify mitigation options and targets and to strengthen implementation and monitoring mechanisms. Identifying RBCF investment opportunities can be integrated into Climate Change Development Report (CCDR) and Climate Smart Agriculture Investment Plan (CSAIP) processes, or other World Bank operations supporting climate-resilient, low-emission development planning in the agriculture sector. Even where NDC agriculture sector commitments are relatively more developed, turning policy commitments into investable, implementable policies and measures or programs may require further analytics and support. This support may be integrated into Agriculture and Food GP or country operations, or when provision of funding and TA has high potential to contribute to the SCALE program pipeline, support may also be available from SCALE.

2.2.2. Transformative and long-lasting impacts

There are many similarities between the impacts that Bank-financed agriculture and food sector operations and RBCF aim to achieve in the agriculture and food sector. Large-scale and sustained adoption of climate smart practices are more likely when:

- technologies have been tested, adapted and validated in the target production systems or regions;
- the evidence for strong benefits of farmer adoption is clear;
- stakeholders involved in Climate Smart Agriculture (CSA) technology promotion (e.g., public or private extension services, input suppliers, rural financial institutions, farmer organizations) have demonstrated capacities for delivery at large scale; and
- policy measures and mechanisms have been successfully piloted.

Sustained change in production practices often requires multiple interventions to enhance the enabling environment.

Not all Bank operations will be suitable to be linked to an RBCF program. In particular, considering the scale of Bank IPF projects (see Section 2.1 above), small-scale operations may be suitable for carbon market mechanisms (e.g., domestic carbon markets, Article 6.4 mechanisms or the international voluntary carbon market) if the value of the emission reductions can justify the additional costs related to carbon project development, MRV and credit issuance, or if there is strong potential for

replication of small-scale activities. Whether and how Bank operations can leverage SCALE investments to take interventions to scale will be a key factor determining the potential for RBCF linked to the Bank's agriculture and food sector operations. There are several potential strategies for achieving the scale required by RBCF on the basis of Bank-financed operations. The suitability of different scaling strategies will vary on a case-by-case basis.

Replicating or out-scaling proven initiatives: Where small-scale projects financed by prior IPF operations or other sources demonstrate effective results, RBCF may be deployed to enable and incentivize scaling up. Box 9 presents the example of scaling a CSA project in Zambia to a sub-national jurisdictional integrated landscape program. For discrete technologies, such as cooking stoves, biogas, solar irrigation, the CDM's programme of activities mechanism also showed how small-scale projects can be replicated within carbon market mechanisms. Similar mechanisms have also been used to address post-farmgate emissions in agri-food value chains, as exemplified by waste-to-energy programs in Cambodia's rice milling sector.[17]

Box 9: Scaling the COMACO Landscape Management project in Eastern Zambia

The COMACO (Community Markets for Conservation) landscape management project was funded by the World Bank Bio Carbon Fund to promote climate-smart agricultural practices in the Luangwa Valley of Eastern Zambia. It aimed to increase crop yields, incomes and the welfare of smallholder farmers, as well as increasing net forest cover while reducing uncontrolled forest loss and degradation. The project consisted of two components, one that promoted sustainable land management practices (SALM) and one focusing on reducing emissions from deforestation and forest degradation (REDD+).

The SALM component introduced improved agricultural practices that increase food production and farm incomes while also increasing soil carbon sequestration on 17,130 ha of agricultural land in the project area. The REDD+ component expanded areas under natural forest and conserved biodiversity through land use planning with traditional leaders and communities. About 11,245 ha of forest were brought under protection in Community Conservation Areas. The project also implemented a separate CDM project that introduced efficient wood stoves to replace open firewood cooking among COMACO farmers and associated communities. At project closure, 19,399 smallholder farmers had adopted various sustainable agriculture practices and 128,375 ha had been brought under sustainable agriculture and forest management. 264,578 tCO_2e were verified by a third party as GHG emission reductions due to the interventions introduced.

The COMACO landscape management project provided many important lessons to inform scaling up project activities into a jurisdictional landscape management program in Eastern Zambia known as the Zambia Integrated Forest Landscapes Project (ZIFLP). The ZIFLP targets improved landscape management and increased environmental and economic benefits for targeted rural communities in all nine districts of the Eastern Province of Zambia. Through a combination of CSA and sustainable forest management activities, ZIFLP aims to remove almost 18 million tCO_2e from the atmosphere over a period of 20 years. The program is implemented via a consortium of experienced partners, including local and national government, local communities, the private sector, NGOs, and international agencies. These partners were included based on their track record of activities in Eastern Province or at national level. COMACO contributes to the ZIFLP in the area of CSA and

[17] NCSD (2018). Better Fuel Better Future. NCSD, Phnom Penh.

REDD+ to upscale its experience from the landscape management project in nine chiefdoms to all 25 chiefdoms in the Eastern Province.

Scaling through national policies and programmes: IPF operations often finance activities in selected districts of a country, while also strengthening national institutions and policy or planning capacities. In some cases, operations are managed by project management institutions and not fully integrated into national processes. Consolidating the experience gained by implementing Bank operations in a particular area of a country, RBCF could potentially support scaling through national policies and programs (Box 10).

Box 10: RBCF to scale low-emission rice cultivation in Vietnam

Vietnam has made a commitment to reduce methane emissions by 30 percent by 2030 and achieve net-zero levels by 2050. About half of agriculture sector emissions, and over 75 percent of methane emissions, come from rice cultivation. Rice is grown on about 55 percent of the country's cropland and contributes to food security for more than 90 percent of the population. Vietnam also accounts for about 9 percent of global rice exports by volume. The large opportunity to reduce methane emissions from rice cultivation is reflected in the national 'Strategy for Sustainable Agriculture and Rural Development for 2021–2030 with a Vision to 2050', which outlines aims to shift agricultural production towards green, environmentally-friendly and climate-resilient pathways, and in sectoral mitigation plans.

The Mekong Delta (MKD) region is a focus for rice production, contributing 50 percent of total production and 95% of rice exports from 4.3 million ha of paddy. However, rice intensification has created a range of environmental issues, which also increase the vulnerability of rice production to climate risks. Vietnam has developed the Mekong Delta Regional Master Plan which sets out the strategic plan to green the MKD's agriculture sector, and includes a program targeting 1 million ha of high quality rice value chain.

Prior World Bank operations have piloted some approaches in line with this new policy framework. The Vietnam Sustainable Agricultural Transformation Project (VnSAT) promoted nationally approved best management practices through two technology packages that increase yields and profits by optimizing input use while also reducing environmental and GHG impacts. These packages were promoted on more than 300,000 ha of rice in the MKD region. Adoption rates of these packages were over 80%. This was achieved through strengthening provincial planning and service delivery capacities, and strengthening public-private partnerships in the rice value chain. VnSAT also supported development of more than 300 farmer organizations, which played key roles in linking members to rice value chains through access to equipment and value chain infrastructure investments.

The policy context and the basis established by prior Bank operations provide an opportunity to upscale proven approaches in support of the country's low-emission, high quality rice production objectives. An RBCF program is being developed targeting 8 provinces in the MKD region where low-emission rice technologies have been piloted and which have potential for scaling up. Activities targeting practice change on 1 million ha of rice paddy will seek to address the barriers faced by farmers who have not yet adopted the existing packages in pilot areas and further strengthen policies and planning, institutional capacities and public investment for scaling up. The RBCF program is being designed alongside a new Bank IPF operation. RBCF will be deployed to incentivize achievement of key milestones and verified outcomes, including GHG emission reductions. By

enabling RBCF payments at different phases of scaling up to the 1 million ha target, RBCF can both provide incentives for national and provincial governments to allocate domestic resources to achieving these targets, and also make finance available to enable investments required in the scaling up process.

Leveraging financial sector investment: High loan interest rates can deter farmers from taking credit to finance low-emission agriculture investments, and can also prevent commercial banks from expanding their investments in otherwise profitable activities. Sustainability linked loans (SLLs) are one way to reduce interest rates for investments with climate and other benefits. In SLLs, banks agree with credit line financiers that the interest rates on products targeting low-emission investments will be linked to the bank achieving pre-defined performance criteria from which emission reductions due to the financed activities can be calculated. RBCF payments could be used as the funding source to allow interest rates to be lowered while ensuring that the lender still receives a commercial or near-commercial return on its loan (Box 11). State development banks are also a key source of investment in many countries. Many national development banks (NDBs) are exploring how they can support low-carbon transitions, including in the agriculture and food sector. RBCF payments could be used as an incentive for NDBs to increase their investment in low-emission activities. For both commercial banks and NDBs, the process of engaging with RBCF can help develop their capacities to support low-emission investments in the longer-term.

Box 11: Sustainability linked finance to expand IPF operations impact

The dairy sector is one of Kenya's most dynamic economic sectors. About 4 billion litres of milk are produced by an estimated 1.4 million smallholders. Low milk yields result in high GHG emissions per litre of milk produced. Milk yields are constrained by poor quality feed, animal genetics, animal health, and husbandry skills, but farmers lack access to capital to improve production, particularly considering the relatively longer repayment periods required for many dairy investments. In 2021, the World Bank designed an investment program to support adoption of improved dairy production practices on smallholder farms, in which the interest rate, grace period and tenor of loans to farmers are improved in view of the GHG benefits that can be achieved by adopting various improved practices on-farm.

The target beneficiaries are members of about 150 farmer producer organisations (POs) supported by the IDA-funded Kenya Climate Smart Agriculture Project and the National Agriculture and Rural Inclusive Growth Project. With TA support from these projects, eligible POs would be those that have robust governance, have turned a profit and have developed a business plan. The investment program involves Tier 1 banks obtaining concessional credit which is on-lent to Tier 2 banks, micro-finance institutions and savings and credit cooperatives, which then lend for specific dairy investments to POs, farmers and other key actors in the dairy value chain (e.g., hay producers). For banks, access to concessional finance is conditional on their leveraging own-resources, with the concessional finance enabling on-lending on conditions suited to the cashflow characteristics associated with productivity-enhancing investments at farm level. The related World Bank projects would support TA to POs, farmers and to banks to ensure that loan products are suited to target beneficiaries' needs, and to support financial institutions to implement MRV systems to track the resulting GHG emission reductions. A concept for an MRV system integrated with financial institutions' credit management procedures has been proposed but not yet piloted.

Developing national and international carbon markets: In some countries, domestic carbon markets may be a viable pathway for leveraging new investment sources. RBCF programs could either support delivery of carbon credits or support the development of the methodologies and infrastructure required for target project types to reach scale (Box 12).

Box 12: Support to carbon market infrastructure

A number of countries are developing carbon markets as part of their climate response strategies. Agriculture is generally not a sector covered in emission trading schemes (ETS), but agriculture has been eligible as a source of offsets in some schemes. Given the limited experience with carbon finance projects in the agriculture sector, engagement of the agriculture sector with the emerging domestic ETS will require significant efforts in terms of policy, institutional capacity, regulation, finance, awareness and replication of agriculture offsets to be eligible for ETS schemes. The support to identification of feasible categories of activities for scaling up mitigation, development of methodologies, piloting of demonstration of projects and programs, and technical capacities for implementation, monitoring and verification are expected to be priorities for countries that intend to use market mechanisms to achieve climate change mitigation objectives.

The Hubei Smart and Sustainable Agriculture Project in China includes activities to support Hubei Province government to develop policy and institutional frameworks in support of agricultural carbon offsets, including by establishing protocols for monitoring, reporting and verification (MRV) of GHG emissions and removals in agriculture, with a focus on major value chains in the province, and promoting a market mechanism for agricultural carbon offsets involving public and private stakeholders through technical support and training. The IPF project would not, however, engage in activities directly related to trade in offsets.

For private investors, engaging in an emerging offset market presents risks related to the regulatory context as well as delivery risks from unfamiliar project types. RBCF could complement the IPF investments by supporting development of agricultural offsets through interventions on both the supply and demand sides. On the supply side, upfront costs for project developers and implementation agencies will need to be covered through innovative financing agreements, such as loans using an ERPA as collateral. The feasibility of such arrangements can also be demonstrated by implementing in the pilot demonstration projects. On the demand side, RBCF could reduce project developers' risks by negotiating ERPAs that ensure a floor price if projects are not able to sell at a higher price in the domestic market. The floor price might be set in relation to the prevailing ETS market price or in relation to the minimum price required for financial viability of the project. If the project entity is able to sell at a higher price to other market actors, then the ERPA would not be triggered. These are just some examples of how RBCF could support development of agricultural offsets. Other specific mechanisms could be developed depending on market actors' specific needs.

2.2.3. Baselines and crediting

IPF operations targets are set out in the project results framework. These are often expressed in terms of numbers of beneficiaries, area under sustainable land management and so on. PforR programs

also have disbursements linked to similar indicators of program activity levels or indicators of policy or institutional change. Only small number of projects include results framework indicators relating to changes in GHG emission or emission intensity achieved through the project activities. RBCF programs may share many of the same program indicators of activity implementation or program outcome. In addition, they will require estimates of emission reduction achieved. How baselines are set, and the level of performance above which emission reductions can be credited are critical elements of RBCF design.

Similar to carbon market methodologies, baselines generally represent the emissions that are expected to occur in the absence of the program. At national or sector level, baselines (or business-as usual, BAU) scenarios may be derived from NDCs, but NDCs often do not explicitly represent specific agricultural activities or activities in sub-national regions, so program-specific BAU scenarios may need to be developed (Box 13). Unlike carbon market methodologies, however, in which the volume of credits is calculated following pre-approved rules, the level of emission reductions credited (or purchased) in RBCF transactions may be negotiated depending on country-specific circumstances. Key factors influencing crediting thresholds include:

- The level of ambition expressed in NDCs or other policy documents
- Existing levels of performance, and
- The potential role of RBCF payments in incentivizing improved performance and/or increased ambition.

Given the aim of RBCF facilities to accelerate transition to large-scale decarbonization, crediting thresholds may be agreed to maximize the incentivizing effect of RBCF payments, as illustrated in Box 14. Crediting thresholds may thus be set below the level of emissions representing a country's unconditional NDC commitment. In many countries, a robust BAU scenario and realistic estimates of potential emission reductions in the agriculture and food sector will need to be developed through analysis conducted during RBCF program development.

Box 13: Enhancing capacities for baseline and target setting

In many countries, livestock populations are increasing, and absolute reductions in livestock GHG emissions are difficult to achieve. The Initiative for Sustainable Forest Landscapes (ISFL) has approved a methodology for calculating emission reductions due to decreasing GHG emission intensity of livestock production. The methodology requires a historical time series of emissions per unit of livestock product (or protein). Deviations below the historical growth trend can be considered for crediting.

As part of a jurisdictional approach to crediting, the Oromia Forest Landscape Program (OFLP) plans to include livestock alongside forestry and land use in a future ERPA. When discussions on including livestock began, population data were available, but the IPCC Tier 1 method used in the national inventory did not meet ISFL requirements. A national inventory using the Tier 2 method was developed by a CGIAR research program. An inventory specific to Oromia Region was drafted on that basis, and ISFL collaborated with the IDA-funded LFSDP to assess gaps between the inventory and ISFL requirements and to develop an inventory improvement plan. The inventory improvement plan called for representative sample surveys of rural cattle keeping households as well as commercial farms. One constraint on a survey of commercial farms was the lack of a sample frame. The

United States Department of Agriculture (USDA) – an IFSL partner – supported the national statistical agency to pilot a process for developing a sample frame for commercial livestock farms, using Oromia Region as the pilot. The rural and commercial surveys in Oromia will be implemented with ISFL funding. When the identified gaps in the Oromia inventory are filled, the baseline can be established using the historical time series obtained.

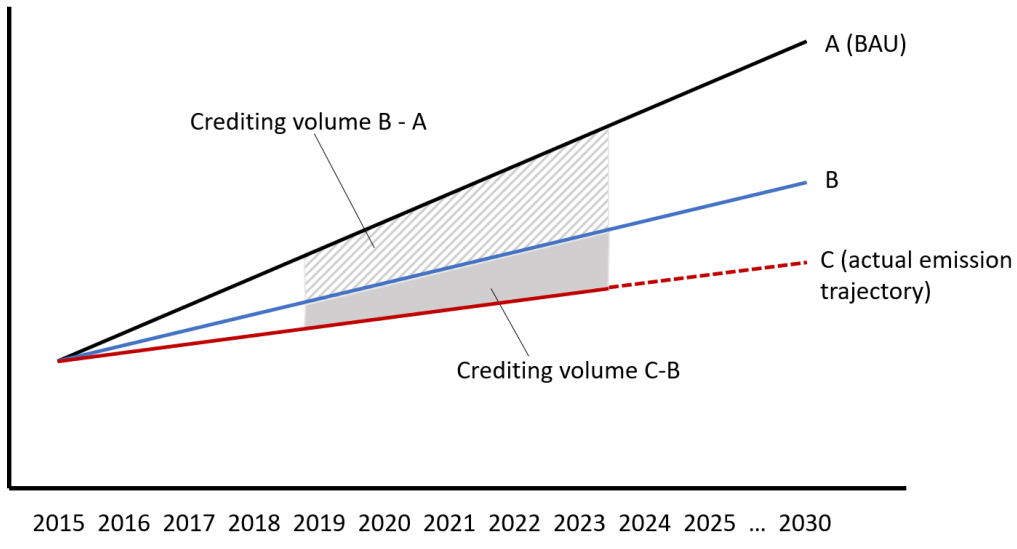
Estimates of potential emission reductions are being explored using monitoring data from the LFSDP. A tool for calculating change in emission intensity due to LFSDP interventions has been developed with support of US Forestry Service, and data to parameterize the tool are being collected with support from a German government project managed by the World Bank. Together with implementation costs from the LFSDP and other projects, this will provide stakeholders in Oromia with evidence on the potential scale of emission reductions at different scales of investment, thus preparing Ethiopian decision makers for negotiations on inclusion of livestock in a future ERPA.

Box 14: Options for baselines and crediting thresholds

Pakistan's initial NDC identified reducing fertilizer N_2O emissions by efficient and targeted use of chemical fertilizers as a priority measure. In 2015 Punjab province – which uses two thirds of fertilizer in the country – initiated a pilot e-voucher subsidy program to support balanced use of fertilizers by subsidizing non-nitrogenous fertilizers, which also have lower emissions than nitrogen fertilizers. The World Bank Strengthening Markets for Agriculture and Rural Transformation (SMART) in Punjab Program for Results (PforR) has supported upscaling of the e-voucher scheme from 25,000 farmers in 2017 to almost 150,000 farmers two years later. Fertilizer subsidies have been funded by Government of Punjab, and SMART has provided results-based disbursements upon verified achievement of agreed disbursement linked indicators verified by third parties.

Baseline setting: Pakistan's NDC assumed a 4% p.a. increase in emissions from synthetic nitrogen fertilizer use, but no targets for fertilizer emission reduction were set. All of Pakistan's NDC mitigation commitments were conditional on international support. The NDC BAU scenario did not consider the GoPunjab e-voucher scheme. Therefore, the BAU scenario could be the scenario without an E-voucher scheme (line A in Figure 4).

Figure 4 Example of baseline, with-program and crediting scenarios



Crediting thresholds: An RBCF program could consider the whole e-voucher subsidy as additional, and results-based payments could be made for any emission reductions achieved, as indicated by the difference between lines B and A. An alternative could be to credit emission reductions due to expansion of the program more rapidly than its historical growth trend, as indicated by the difference between lines C and B.

In practice, one constraint on setting a crediting threshold was the unpredictability of future federal government allocations to the Government of Punjab. Negotiations on a crediting threshold would have to consider the extent to which RBCF payments could incentivize both federal and provincial governments to make commitments on future funding levels.

2.2.4. Measurement, reporting and verification

Specific requirements for MRV will depend on the type of financing used to support the SCALE program. Programs generating credits in domestic emission trading systems (ETS) will need to apply methodologies approved for use in the country's ETS. Article 6.4 carbon finance should apply methodologies approved for use in that mechanism. These methodologies are likely to be similar to the former CDM methodologies, but the Article 6.4 mechanism is still under development. Currently, the voluntary carbon market is the main source of carbon finance for the agriculture sector, and methodologies approved by voluntary carbon market standards should be used.

For Article 6.2 mechanisms, CDM and voluntary carbon market methodologies, and methodologies used in existing World Bank managed climate funds (e.g., BioCarbon Fund, ISFL) are generally taken as the main reference. For contributions to the host country's NDC, at a minimum the method for MRV should be at least as robust as and compatible with the country's national GHG inventory, since the national GHG inventory will in most countries be the main source of data used to demonstrate progress towards a country's NDC.

These options present two main challenges for the agriculture sector. First, previously approved GHG quantification methodologies are applicable only to a sub-set of potential agricultural GHG mitigation options. Even where relevant methodologies have been approved, in some cases the methodologies are only feasible in data-rich contexts or under specific assumptions that may not apply in all countries where the Bank operates. SCALE support may be useful in adapting existing or developing new GHG quantification methodologies to match country- or program-specific circumstances (Box 15). Methodologies should be consistent with the SCALE Methodological Framework for Pillar 1 programs.[18]

Box 15: Adapting carbon market methodologies to large-scale programs

The former CDM approved a number of methodologies applicable in the agriculture and food sector.[19] Many of these methodologies were approved for use in small-scale projects (i.e., <60,000 tCO_2e p.a.) in order to reduce risks to environmental integrity while allowing simplified project design, monitoring and verification procedures. CDM and voluntary carbon market methodologies

[18] INSERT LINK TO ONLINE VERSION
[19] https://cdm.unfccc.int/methodologies/index.html

have all been written to meet the requirements of a specific standard, not all of which will be applicable in the SCALE context. So application of these methodologies to larger scale initiatives may require assessment of adjustments required to ensure environmental integrity at larger scale. In particular, applicability conditions limiting the use of a methodology under specific conditions may need to be reviewed in light of the actual conditions likely to be targeted at larger scales; additionality requirements may need to be adjusted in light of references levels set in relation to a country's NDC targets and SCALE methodological requirements; and monitoring requirements may need to be adjusted to reduce transaction costs at larger scale, while ensuring environmental integrity.

SCALE has developed a Methodological Framework for investments under Pillar 1 (Natural Climate Solutions).[20] The framework is structured around different crediting approaches:

• **Programmatic crediting**, which is relevant to replication and scale up of technologies and processes (e.g., small scale energy efficiency improvements);

• **Policy crediting**, which supports implementation of policies at scale (e.g. sectoral standards, large-scale incentive schemes);

• **Sectoral crediting**, which targets aggregate emissions in a defined economic sector or sub-sector (e.g. crop production, agro-processing)

• **Jurisdictional crediting** which targets aggregate emissions in a jurisdiction (e.g. agricultural emissions in a province); and

• **Economy-wide crediting**, which targets emissions on the level of the economy as a whole.

Depending on the selected crediting approach, different GHG accounting standards and/or methodologies can be used by SCALE-supported programs, but all methodologies must adhere to the framework's common principles. For example:

• Similar to other standards, SCALE requires that quantification of GHG effects generated by SCALE-supported programs shall follow clear methodologies and protocols that have been publicly disclosed

• SCALE aims to set crediting baselines below BAU emissions, additionality will be assessed in relation to the crediting baseline, and crediting baselines will be updated periodically, which differs from the treatment of additionality and crediting baselines in most carbon market methodologies;

• SCALE programs should aim to identify and reduce uncertainty over time, whereas some other methodologies and standards require discounting credits based on ex ante estimates of uncertainty levels. For SCALE initiatives resulting in carbon sequestration as part of jurisdictional approaches, an approach must be in place to manage the potential risk of reversal and leakage, but the approaches adopted under SCALE may differ from those used by other carbon standards.

Second, potential programs may face challenges with providing the activity data needed to measure and report the GHG effects of interventions. At national scale, improvements in agricultural statistics are often sorely needed to inform sector planning as well as specific needs such as GHG inventory compilation. Agriculture sector M&E systems are also often weak. Carbon market projects

[20] INSERT LINK TO ONLINE VERSION

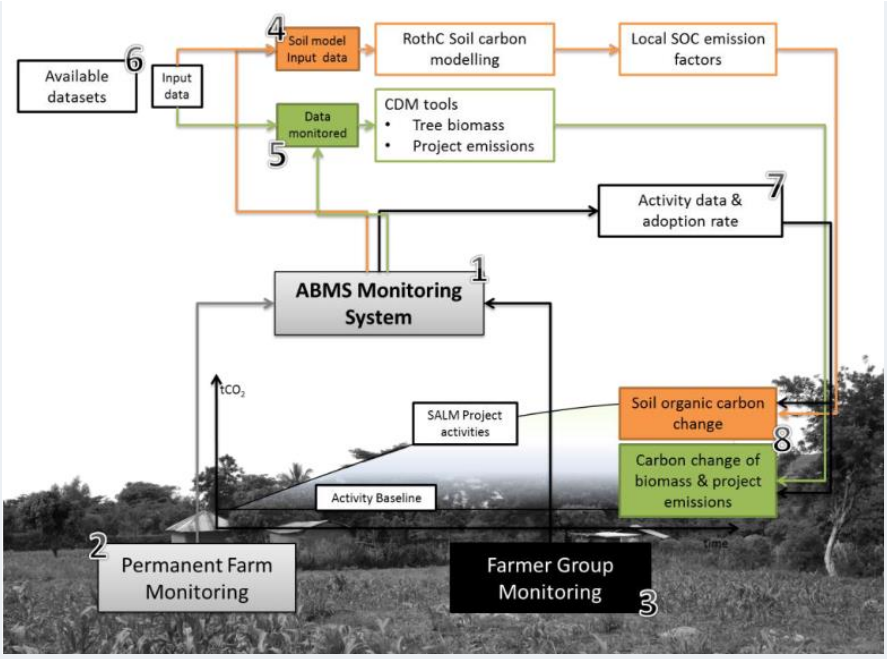
will often require project-specific monitoring systems. A major challenge to address is the transaction costs of monitoring large numbers of farmers, an area in which the BioCarbon Fund and other initiatives have gained some experience (Box 16). The costs of monitoring at larger scales may be able to be reduced by building program MRV systems on national data management systems, which is encouraged in SCALE programs. Strengthening MRV systems could therefore also contribute to strengthening national data management systems in the agriculture and climate sectors.

Box 16: MRV in the Kenya Agriculture Carbon Project (KACP) and the ProSoil project

The KACP was funded by the BioCarbon Fund to implement Sustainable Agricultural Land Management (SALM) practices within smallholder farmer systems in Western Kenya. SALM was defined as any practice that increases the carbon stocks on the land including practices such as agroforestry, composting, cover crops, manure management, and mulching. The KACP covers 3000 registered farmer groups with 60,000 smallholder farmers who practice mixed-cropping systems on 45,000 ha of land. The KACP has generated about 100,000 tCO_2e annually through the adoption of SALM practices. The sale of the carbon credits generated from the project supports village savings and loan associations in the project communities.

Central to the success of the KACP was the development of a GHG quantification methodology for SALM activities under smallholder conditions and the use of an activity baseline and monitoring system (ABMS) as a cost-efficient way to estimate soil organic carbon (SOC) removals. The ABMS system combines activity monitoring (e.g., monitoring farmers' SALM practices) with soil carbon modelling to derive local applicable default values change in SOC due to SALM adoption.

Figure 5 Activity baseline and monitoring system



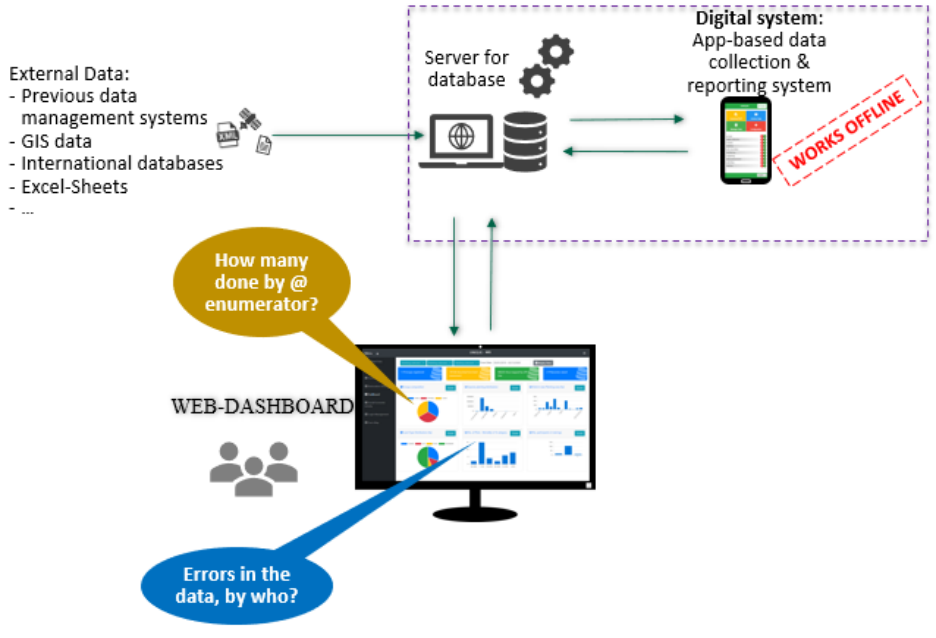
The ABMS system (1) aggregates data from the project from permanent farm monitoring (PFM (2) and farmer group monitoring (FGM) (3). The PFM is implemented by extension agents of the implementing NGO on permanent sample farms selected to be representative of the whole KACP project area. The survey sample size is determined by the variability between farms and the precision level required by the carbon accounting methodology, and use of a representative sample for the PFM reduces monitoring costs. The PFM helps establish the project baseline and estimate the ex-

ante actual GHG emissions and removals from the entire project area (i.e., 45,000 ha). The PFM also enables the project developers to monitor overall project implementation and performance (SALM adoption and crop yields), and helps to verify results from the FGM.

The FGM employs self-reporting by all farmers and farmer groups, who are trained in data collection and record keeping by project staff to ensure accuracy of the system. Annually, farmers record all relevant data needed to monitor the KACP and report the data to field officers using the short message service (SMS) into a system of verification and further data aggregation. The aggregated data (which represents the full inventory of the farms adopting SALM practices in the project) are then used to model (4 – 7) the actual (ex-post) GHG emissions and removals from soil organic carbon and tree biomass on project farms (8).

Another project in western Kenya is looking into how to upscale the ABMS system to enable farmers to access carbon markets. Soil Protection and Rehabilitation of Degraded Soil for Food Security (ProSoil) is a GIZ project that implements soil protection practices (including SALM) at large scale in western Kenya. The project aims to rehabilitate 100,000 ha of smallholder farmland seriously affected or threatened by degradation, while increasing crop yields by 35%. ProSoil decided to implement a soil carbon component within its activities so as to leverage carbon revenues from the voluntary carbon market to ensure continued funding of agricultural extension services after the donor's exit from the project. The MRV system for a project of this scale must have a functional coordination structure at different levels (e.g., organization and farmer levels), and a good data management and quality assurance plan.

Figure 6 General structure of the digital platform used in the GIZ ProSoil project



ProSoil uses a robust digital platform (developed by unique land use) to collect, manage and report monitoring data on participating farmers. ProSoil uses extension officers and trained enumerators to collect farm activity data using a smartphone app which works both on- and offline. The app has several modules which each record different aspects of the activity data required to quantify the changes in SOC as a result of farmers' activities. Once there is access to internet, the information collected in the app is synchronized (sync) and stored into a central database. The data in the central database can be accessed, analysed, and monitored using a web-dashboard

accessible to the data administrator. Using this digital platform, MRV for different projects across large geographical areas can easily be aggregated, allowing different projects, NGOs or farmer groups adopting SALM practices to participate in a carbon project and collectively achieve the scale required.

2.2.5. Financing and the use of ERCs

RBCF programs incur significant costs in upfront investments for project design as well as implementation costs, so access to upfront investment is required for project preparation, capacity building and implementation. Where projects target carbon markets or other international transfers of mitigation outcomes, there will be additional verification costs that are not typically incurred in other World Bank operations. Where significant amounts of analytics are required to prepare a project or where key components of the enabling environment need to be put in place to ensure ERC delivery, experience from BioCarbon Fund projects shows that upfront investments can be coordinated with World Bank IPF projects (Box 17). Drawing on these lessons, SCALE has facility to support some upfront program development costs as well as ongoing support to ensure successful transactions are achieved. Close coordination with Bank operation pipeline development will also be key to ensuring that upfront investments – and in some cases ongoing costs – will be supported.

Box 17: Lessons from the BioCarbon Fund on financing

A review of 22 BioCarbon Fund projects[21] provided the following key lessons:

• Since results-based payments can only be received when results have been generated, securing finance for upfront investments in project development and initial implementation of project activities was critical.

• Project entities that were able to either provide self-financing for project development or access financing leveraged through larger initiatives (e.g., World Bank investment projects) were able to adequately fund project preparation and implementation. BioCarbon Fund projects that did not have adequate financing faced significant challenges during implementation.

• Loans, grants, and other financing mechanisms can all be used to meet investment needs in the early phases of implementation. There are examples of projects that were able to use expected verified emission reduction credits as collateral against a loan to cover early-stage investments, but for many projects uncertainty about the volume of future emission reductions meant this option was not feasible. Grants from World Bank managed trust funds have been useful to cover costs of methodology development, baseline data collection, development of monitoring systems and capacity building for communities and project entities. Loans to host governments through World Bank investment operations also enabled emission reduction programs to leverage both financial resources and technical capacity to implement and monitor project activities, especially in the early phases of project implementation.

[21] World Bank (2020) Insights and experiences from the BioCarbon Fund Emission Reductions Projects in the Land-Use Sector: an overview. World Bank, Washington D.C.

• Targeted TA funds were also critical for many projects to support project preparation, methodology development, establishing monitoring systems, and specific carbon costs, such as project validation and verification, which were critical for these projects to deliver verified emission reductions and receive results-based payments.

• BioCarbon Fund also has experience with negotiating upfront or interim advance payments as part of the ERPA in order to help projects meet their cashflow needs. However, these conditions increase investor risk and may be negotiated in return for a lower result-based payment. Advance payments may be more suitable when the project entity is strong and there is a good enabling environment, which reduces the related risks.

• The cost of implementing the projects was nearly half the value of emission reduction payments received by the projects.

There are many options for the use of the ERCs generated, and these will vary depending on the carbon or climate finance mechanism targeted. For activities supported in the context of Article 9 (climate finance), emission reductions remain with the host country, who can use these to meet their own NDC commitments, or choose to transfer the mitigation outcomes. In the context of Article 6.2 (cooperative approaches), host countries would be expected to engage in ERPAs that transfer a portion of the mitigation outcomes to investor countries. In principle, SCALE will aim to contract the smallest number of ERCs necessary to achieve the program's desired outcomes. This means that if the ERCs generated in a program exceed those contracted in the ERPA, the host country may use these excess ERCs against NDCs or sell them to another buyer (i.e., another government or a private sector actor).

At present, there is significant uncertainty associated with both supply and demand for ERCs through several of the potential mechanisms:

• Developed country public funds for Article 9 contributions have historically been a very small proportion of total climate finance. Most climate finance is in the form of loans, and much of it at market rates. For agriculture and food sector mitigation, where project activities may have a higher risk profile than potential low-emission investments in other sectors, this may make these forms of finance less attractive for project entities.

• Article 6.2 transfers of mitigation outcomes are a new and emerging mechanism. Gaining experience by joining early movers may be attractive for host government agencies. However, many countries may be reluctant to commit to transfer ITMOs when they are not yet sure whether those emission reductions will be needed to meet their own NDC commitments.

• The market mechanism established under the Paris Agreement is envisaged to issue 'Art 6.4ERs'. It is not yet certain when the Article 6.4 Mechanism will become fully operational, and how the Art 6.4ERs market price will compare to other mechanisms is not yet known.[22]

• International voluntary carbon markets have been the main arena in which innovations in agriculture mitigation projects have been made. Many such projects have been transacted through 'over the counter' deals in which project entities directly (or through an intermediary) sell emission

[22] Zaman, P. et al. (2022) Nationalisation risk: Will host countries hedge their bets between Article 6 and the voluntary carbon markets? HFW Briefing, HFW, Singapore.

reduction credits to companies for non-compliance uses (e.g., offsetting or insetting within agricultural commodity supply chains). Although it is not currently required, it is not uncommon for buyers to require that voluntary market projects secure a letter of no objection from host governments to reduce regulatory risks, and it is likely that national legislation and authorization frameworks will evolve in the coming years.

This current context implies that host countries face significant constraints on their ability to make an informed decision about which mechanism to pursue. In this context, the SCALE envisions several options for the use of ERCs, some or all of which could potentially all be negotiated in the same ERPA. For example, a portion of ERCs could be used by the host government against their conditional NDC targets; a portion retained by the host country with an option to receive climate finance against ERCs or to sell on the spot market if this would give greater returns than the price agreed in forward contracts; and a portion could be transferred at a fixed forward price, which despite the likely lower price of forward sales limits the risk of not finding a buyer. In all cases, the premise is that high-integrity ERs are essential to the credibility of all such transactions.

In addition, SCALE is exploring innovative financial mechanisms to enable countries or corporates to manage related risks while unlocking the upfront finance needed. One such mechanism is insurance to cover risks associated with authorization of credits and corresponding adjustments. At present, not all voluntary carbon market standards require corresponding adjustments, and technical aspects of implementing corresponding adjustments remain to be determined. An insurance mechanism could reduce the risks faced by investors in either directly investing in projects or making pre-payments for mitigation outcomes of projects that will supply an adjusted volume of credits after corresponding adjustments. Guarantees could also be taken out by host countries as a strong signal that corresponding adjustments will be made, enabling the country to collect corresponding adjustment payments when participating in Article 6 mechanisms, which provides additional funding for the opportunity cost of meeting NDC targets. Emission-reduction linked bonds are another potential mechanism to unlock investment in return for payments from the sale of ERCs. As the various mechanisms for transfer of mitigation outcomes and national regulatory approaches evolve, these and other innovative financing mechanisms will continue to be developed.

3. Decoding RBCF support to the agriculture and food sector

The priority given to agriculture in the NDCs has given new impetus to climate change mitigation in the agriculture and food sector. Experience with RBCF in the World Bank, innovation of GHG quantification methodologies and MRV systems in the international voluntary market, and the demonstrated potential for large-scale agriculture sector initiatives indicate that some of the huge global potential for agricultural mitigation can be achieved.

RBCF can complement World Bank finance and other sources of climate and carbon finance, providing incentives for governments and companies to strengthen their policies and measures and enhance the ambition of beyond existing commitments. RBCF can provide an additional revenue stream in situations where carbon markets cannot be accessed or are unable to provide the incentives to achieve mitigation at scale. Agriculture and food sector mitigation often requires significant upfront investments. RBCF can complement other sources of finance, and a secured ERPA may enable host governments and project developers to leverage upfront investments from other sources. RBCF payments can be linked to interim milestones, so that RBCF revenue streams match the financing needs of transformative climate action.

SCALE will be fully integrated with World Bank business unit operations, developing RBCF programs in relation to existing and pipeline agriculture and food sector investments. Agriculture sector mitigation often faces both financial and non-financial challenges. There will be stronger potential for linking with RBCF where prior Bank operations have demonstrated effective solutions to overcoming these challenges, and strengthened the capacities of host governments and other sector stakeholders to implement mitigation actions at scale. Considering the small scale of most Bank IPF operations, related RBCF programs will need to be based on upscaling initiatives of host governments and/or the private sector in order to reach sufficient scale.

Large-scale and sustained adoption of climate smart agricultural practices are more likely when:

- technologies have been tested, adapted and validated in the target production systems or regions;
- the evidence for strong benefits of farmer adoption is clear;
- stakeholders involved in technology promotion (e.g., public or private extension services, input suppliers, rural financial institutions, farmer organizations) have demonstrated capacities for delivery at large scale; and
- policy measures and mechanisms have been successfully piloted.

Experience with agricultural mitigation is still emerging, and in all cases mitigation programs will have to be tailored to local conditions. The potential for RBCF programs will be stronger where countries have prioritized agriculture and food sector mitigation in their NDC and have already elaborated NDC implementation plans for the agriculture and food sector. In many countries, integration of agriculture and climate policies is still underway, and the development of RBCF programs may support host countries to identify mitigation option and strengthen implementation mechanisms. Similarly, while several relevant GHG quantification methodologies already exist, many

agriculture sector mitigation options will require novel methodologies and MRV systems, particularly for use at scale. RBCF program development can support the development of these methodologies and strengthen national MRV systems. Strengthening these elements as well as other host country capacities will often be required, so program development will often need to source up-front investments from a combination of SCALE and World Bank operation resources.

It is important to recognize that there are no 'low hanging fruit' for climate change mitigation in the agriculture sector. Unlike some other sectors, variation in biophysical and socio-economic conditions may make the same technology viable in one location and unviable in neighboring locations or countries. The challenges of reaching large numbers of farmers and coordinating a multitude of other actors in agri-food supply chains; widespread needs to strengthen government agencies' capacities for policy-making, planning and service provision; and limited prior experience in the agriculture sector in most countries with meeting mitigation program requirements all suggest that RBCF initiatives will most often need to be embedded in ongoing capacity strengthening and policy development processes supported by related World Bank operations, and scaling ambitions will need to be set accordingly.

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