Opportunities for Climate Finance in the Livestock Sector

Removing Obstacles and Realizing Potential

WORLD BANK GROUP

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Abbreviations

AATIF	Africa Agriculture and Trade Investment Fund
ASTI	Agricultural Science and Technology Indicators
CATIE	Tropical Agricultural Research and Higher Education Center
CDM	Clean Development Mechanism
CER	Certified Emission Reduction
CH_4	methane
CO_2	carbon dioxide
CO_2e	carbon dioxide equivalent
CPI	Climate Policy Initiative
CSR	Corporate Social Responsibility
DAC	Development Assistance Committee
DFI	development finance institution
ETS	Emissions Trading Scheme
FAO	Food and Agriculture Organization of the United Nations
FCPF	Forest Carbon Partnership Facility
FDI	foreign direct investment
FI	financial institution
GCF	Green Climate Fund
GEF	Global Environment Facility
GHG	greenhouse gas
GIIN	Global Impact Investing Network
GRA	Global Research Alliance
GRSB	Global Roundtable for Sustainable Beef
GWFP	IFC's Global Warehouse Finance Program
IBLI	Index-Based Livestock Insurance
IFC	International Finance Corporation
IFI	international financial institution
IFPRI	International Food Policy Research Institute
ILRI	International Livestock Research Institute
INOCAS	Innovative Oil and Carbon Solutions
INRAE	French National Research Institute for Agriculture, Food and Environment
IPCC	Intergovernmental Panel on Climate Change
ISL	Investing in Sustainable Livestock
JI	Joint Implementation
KLIP	Kenya Livestock Insurance Programme
LDCs	least developed countries
LDN Fund	Land Degradation Neutrality Fund
LMIC	low- and middle-income countries
MDBs	multilateral development banks
MFI	microfinance institution
MRV	Measurement, Reporting and Verification
MSME	micro, small, and medium enterprise
Mt	Megaton (one million metric tons)
NDC	Nationally Determined Contribution
NDVI	Normalized Differenced Vegetation Index
NGO	Non-governmental Organization
NO_3	nitrate
ODA	Official Development Assistance
OECD	Organisation for Economic Co-operation and Development.
PfR	Program-for-Results
PPP	public-private partnership
R&D	research and development
SCF	Standing Committee on Finance
SPV	special purpose vehicle
t	ton (note that, unless specified otherwise, ton in this report refers to a metric ton = 1,000 kilograms)
TAC	Terms of Adjustment of Conduct
UNCCD	United Nations Convention to Combat Desertification
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
VCS	Verified Carbon Standard
VSA	Verified Sourcing Areas
WWF	World Wildlife Fund

***All dollar ($)** amounts are US dolars unless otherwise indicated.

Executive Summary

Climate finance can play a key role in bending the arc of the livestock sector from one that threatens to produce increased emissions and environmental damages to one that reduces its emissions and makes greater contribution to sustainable development. In terms of greenhouse gas (GHG) emissions, livestock is associated with significant costs that will continue to increase if nothing changes. While the sector and its value chains are responsible for about a sixth of GHG emissions, it can be part of the solution by reducing emissions and also putting carbon back into the soil.

Demand for animal protein is expected to grow with increased prosperity, especially in emerging economies. And while calls for the reduction or elimination of animal protein in the human diet are important, complementary action to transform the sector is necessary. Acting now will come at a significantly lower cost and help jump-start the transition. This means introducing practices that increase productivity while reducing GHG emissions from the sector, and ensuring protection of the natural environment and public health. Directing climate finance to the livestock sector is an opportunity to mitigate climate change, improve adaptation, and increase economic gains along the animal protein value chain.

Potential for climate change mitigation in the livestock sector

Adopting the right policies, such as penalizing carbon emissions and rewarding carbon sequestration, have the potential to reduce their net emissions by 89% according to recent studies. This is in line with the objective of keeping global temperature rise to 2°C.

The most important mitigation opportunities in the livestock sector are:

i. Increasing productivity and production efficiency offers a potential reduction in GHG emissions per unit of product of some 30%, while lowering costs to farmers and improving farm incomes through higher production and productivity. A major approach to this is by improving animal feed digestibility and nutritional levels, a strategy that can produce relative reductions in GHG emissions from ruminants – specifically beef and dairy cattle – from the way they digest feed. Such an approach can increase productivity while reducing enteric (stomach-produced) methane (CH_4). Extracting CH_4 from manure for fuel can reduce the amount of methane emission by up to 80%. Matching nitrogen in animals' feed to their requirements, while matching manure application to the needs of crops can result in lower nitrous oxide emissions.

ii. Reducing the amount of carbon already in the atmosphere is possible through efficient land management including the restoration of organic-matter-depleted soils. Avoiding additional emissions from land use and land use change is also crucial. Practices to increase biomass accumulation and soil organic carbon levels in pasture sequester carbon from the air and can improve the quality of grasslands grazed by ruminants, which improves their diet and reduces enteric methane production, resulting in an additional global potential mitigation effect of up to 800 Mt CO_2-eq/yr.

Access to finance to invest in mitigation and sequestration is a major challenge for rural communities and policy makers in low- and middle-income countries (LMICs). Finance has long been difficult to access for livestock smallholders who often do not hold collateral except for their animals and have little experience of working with financial institutions. Traditional lenders see the livestock sector as over-risky, with little potential to generate significant returns; it is, therefore, of little interest to them and largely unknown territory. Using Climate Finance to expand financial inclusion to enable adoption by producers of more sustainable practices would improve livelihoods, increase resilience, and achieve a better GHG balance.

A Role for Increased Climate Finance

There are substantial opportunities in the livestock sector for investment by climate finance funds that could accelerate the transformation towards low-carbon and sustainable animal protein value chains. Investment interest can grow with a greater understanding of the sector, fresh approaches to financing, and innovative thinking along the value chain. However, the lack of data, common terminology, and indicators in the field of livestock and climate change hinder development of climate finance for the sector.

In LMICs, productivity gains and improved livelihoods for farmers linked to mitigation could be substantial. Hence, climate finance investment in the sector is potentially a crucial factor, leading to more investment, higher efficiency, and lower emissions per unit of product, despite an initially unwelcome trade-off in the form of increased volumes of production and of GHG, overall. Such a potential trade-off (rebound effect) may be temporary and would not equal the cost of doing nothing, which would be equivalent to increasing emissions from an expansion of the sector relying on business-as-usual production practices.

Farmers and actors along the animal protein value chain, as well as the public authorities, have an opportunity to present the livestock sector as a viable destination for climate finance by clarifying where direct benefits – such as biofuels from methane extracted from manure – and indirect benefits – from good grazing management, for example – can be produced. Policy makers can enact measures to encourage investment in the sector and work with financial institutions – including the multilateral development banks – to form

partnerships toward blended institutional/multilateral/climate-specific investment initiatives.

Blended investment systems can combine local and international technical know-how with local and external financial resources to overcome knowledge gaps and reduce risk, overcoming some of the opacity that has characterized the livestock sector in LMICs due to its disparate nature. Enabling smallholders to aggregate into associations or cooperatives can allow them to communicate with potential investors, while policy can direct resources to raise skills levels, foster innovation and improve traceability and data collection along value chains. The essential objective is to raise awareness about bankable climate investment opportunities in the livestock sector and so direct existing financial flows into mitigating the impact of climate change and to achieve associated co-benefits.

Integrating Innovative Financing into the Animal Protein Sector

Reducing GHG emissions while maintaining livelihoods and reducing poverty is essential for a sector that plays an essential economic role for some 60% of 1.7 billion people and contributes up to half of agricultural GDP. This report identifies six innovative investment opportunities to drive the sector's sustainable transformation with climate finance. There is strong justification for the use of public finance for this transformation, including that of the multilateral development banks and international financial institutions. Public finance will help 'prime the pump' through early action, address market failures, and importantly attract private partners. These opportunities need to be taken alongside complementary efforts to rethink the role of livestock products and proteins in sustainable diets, especially where high levels of meat consumption occur.

Condition credit lines on climate mitigation actions. Lending through local financial intermediaries, presents opportunities for channeling climate finance into greening the livestock sector, while increasing farmers' access to financial and knowledge resources with an identified ecological impact. Climate finance can define mitigation conditions against which it enables stakeholders' access to finance through existing credit institutions, for example by de-risking investments, lowering interest rates and providing technical assistance.

Encourage value-chain finance for native ecosystem protection. With proper incentives, stakeholders along value chains will have the opportunity to adopt practices that, for example, do not rely on deforestation. This is particularly important for livestock value chains given the number and geographic spread of actors and production steps. Linked to strong traceability systems, climate finance can support the development of virtuous value chains.

Drive clean investment through Emissions Trading Schemes. Putting a price on emissions is another tool to bring down emissions and drive investment into cleaner options in the livestock sector. Climate finance can help overcome

the obstacles in linking livestock producers to an ETS: aggregation through existing or ad hoc organizations to lower transaction costs, and the development of cost-effective Measurement, Reporting and Verification systems (MRV). ETS credits sales will make more funds available for further progress in both mitigation and adaptation.

Reward proactive policy commitments through ODA. Remedying the problems of weak or unenforced legislation and a lack of proactive policy commitments to foster climate action, is essential in the transition to a lower emission livestock sector. Programmatic ODA and IFI funding have the capacity to drive policy changes and create the conditions for innovation and private sector investment in climate-sensitive technologies and practices.

Verify sustainable sourcing of livestock feed. Improving the feed of animals to reduce their GHG emissions can displace emissions at the level of feed production, for example by driving feed-crop expansion into forests. Verified Sourcing Area-based climate finance is an innovative solution that supports the marketing of feed that is certifiably sourced from geographical areas free of deforestation. The system offers a win-win of discouraging deforestation while enabling better quality animal feed and associated GHG mitigation benefits.

Innovate in livestock climate finance through prize-based programs. Practices and technologies to reduce GHG emissions and improve the sustainability of livestock value chains remain severely under-researched, with much of the potential gains yet to be uncovered. Prize-based programs provide incentives for research and development by encouraging researchers and entrepreneurs to compete with each other to bring innovations to market. Climate finance supporting such programs can therefore realistically push the frontier of mitigation potential in the sector in cost-effective ways.

Conclusion

Livestock production for animal protein is a major contributor to GHG emissions and climate change. However, there are innovative and traditional solutions to easing the pressure on the environment from livestock raising, while increasing productivity and serving an ever-growing demand for animal-protein products. Collaborating on channeling climate finance to the animal-protein sub-sector is the responsibility of multilateral finance institutions, institutional investors, policy makers, and the entire population of the value chain. There is a need to build concepts in dialogue with local stakeholders and partners toward development of the considerable opportunities for investors and potential benefits for smallholders in low- and middle-income developing countries, recognizing livestock systems as part of broader agriculture and livelihoods system.

1 Introduction

Addressing climate change is a global imperative; there are few, if any, global activities or economic sectors that are exempt from the pressing need to adapt actions or mitigate its effects. Climate finance mechanisms can aid this process. Such financing can be local, national, or transnational. It can come from public, private, or a combination of public-private sources. The livestock sector has captured only a limited part of the climate finance flows, despite its being a sector where not only are mitigation and adaptation crucial to climate health, but its maintenance is crucial to human health and livelihoods. In many parts of the world, reducing the environmental impacts of animal protein production is dependent on accessing climate finance. This report studies existing experiences, as well as promising trends in impact finance, to identify the economic rationale, obstacles, and opportunities for improving the animal protein sector's readiness to access climate finance.

The livestock sector provides multiple human security benefits for all members of society at all scales of production—from backyard and small-farm holders and producers to large holdings (industrial farms) and the value chains they support—including health and nutrition, income, employment opportunities, empowerment possibilities for women and youth, and contributions to the national gross domestic product (GDP). Animal products contribute to food security and constitute a rich source of proteins and micronutrients (FAO 2019a; ILRI 2019). Globally, 1.3 billion people are involved in livestock value chains, with the majority of rural livelihoods strongly dependent on animal rearing. Livestock systems carry out important socio-economic functions in low- and middle-income countries (LMICs), as the agriculture sector continues to be the main source of income for rural populations, making it crucial to economic sustainability and growth in LMICs. The importance of livestock holdings to rural families, especially in LMICs, cannot be underestimated. They are capital assets that can be monetized in case of emergency (ILRI 2019) and are thus instruments to access savings and insurance. They also enable diversification of rural income, in particular for women and youth. But vulnerability to climate change and the need to adapt places all of these benefits at risk with the smallholder farmers most affected.

Triggered by population growth, rising incomes, and urbanization, the demand for animal products has increased dramatically; global per capita consumption has doubled since the mid-1980s (Herrero et al. 2016). This global trend is expected to continue. While demand for animal products is growing modestly in Europe and North America, Africa's demand for animal products was expected to increase by 80 percent from 2010 to 2030. At the halfway mark, that demand is not abating. In 2030, Asia—already consuming nearly twice as many animal proteins as any other region—will demand three times as many animal products as Europe (ILRI 2019).

The many advantages and opportunities afforded by the livestock revolution, do, however, have a negative side. The animal protein sector is a main contributor to climate change, as approximately 14.5 percent of anthropogenic GHG emissions stem from the sector, mostly occurring at farm stage (enteric

methane, manure management) or in relation to input provision (feed production in particular) (Gerber et al. 2013). With the demand projections for Africa and Asia, the environmental impact of the livestock sector is likely to increase over the coming decades if production practices remain unchanged. This points to the need for sector transformation. Fortunately, several mitigation pathways exist. These include increasing the efficiency of livestock production and resource use, minimizing losses and promoting circular bioeconomy, enhancing soil carbon sequestration, and capitalizing on nature-based solutions (FAO 2019a).

A significant challenge for transforming the sector toward a sustainable, efficient, and low-carbon profile is the heterogeneity of production systems and the implications for productivity per herd, as well as per animal. For example, in many pastoralist communities, the role of livestock goes beyond the production of protein outputs, as animals fulfil a range of social and economic functions (one example of this is the cattle complex; see Herskovits 1926).[1] Therefore, animals that do not significantly contribute to food output can be kept for other reasons, with possible trade-offs for GHG emissions, but also for animal nutrition, health, and productivity at the herd level. The diversity of livestock production systems is also reflected in respective emission profiles that can be dominated by different sources: enteric methane, land use change, manure management, feed cultivation. Yet, even within the same production system and region, emission intensities vary greatly among producers. The broad range of emission intensity suggests the enormous potential that the mitigation of production inefficiencies could have, if the best technologies and practices were adopted on a wide scale (Gerber et al. 2013).

Diverse pathways exist to reduce livestock emissions ranging from adopting existing best practices, which have co-benefits for farmers' income and food security, to more emerging interventions. These pathways can be grouped into three categories, each leading toward a low-emission transformation of livestock production systems: methods to improve productivity, better land management, and applying technological advancements.

Improving productivity. Examples of methods to improve productivity include adapting animal husbandry practices such as selecting more productive breeds, herd management, and adopting approaches to enhance animal health (e.g., improving feed ration balancing and digestibility to reduce methane emissions in ruminants).

Better land management to maintain or increase carbon stocks and improve feed production has several avenues. This pathway includes avoiding deforestation, practicing grazing management methods (e.g., changing grazing patterns, restoring grasslands, using integrated pasture cropping, using

1 The term has been introduced by the anthropologist Melville Herskovits (1926) to describe the system of values beyond monetary worth governing native cattle ownership in large parts of East Africa. For instance, most enduring social relationships were mediated through the loan, gift, or exchange of cattle. A cattleless man could enjoy neither social position nor respect and, in Rwanda, cattle ownership was the source of political power and the prerogative of the rulers.

legumes in pastures), implementing silvopastoral systems, and adopting reduced or no-tillage practices in feed crop production.

Technical solutions to emissions include several diverse interventions such as rumen modification, sound manure management, production of renewable energy, and the use of energy-efficient equipment and machinery.

Compared to other sectors, where high abatement costs and capital intensity can hamper the implementation of mitigation strategies, agriculture has substantial potential for effective mitigation strategies at low cost and investment needs (McKinsey & Company 2013). McKinsey's global agriculture marginal abatement cost curve offers insights into the economic viability of different mitigation strategies within agriculture, and identifies the 15 most promising strategies, 8 of them directly related to animal proteins (Ahmed et al. 2020). Table 1.1 lists the animal-protein related strategies,[2] their respective technical GHG mitigation potential, and their cost of abatement (although only private costs were included in the analyses, public costs were not considered). The animal protein sector is a competitive option for cost-effective mitigation. Despite the economic viability of these strategies, implementation is limited because of persistent obstacles (see Chapter 4), particularly in LMICs where demand for animal products is projected to grow rapidly. While some of the obstacles

TABLE 1.1 Marginal Abatement Costs of Animal Protein–Related Mitigation Strategies

Mitigation Strategy	Technical GHG Mitigation Potential by 2050	Estimated Cost of Abatement
Adopt zero emissions for on-farm machinery & equipment	~537 $MtCO_2e$	~US$−229/t CO_2e
Employ GHG-focused genetic selection and breeding	~506 $MtCO_2e$	~US$0/t CO_2e
Improve animal health monitoring and illness prevention	~411 $MtCO_2e$	~US$−5/t CO_2e
Optimize the animal feed mix	~370 $MtCO_2e$	~US$131/t CO_2e
Expand the use of feed additives	~299 $MtCO_2e$	~US$88/t CO_2e
Expand the use of anaerobic manure digestion	~260 $MtCO_2e$	~US$92/t CO_2e
Expand the use of feed grain processing for improved digestibility	~219 $MtCO_2e$	~US$3/t CO_2e
Expand the uptake of technologies that increase livestock production efficiencies	~180 $MtCO_2e$	~US$119/t CO_2e
Apply nitrification inhibitors on pasture	~123 $MtCO_2e$	~US$15/t CO_2e

Source: Ahmed et al. 2020.

Note: $MtCO_2e$ = million metric tons of carbon dioxide equivalent; t CO_2e = metric tons of carbon dioxide equivalent.

2 One additional mitigation option relates to indirect emissions on-farm from energy and transport and is included in Table 1.1, as it is relevant for the animal protein sector.

could be removed through policy by creating an enabling environment, most constraints are related to the lack of finance and technical capacity.

The mitigation pathways noted in Table 1.1 have proved to be effective and cost-efficient in improving carbon balances. Moreover, most often these pathways lead to efficiency, as well as productivity gains (either as a result of increased output per animal or of reduced input use), lowered production costs, and improved overall economic performance of the farm.[3] Hence, pathways are likely to manifest additional livelihood and adaptation outcomes alongside climate change mitigation; in effect achieving three outcomes (a co-benefit). The achievement of triple outcomes forms an interesting case for sector development and investment. However, because of technical adoption obstacles, underinvestment, and a lack of political will this potential is rarely exploited (Herrero et al. 2016; ILRI 2019).

Given the abundance and diversity of livestock production systems and value chains, as well as the increasing challenge that growing animal protein consumption represents for the environment, it is crucial to study how climate finance can be incorporated into the sector and contribute to transforming it. The knowledge and technical solutions exist, but it remains unclear what financial mechanisms and financial flows would be most appropriate to implement them at a large scale.

To determine how climate finance can contribute to sustainable transformation of the animal protein sector, this study offers some potential strategies in chapter 2, then maps current climate finance within the sector illuminating trends and emerging approaches (chapter 3). Chapter 4 considers the technological, financial, and implementation obstacles before turning to lessons from adjacent sectors to arrive at six opportunities for increasing climate finance toward the sector (chapter 5). The growing demand for animal protein products in the global South has highlighted the increased need to transform its production systems, therefore this report focuses on climate in finance within the animal protein value chain in LMICs, concentrating on input providers and livestock production as well as aggregators, who enable remote and small-scale producers to access finance.

3 Whether mitigation pathways lead to productivity gains is included in the pathway-specific obstacle matrix, see chapter 4.

2 Climate Finance and the Animal Protein Sector: Scope and Definitions

The nexus between climate finance flows and the livestock sector is not fully recognized because research on the ways climate finance can be used to catalyze meaningful change toward lower emissions and sustainability in the sector at the appropriate scale is relatively scarce. To further both knowledge and understanding, this chapter clearly defines these three intertwined topics: climate finance, the animal protein sector, and GHG emission reduction in the animal protein sector.

BOX 2.1 Definition of "Livestock", "Animal Protein" and Their Use in This Report

Livestock are domesticated terrestrial animals that are raised to provide a diverse array of goods (animal proteins from meat, milk, and eggs, but also hides, fibers, and feathers) and services. Livestock provide 25 percent of the dietary proteins consumed globally (FAO 2009) and the sector is largely geared toward its direct contribution to food security (proteins, but also micronutrients including vitamin A, vitamin B_{12}, riboflavin, calcium, iron and zinc). Yet, for many farmers, especially smallholders, the other functions of livestock are of significant importance (e.g., traction, soil fertilization with manure, capital, insurance, income diversification, cultural value, landscape maintenance, etc.).

The term "animal protein sector" spotlights the protein production function of the sector and, at the same time, opens to sources of protein other than livestock, such as fish, insects, and cultured meat. The use of "livestock" emphasizes the animal production stage and its interaction with the socio-ecological system in which it is embedded. The use of "animal protein" enfolds the perspective of the complete meat, dairy, and eggs value chains and the range of stakeholders that they involve, including the consumers and their dietary choices.

Evaluating the mitigation potential that exists at the level of the "animal protein sector", this report refers to the potential role of climate finance for the entire sector, although most experience and data available to date more specifically concerns the "livestock" sector.

Climate finance

This report follows the official definitions of Direct and Indirect climate finance as adopted by the United Nations Framework Convention on Climate Change (UNFCCC) Standing Committee on Finance (SCF). Direct climate finance is defined according to the operational definition of climate finance by the UNFCCC SCF as finance that "aims at reducing emissions and enhancing sinks of greenhouse gases and aims at reducing vulnerability of, and maintaining and increasing the resilience of, human and ecological systems to negative climate change impacts" (UNFCCC SCF 2018). Indirect finance are finance flows that are "consistent with [but not specifically aimed at] a pathway toward low

greenhouse gas emissions and climate-resilient development," in line with Article 2.1(c) of the Paris Agreement.

These definitions explicitly include mitigation and adaptation in relation to climate change, as does this report. While adaptation and food security are already compelling arguments for investment in the animal protein sector, particular emphasis is placed on mitigation.

Climate finance includes local, national, and international financial flows that can stem from public, private, or blended sources and are directed toward low-carbon and climate-resilient development interventions with direct and indirect greenhouse gas mitigation and adaptation benefits (CPI 2017; UNFCCC 2019a). The infographic in Figure 2.1 provides an overview of relevant sources, actors, and flows providing finance. As an overview, it is not intended, to indicate differences in the relative importance of certain actors or flows.

This report distinguishes between private and public sources, based on the type of actor who is providing finance. The overlap of private and public spheres in the flow chart of Figure 2.1 shows how private actors may direct finance through public actors to the recipient and vice versa.[4]

Private sources include corporations as well as commercial financial institutions (FIs) that are providers of primarily private debt capital and include commercial and investment banks. The term institutional investors, also considered as a private source, are insurance companies, asset management firms, pension funds, foundations, and endowments.

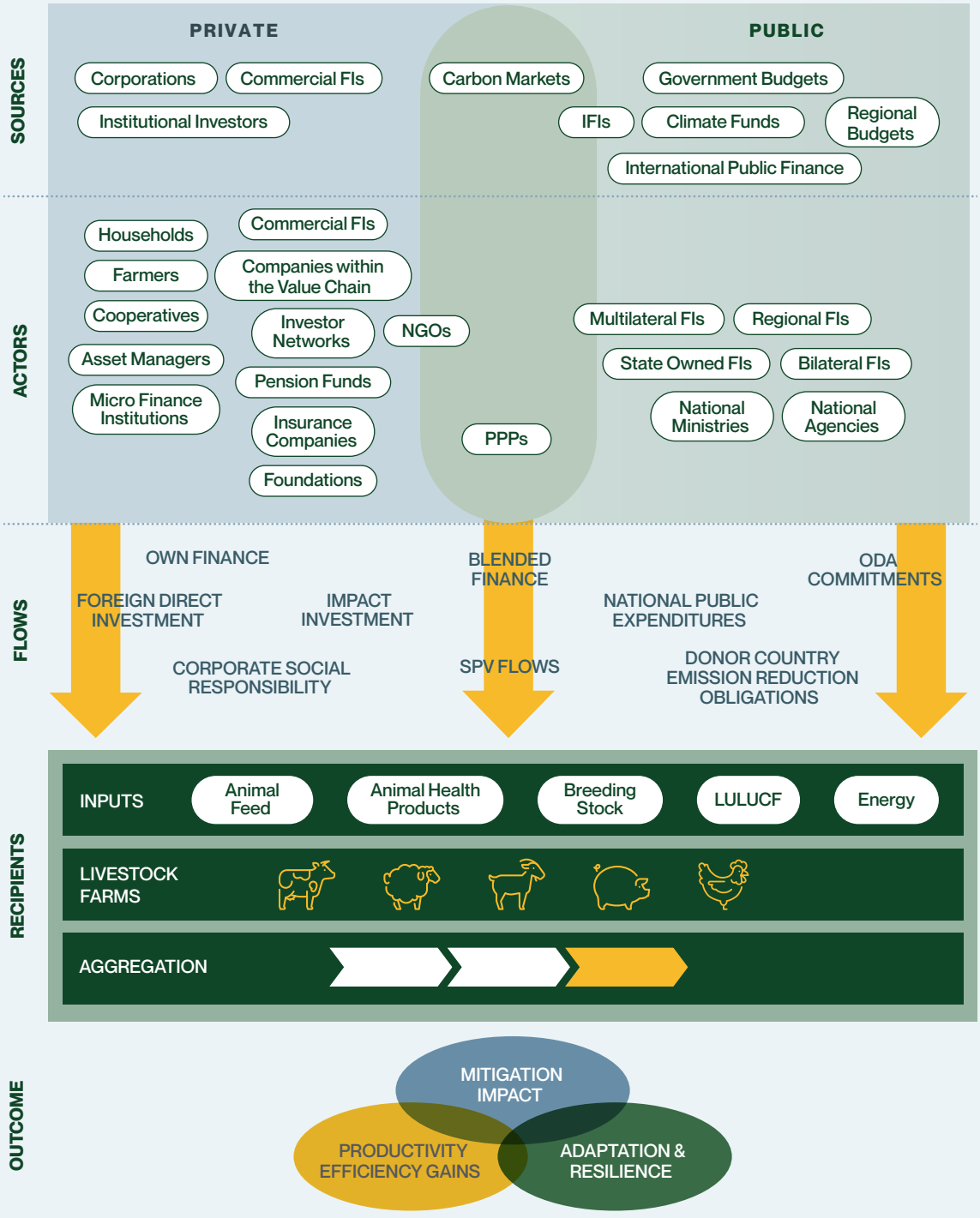
Public finance stems from national governments and regional budgets. International finance, specifically co-financing of climate-related official development assistance (ODA), is recorded by the Organisation for Economic Co-operation and Development (OECD). In addition to national and regional budgets, international financial institutions (IFIs) contribute to public sources. National and multilateral climate funds also count as public sources, as does international public finance. The latter denotes the transfer abroad of national public revenue for ODA or transnational public policy purposes such as reacting to climate change. International resource mobilization requiring joint efforts, such as levying a financial transaction tax, is considered under international public finance.

Carbon markets are recognized as a source of finance, providing a system that allows the trading of emission units, in the form of credits or offsets that represent emission reductions. Accordingly, credits and offsets are funding instruments related to both public and private finance sources; as both private and public actors operate on the field, this source overlaps in public and private spheres.

Actors are the stakeholders who either invest money into climate action within the livestock sector or facilitate such flows. It is, however, not always possible

4 Private domestic finance is not included in this graphic as it is difficult to track because its origins are not necessarily recorded.

FIGURE 2.1 Potential Actors and Sources of Climate Finance Relevant to the Animal Protein Sector



to clearly separate actors and sources, on one hand, and actors and recipients on the other. For example, when farms and corporations within the value chain (for example, cooperatives, feed providers, breeders, and retailers) invest own resources to achieve climate goals, the line between actors and recipients becomes blurred.

Among the private actors, *Investor networks* are coalitions of shareholders from different asset management firms, public pension funds, foundations and/or venture capital firms that advocate new investment practices, corporate engagement strategies, and regulatory solutions. Other important private actors are nongovernmental organizations (NGOs), asset managers, pension funds, micro finance institutions, insurance companies, and foundations.

Public actors include IFIs: multilateral and bilateral FIs, as well as regional and national, state-owned FIs, and national ministries and agencies with extension networks that reach farm level.

Impact investors are private-sector actors (alongside public actors and philanthropies in blended finance structures) who generate value by targeting societal challenges and help grow underserved capital markets. Impact investments are defined by the Global Impact Investing Network (GIIN) as "investments made with the intention to generate positive, measurable social and environmental impact alongside a financial return" (GIIN 2019). Impact investors are not interested in immediate returns, but have a longer-term understanding of their investment,[5] and thus have the potential to incentivizing behavior change.

Public-private partnerships (PPPs) are characterized by long-term cooperation, usually between a country's Ministry of Agriculture and private sector agri-business companies. They are often established to leverage the strengths of each actor managing risks and yielding returns from new technology or infrastructure.

The flows covered in this study are often actor specific. For instance, PPPs provide flows via special purpose vehicles (SPVs),[6] and corporations and FIs can invest their own finance, through foreign direct investment (FDI), through corporate social responsibility (CSR) investments or through financing of self-set commitments (for example, science-based targets). Impact investors select and finance projects that have social and/or environmental benefits, within a pre-established impact area or regional focus. Governments direct national public expenditures and country emission reduction obligations nationally and ODA commitments internationally (see Box 2.2 for an overview of the role of blended finance structures).

5 Interview conducted with Polly Ericksen of the International Livestock Research Institute (ILRI), November 29, 2019.

6 An SPV is a legal entity created for a specific purpose, in this context for raising capital. Most often structured as a limited liability company, SPVs amalgamate all investors into one entity. An SPV is a suitable instrument when the limited size of single projects stipulate aggregation to be effectively financed. A NAMA proposal could for instance create such a mechanism to finance NAMA projects within the livestock sector on affordable terms.

Financial instruments dedicated to Climate Finance consist of a diverse array that includes grants, concessional and non-concessional loans, equities, carbon credits, and virtually any alternative financial mechanism oriented toward mitigation and adaptation. A selection of financial instruments that climate finance providers employ is presented in Table 2.1.

A 2020 World Bank study analyzes the levers through which Climate Finance can be delivered in order to foster the transformation of a whole sector and contribute to economic and social development. The study identifies eight levers that have the catalytic potential needed to drive the transformation of a sector:

1. Project-Based Financing: Finance or project support to enable climate investments.
2. Financial Sector Reform: Financial sector regulations that catalyze green investment.
3. Fiscal Policy: Setting taxes and adjusting spending priorities to support climate action.
4. Sector Policies: Regulatory standards or information provision policies.
5. Trade Policy: Trade policies to encourage exchange of low-carbon and climate resilient (LCCR) products.
6. Innovation and Technology Transfer: Development of new, more effective, and lower cost green technologies.
7. Carbon Markets: System to define and trade mitigation outcomes for cost efficient mitigation.
8. Climate Intelligence and Data: Knowledge and planning tools to support policy and investment decisions.

BOX 2.2 The Role of Blended Finance Structures

Blended finance uses development finance in a strategic way for the mobilization of additional finance toward sustainable development in developing countries (OECD 2019a). It can serve as a de-risking tool to catalyze private sector investment toward sustainable development in emerging economies.

Blended finance can be a potential tool for mobilizing private flows into climate mitigation initiatives in the livestock sector by addressing the main obstacles that deter private actors from investing in the sector, such as high risks and transaction costs, and lower risk-return profiles desired compared to other investments.

According to the International Finance Corporation (IFC), blended finance structures must adhere to a series of principles. They should:

- Contribute to bridge funding gaps in development finance.
- Be designed with the objective of leveraging private finance.
- Be tailored to the local context.
- Effectively address existing market failures.
- Promote high standards of transparency, governance, and environmental impact (IFC 2019).

What exactly does it mean to "de-risk"? More than eliminating risk for investors, blended finance approaches offer different risk-return profiles (or the relation between potential returns and levels of uncertainty) that are appropriate for each kind of investor (Convergence 2018).

An example of a blended finance structure is the Land Degradation Neutrality (LDN) Fund established by the United Nations Convention to Combat Desertification (UNCCD) and private asset manager Mirova. It is an impact investment fund that provides long-term debt and equity financing aimed at "profit-generating sustainable land management (SLM) and land restoration projects worldwide" (UNCCD and Mirova 2019). The LDN Fund is structured to leverage private investors who might otherwise not have invested in sustainable land management projects. To achieve such goals, the Fund has been designed as a blended finance approach with a layered capital structure aimed at decreasing risk for private sector investors. Figure B2.2.1 illustrates the structure of the LDN Fund.

Within this structure, different risk-return profiles are divided into junior, mezzanine, and senior tranches. Public actors such as governments, development finance institutions (DFIs), other concessional sources, and private foundations are characterized as junior investors, meaning that they take a higher risk, first-loss position in the fund, shifting part of the risk away from senior investors. Senior investors are private actors such as pension funds, commercial banks, insurance companies, corporations, and other impact investors. The layered structure of this Fund provides senior investors with more immediate returns and a lower risk profile (UNCCD and Mirova 2019). Impact investors have the option of taking a higher risk profile with the idea of bringing in other investors, particularly private actors to mobilize even more climate finance. Blended finance schemes are an effective way to catalyze private investment in sectors that are otherwise too risky (such as climate mitigation/adaptation in livestock). These structures ensure that junior tranches de-risk senior tranches, incentivizing private sector investment in sustainable development.

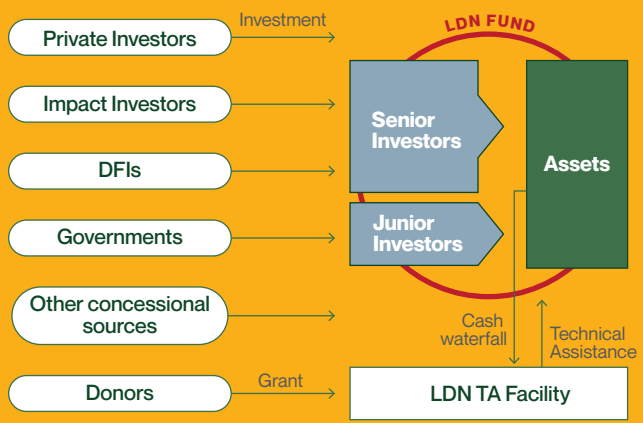


TABLE 2.1 Overview of Financial Instruments

Instrument	Characteristics	Available to
Grants	Transfers made in cash, goods, or services for which no repayment is required. Grants are provided for investment support and/or policy-based support Commonly used to remove obstacles through one-time expenses, such as demonstration projects or capacity building	Widespread in developed countries in the form of ODA, much less so in many least developed countries (LDCs)
Concessional Loans	Concessional loans are a subset of development finance and are loans offered at below market-rate terms, such as through longer repayment times, low interest rates, or both; often used to de-risk or encourage certain investments (Bloomberg NEF 2019) Nature of concessional loans in context of livestock may be worth examining beyond reduced interest or extended tenor (e.g., waiving mortgage requirements, offering fixed interest, flexible repayment terms, etc) Receiving governments might be reluctant to accept concessional loans for unproductive sectors, for example, smallholder livestock rearing	Widespread in selected developing countries with low-risk profile (ODA)
Loans	Low-cost, cooperative or market term loans are transfers for which repayment with interest is required For primary producers often in the case of agricultural credit (short duration) or bank loans. Flexible in cost, duration, and conditions and can be backed by collateral	Widespread in developed countries, much less so in many LDCs
Mezzanine Financing	Denotes unsecured, higher-yielding loans that are subordinate to bank loans and secured loans but rank above equity	Private and listed companies above a certain threshold
Equity, including venture capital	Equity is money invested in shares in a company and gives the shareholder [a share of the] power in the company All companies require equity capital; equity capital investors are the first to lose their money if the company is closed ("first loss position") Can also include new variants such as quasi-equity, such as loans that can be turned into equity	Government sources, IFIs, and DFIs as well as private and listed companies, often above a certain size threshold. Important for all start-ups to secure equity. Limited availability in certain LDC geographies and for smallholders

Instrument	Characteristics	Available to
Guarantee	Contract by a third party (guarantor) to back the debt of a second party (the creditor) for its payments to the ultimate debtholder (investor). In other words, a guarantee is an insurance that a debt issue will be paid to the ultimate debtholder Guarantees can be used to leverage financing from other sources due to risk-reducing nature	Financial institutions such as asset managers or corporations. Issued by DFIs, insurance companies, or other medium- to large-scale actors
Bonds, including Green Bonds	Fixed income instrument since bonds traditionally paid a fixed interest rate (coupon) to debtholders For this instrument, a green or climate variant is increasingly offered, often used to finance a project with primary environmental or climate objectives	Large companies, municipalities, governments, etc. Often conditional on more than €1 million in principal
Own and value chain finance, incl. research and development (R&D)	Internal working capital not backed by outside investor. Often not visible to outsider but backed by the company's own equities. In principle this also includes informal finance Particularly in Asia, but also in Africa and Latin America, there is informal financing by families, groups pooling cash and issuing loans or directly investing in businesses themselves	Private companies of all sizes
Cap and Trade	Market-based: Units are issued to entities included under the cap by an administrator, and entities are meant to surrender a specified quantity of units to offset/compensate their emissions	Widespread among industrialized countries and regions (EU, Australia, New Zealand, California), but also in Kazakhstan and China; could also emerge from international markets (for example, Kyoto Protocol global cap and trade scheme)
Baseline and Credit	Market-based: Units are earned from a calculation of the difference of emissions between a baseline scenario and the project scenario, yielding credits	Global as well as domestic, obstacles for small-scale projects and actors exist

Source: Adapted from COWI, Oeko-Institute, and CIFOR 2018.

Table 2.2 illustrates how levers can be combined within the same project and can use various financial instruments as noted above. The variety of transformative levers underlines the necessity of creating partnerships between public and private entities and the climate finance and animal sector communities to reach the full mitigation potential of the sector.

TABLE 2.2 Key Actions, Obstacles, and Finance Instruments of the Eight Climate Finance Levers

Climate Lever	Main interventions	Obstacles to Action	Key Climate Finance Instruments
Project-Based Financing	• Invest in projects • Blended finance to manage risks • Manage risks and returns to enable private finance opportunities	• Capital constraints • Limited capacity to deliver effectively	• Investment financing for de-risking and crowding in other funding • Technical assistance for enabling investment
Financial Sector Reform	• Report and manage climate risk • Regulate green assets • Deploy incentives for green investment • Integrate climate risks into financial sector prudential regulation	• Public finance and capital constraints • Limited institutional and technical capacity • Perceived conflict with development	• Technical assistance for improving governance, capacity, and expertise • Investment financing for catalyzing green investment
Fiscal Policy	• Implement carbon taxes • Reform subsidies and taxes to incentivize climate action • Adjust government procurement • Plan for climate impacts in fiscal planning	• Concerns on reducing international competitiveness and distributional consequences • Capital constraints	• Policy-based financing • Technical assistance for addressing knowledge and capacity gaps
Sector Policies	• Implement regulations conducive to LCCR alternatives • Enforce green technology standards	• Information gaps to develop policies • Limited resources and institutional capacity to enforce regulation • Concerns on reducing international competitiveness	• Policy-based financing to create incentives • Technical assistance for knowledge sharing on policy development
Trade Policy	• Consider trade liberalization for environmental goods • Apply border carbon adjustments • Coordinate through climate clubs	• Tariff revenue reduction • Insufficient infrastructure • Technical and political challenges to policy design	• Trade finance for LCCR goods and services • Technical assistance for developing climate-friendly trade policy

Climate Lever	Main interventions	Obstacles to Action	Key Climate Finance Instruments
Innovation and Tech Transfer	• Provide public funding for basic research • Implement tax credits for research and development • Develop technology transfer policy that targets appropriate cleantech and builds local capacity • Enforce intellectual property rights • Promote green procurement schemes	• Limited resources • Uncertain, long-term, and diffuse payoffs • Limited capacity to develop broader innovation ecosystem	• Investment financing for high-risk innovation • Technical assistance for early-stage innovation
Carbon Markets	• Establish domestic carbon markets • Link markets internationally	• Concerns on reducing International competitiveness and distributional consequences • Uncertainty around carbon prices • Limited capacity and knowledge	• Results-based financing for supporting market development • Technical assistance for establishing and linking markets
Climate Intelligence and Data	• Develop long-term planning tools • Provide policy risk information • Improve disaster risk-management tools • Generate localized climate impacts and opportunities data	• Challenges to collect data and develop intelligence • Limited confidence in accuracy • Uncertain policy response	• Technical assistance for building capacity in measuring and using climate data

Source: World Bank 2020

A wide diversity of animal protein production systems and value chains

The main livestock species can be grouped into two categories: ruminants (cattle, buffalos, and small ruminants including sheep and goats) and monogastrics (pigs, chicken, and other poultry). Ruminants are characterized by their stomachs' having four compartments where food is regurgitated (ruminated) and fermented, allowing them to digest cellulose. In rangelands and marginal lands covering up to 25 percent of the Earth's ice-free lands (Ramankutty et al. 2008), no crops can grow; ruminants are the only way to produce food. Monogastrics have only one compartment in their stomach and mostly lack this ability to digest cellulose; therefore, their diet is often largely composed of human-edible food.

Livestock production systems are defined by multidimensional components and drivers that interact to achieve a specified livestock production objective. The systems are often classified based on one vital component: the feed diet of the animals. For instance, Séré & Steinfeld (1996) classify global livestock production systems using agroclimatic conditions, farm income structure, and feed. Based on feed, they differentiate the following types of systems: landless systems (which may be monogastric or ruminant); grassland-based system (in which crop-based agriculture is minimal); and mixed systems where livestock is combined with cropping, and which can further be split between rainfed and irrigated agriculture.

More specific production systems categories have also been used. For instance, pastoral systems refer to ruminant grassland-based systems where mobility plays a central role, although it can cover different realities, from nomadic to semi-nomadic, transhumant, rangeland-based, etc. Landless systems in beef cattle correspond to feedlots, yet they remain dependent on grassland-based systems during the early, cow-calf phase of an animals' life. In pig and poultry production, a gradient exists from "backyard" production systems that are mainly subsistence driven (or for local markets) and where a high share of feed comes from swill, scavenging, and locally sourced feed; to industrial systems that are fully market-oriented, with mostly purchased, non-local, and intensively produced feed.

Livestock production systems defined based on feed resources correlate with the notion of farming intensity, which can be defined as increased reliance on capital and technology, or increased productivity of land (Netting, 1993) and measured with either output-oriented (production, e.g., crop yield, animals / ha) or input-oriented (utilization, e.g., kg N / ha from fertilizers) metrics. Grassland-based systems are typically extensive, requiring large grassland areas to produce meat and milk outputs. Conversely, landless systems are typically described as intensive as they rely on high-yielding, commercial feed crops that are also of high nutrition quality and efficiently transformed into milk, meat (and egg) proteins. Agricultural (land) intensity also relates to

intensity of other production factors (FAO 2018). Landless systems such as feedlot, intensive dairy, or industrial monogastric production are capital-intensive, requiring high initial investments and cash flow. Labor-intensive systems are typically ruminant smallholder farms with low returns and a surplus of labor, often constrained by scarcity of both land and capital.

Based on these considerations, this report follows the six livestock production systems ("contexts") defined in the guide for Investing in Sustainable Livestock (ISL) that combine the feed and agroecological dimensions (Table 2.3).

The corresponding value chains of livestock production systems are no less diverse and equally complex. With different types of stakeholders, related to input provision, aggregation (farmers' groups, cooperatives, and traders), processing (from slaughterhouses to high-end butchers), and distribution, their complexity is evident (see Figure 2.2). In addition to targeting stakeholders directly involved in the value chain, finance can also be targeted toward the national or global enabling structures such as the policy environment and market structures, as well as extension services and finance infrastructure (FAO 2019b).

FIGURE 2.2 The Animal Protein Value Chain

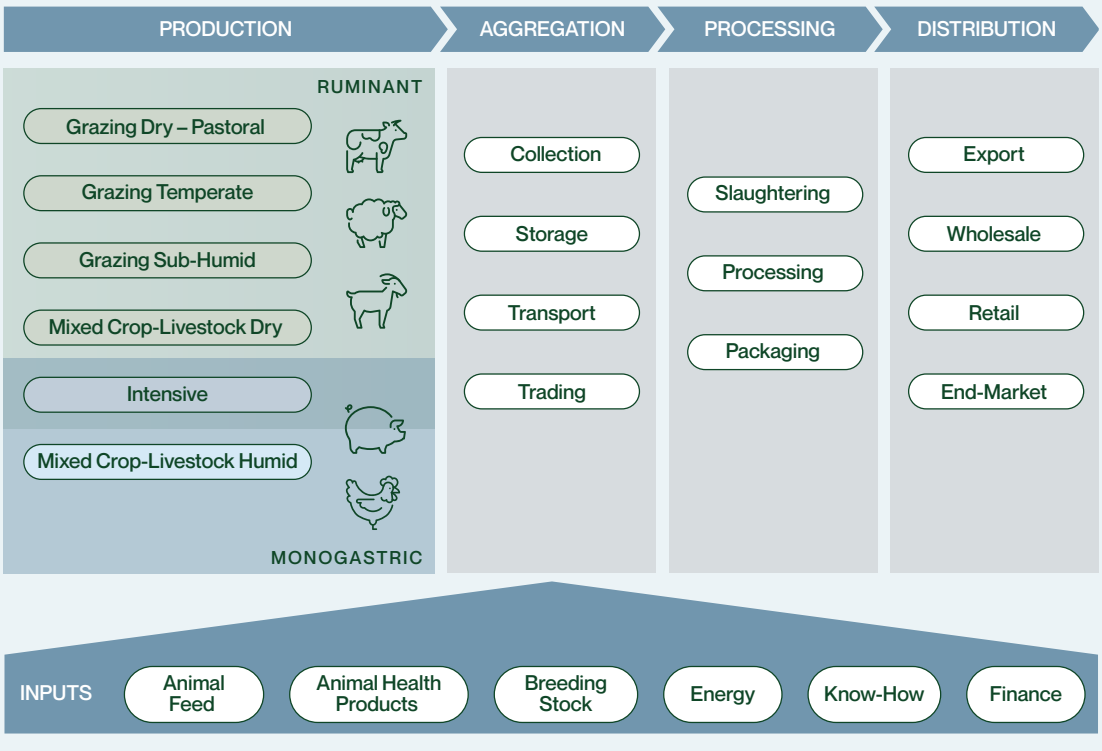


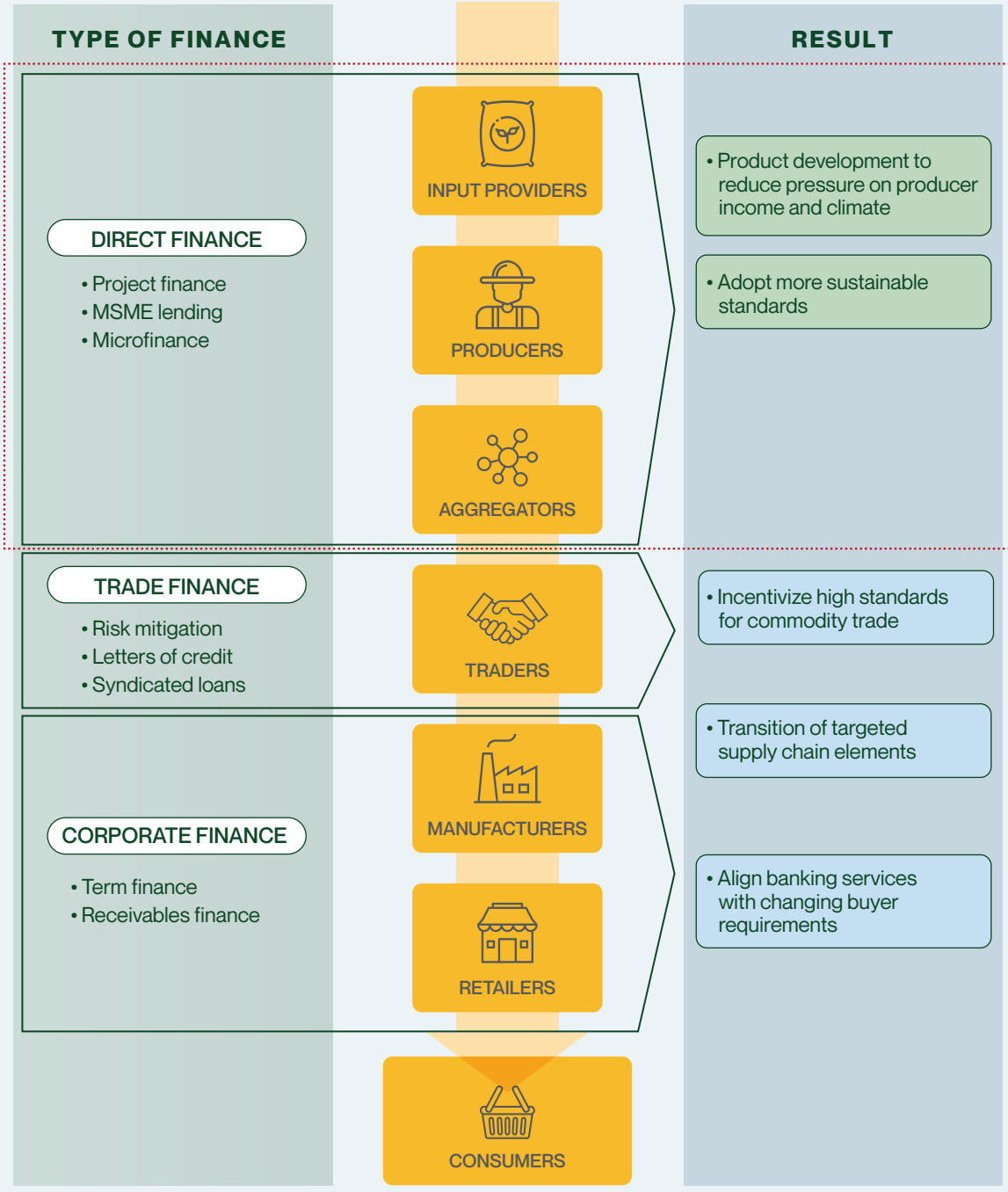
TABLE 2.3 Production Contexts of Livestock Systems

Production Context	Characteristics	Geographies
Grazing Dry – Pastoral (Ruminants)	• Constant/seasonal mobility of the herd • Natural vegetation as feed	Horn of Africa, Mongolia, Sahel, and high-altitude lands
Grazing Temperate (Ruminants)	• Commercially orientated, extensive systems, mainly beef • Small- to large-scale private farms	Argentina, Botswana, Chile, Kyrgyz Republic, South Africa, Tajikistan, Uruguay, and Uzbekistan
Grazing Sub-Humid (Ruminants)	• Former forest lands converted to rangelands • Production for export	China, Latin America and the Caribbean, Sub-Saharan Africa, and Vietnam,
Mixed Crop-Livestock Systems	• Favorable climatic conditions • Land constraints for farm development • Traditionally subsistence, limited market-off take	Andean region, Ethiopia, Kenya, South Asia, and East Asia
Mixed Crop-Livestock Humid (Monogastrics)	• Integrated systems of rice-production, livestock, aquaculture, and horticulture • Commercially oriented	Bangladesh, China, India, Indonesia, Malaysia, Myanmar, Thailand, and Vietnam
Intensive (Monogastrics & Ruminants)	• Large-scale industrial livestock production, commercially orientated • High level of specialization, limited land use, predominantly pigs and poultry but also beef and dairy	Middle- and high-income countries across the world

Source: World Bank and FAO 2020.

Along this supply chain, IFIs have several finance entry points, as depicted in Figure 2.3. Climate finance can flow in the form of project finance, general purpose lending (working capital, small business lending), or capital raising, for example. Financial instruments can include new modalities such as climate conditionalities and MRV requirements resulting in livelihood and climate outcomes as well as raising the bar toward higher production standards (see "result" heading in Figure 2.3). Other ways to finance sustainable value chains constitute trade finance, which incentivizes import/export of climate-friendly animal proteins; corporate finance, in the form of general-purpose lending (working capital) and capital raising; and term or receivables finance, which targets downstream activities in the value chain connected to processing and distribution.

FIGURE 2.3 IFI Finance Entry Points



Source: Adapted from CISL 2016.

Note: The red box denotes the relevant recipients of climate finance directed to upstream activities; the green text boxes show the results of livelihood and climate outcomes.

Mitigation pathways and the triple wins

Net GHG emissions reduction in livestock production

Setting the animal protein sector on a low-carbon path requires the adoption of a life-cycle perspective to assess emissions. Such a perspective considers emissions occurring along the entirety of livestock supply chains and not just those originating from the animals or animal farm holdings. There are three main categories of sources of emissions:

1. Feed-related emissions:
   - N_2O emissions from applied and deposited manure, applied synthetic fertilizer, and crop residues decomposition;
   - CO_2 emissions from land-use change associated with the expansion of pastures into forests or feed crops into forests/grasslands; and
   - CO_2 emissions from field operations, input production (fertilizers, pesticides), and feed processing/transport.
2. Emissions directly related to the animals:
   - CH_4 emissions caused by enteric fermentation; and
   - CH_4 and N_2O emissions arising from manure storage and management.
3. Other sources of emissions:
   - CO_2 emissions from energy use on-farm and arising during the construction of farm buildings and equipment; and
   - CO_2 emissions occurring downstream from the processing and transport of livestock products.

The emission profile of a specific livestock production system and value chain corresponds to the relative importance of the different emission sources described above. The diversity of livestock production systems translates into contrasting emission profiles (Mottet et al. 2017). In grazing systems, a large share of the emissions comes from enteric fermentation due to the relatively low digestibility of grass that represents the most important feed resource, with manure deposition on pastures also accounting for emissions. Depending on the agroecological context, significant emissions can be related to land use change as well. For instance, pasture expansion into forests can occur in grazing sub-humid systems while most grazing dry systems will not have land use change emissions because rangeland is the native ecosystem. In mixed crop-livestock (smallholder) systems, the emission profile is dominated by enteric fermentation (due to the use of feed material of limited quality such as crop residues) and manure management (due to the concentration of animals and lack of optimal manure management strategies). Intensive systems tend to optimize efficiency and provide high quality feed materials to

animals, resulting in a lower importance of enteric methane emissions and a high share of emissions related to feed cultivation (especially if it is associated with land use change) as well as manure management.

Within a given livestock production system, a common emissions profile emerges but the level of emissions (absolute or per unit of output) often varies drastically. This reveals considerable room for improvement even without shifting among protein sources, livestock species, or production systems. Gerber et al. (2013) estimated that a 30 percent mitigation potential could be achieved if the bulk of the producers adopted best practices already existing within the same production system. In addition to existing best practices, innovative technological opportunities are also emerging. Three main categories of mitigation options are detailed below. Despite a major mitigation potential, it is important to note that the "zero-emissions cow" (or ruminant) does not exist, and that carbon neutrality may be achievable in specific systems but likely not by the global livestock sector as a whole.

The mitigation outcome can be achieved through absolute emission reduction or through a reduction in emission intensity— a change in the GHG emissions per unit of output (e.g., CO_2e/kg of animal proteins). The emissions of the animal protein sector should ideally be reduced in absolute terms, to mitigate climate change effectively and keep the rise in temperature well below 2°C, in line with the Paris Agreement. Due to the expected increase in global demand and the economic pressure that rural producers in LMICs face, reducing emission intensity is a first step and an important entry point, since it shows that the production of animal products is not at odds with achieving carbon balances. Reducing the emissions of each kilogram of beef or liter of milk, especially in developing countries, could help support food security and reduce further degradation of natural resources while avoiding emissions, compared to a "business-as-usual" scenario where an increase in production is achieved solely from herd expansion rather than from efficiency gains.

Emission intensity reduction through efficiency and productivity gains

This category of mitigation options is where most best practices already exist and could result in important mitigation outcomes if widely applied. Emission intensity is expressed as GHG emissions per unit of product, in CO_2e./kg of milk, meat, egg, or other animal proteins. Therefore, productivity can be increased [through applying best practices] in the form of more protein produced per animal, which has a direct effect on emission intensity reduction. This means that the same level of production occurs with greater output gains (protein) with lower absolute emissions. Best management practices target three main areas for productivity gains and emission intensity reduction:

- **Feed and nutrition.** Poor nutrition is one of the main factors of low productivity; therefore, improving feed quality and balancing the feed ration to animals' requirements is an important leverage for productivity gains and emission intensity reduction. Using feed of higher quality and digestibility can also lead to absolute emission reductions. Feed and

nutrition improvements include improved grassland management, improved pastures (e.g., fertilization, use of grass and legume mix), forage mix, feed processing (e.g., chopping, urea treatment) and strategic feed supplementation.

- **Animal health and husbandry.** Decreasing mortality, increasing fertility, and managing the herd to optimize the number of productive animals leads to improved productivity over the lifetime of the animals and at herd level. Emission intensity is decreased through higher productivity and by cutting 'unproductive' emissions that are associated with animals not producing any output. Optimizing animal health and husbandry practices include veterinary interventions, management of reproduction (e.g., artificial insemination, sexed semen) and of the herd (e.g., optimal culling rate and offtake of young animals). Improving feed and nutrition also has an important effect on animal health and reproductive performance.
- **Animal genetic resources.** Breeding to maximize desirable traits can strongly increase productivity by improving traits such as live-weight gain, milk yield, or fertility. Adaptation traits can also be sought, to reduce mortality in challenging climate or disease contexts.

Emission removals though land management

Grassland worldwide covers 3.3 billion hectares and grassland soil is estimated to contain 343 billion tons of carbon, an amount higher than the total carbon stored in forests (FAO 2010a). The potential for soil organic carbon (SOC) sequestration in grassland depends on pedoclimatic factors as well as on grassland management, with moderate levels of fertilization and livestock density often being optimal to maintain or increase SOC stocks (Soussana et al. 2004).

Approximately, 10 to 20 percent of global pastures are degraded (FAO 2010b) and it is estimated that degradation can reduce SOC stocks up to 95 percent in temperate and tropical regions (Soussana et al. 2010). A major proportion of the loss of soil carbon is released into the atmosphere as CO_2, contributing to GHG emissions. Conversely, restoring degraded grasslands provides a major opportunity to offset GHG emissions by putting the carbon back in the soil. Increasing soil organic matter has co-benefits for fertility, subsequently allowing more plant species to grow and boosting pasture productivity. Grazing management can play an active role in grassland restoration, mainly by adapting the timing, intensity, and spatial distribution of animals to match the productivity of biomass. This can be achieved, for instance, through rotational grazing, fencing, introduction of species (e.g., legumes), or improved mobility of animals.

This category of mitigation options of interventions related to land management could offer the largest potential for absolute emissions reductions through carbon sequestration. There are, however, uncertainties in quantifying this potential, as the science regarding how climate, land use, and management interact to influence SOC changes is ongoing. Similarly, the importance

of background carbon stocks and historical land uses or management, and the reversibility of soil carbon sequestration is not fully understood (Smith et al. 2020). Cost-effective MRV approaches on soil carbon are still lacking although it is an area of rapid methodological developments as the world moves to greater understanding of these interactions.

Carbon sequestration through grassland management and restoration should not overshadow the need to maintain existing carbon stocks. Avoiding deforestation is critical, by preventing pasture expansion and sustainably sourcing feed (soybean in particular). All land uses and their integration should be considered including avoiding pasture conversion to cropland, promoting no-tillage cultivation, crop-livestock integration, and silvopastoralism.

Technical options to reduce direct emissions

This category gathers mitigation interventions ranging from already established best practices to emerging options, as classified by GRA and SAI (2015). They target two sources of emissions: manure management and enteric fermentations.

Manure management – diet has an impact on the composition of feces and urine and on emissions related to manure management. Lower feed digestibility generally results in higher levels of organic matter in manure, which can be fermented and result in CH_4 emissions. Matching protein intake from feed with animal requirements can be a way to limit nitrogen concentration in manure and to reduce N_2O emissions.

Proper manure collection and storage is an important mitigation option in systems (both low and high technological ones) where animals are concentrated. Using best practices or adopting these mitigation measures results in significantly lowering manure management emissions in emission profiles. There are also co-benefits such as enhanced nutrients when used as fertilizer, improved hygiene, and reduction of environmental damage caused by nutrient run-off (e.g., eutrophication and acidification). Housing systems with hard floors (e.g., concrete, clay) combined with simple storage equipment reduce emissions compared to the absence of a storage facility. Reducing storage time but also aeration and cooler temperatures will limit or slow down the microbial fermentation processes causing GHG emissions. Storage cover could reduce CH_4 emissions, but it depends on the cover type (porosity, degradability) and is likely to result in higher N_2O emissions when effluents are further applied on land.

Capturing biogas from anaerobic processes, however, can be an effective mitigation option with economic co-benefits. Biogas digesters can capture up to 60-80 percent of the CH_4 from manure that would otherwise be emitted into the atmosphere. Mitigation potential is highest when CH_4 is combusted to produce electricity or heat as a replacement for fossil fuel. Biogas production can be done at various scales, from simple digestors adapted to subsistence farming systems (still requiring some capital investment) to produce cooking gas,

to large-scale biogas plants that can produce renewable energy for the grid, if the corresponding infrastructure is developed.

In grazing systems, manure and urine is directly deposited in pastures. Most of the manure that is collected and stored (as well as biodigester effluents) is also eventually applied back to soils. One option to mitigate the N_2O emissions from these practices is to match the amount of manure deposited or applied to the nutrient requirements needed for optimal pasture or crop growth. This can be achieved by delaying application, covering a wider area, achieving a more uniform distribution, and factoring in the application of additional, synthetic fertilizers.

Rumen modification – As enteric methane emissions represent the most significant emission source from the global livestock sector, much of the science and research in the sector focusses on methods to mitigate them. Given their significance, technological mitigation options have been the primary focus.

Methane inhibitors are chemical compounds with an inhibitory effect on rumen micro-organisms. Certain compounds have been successfully tested in vitro as well as on animals with initial trials shown to completely suppress CH_4 emissions. However, uncertainties remain regarding commercial viability, implications for productivity, animal health, and food safety, as well as long-term efficacy due to the possible adaptation of the rumen ecosystem.

Other technologies are at even earlier stages of development. Vaccines could stimulate the animal immune system to produce antibodies against methanogen micro-organisms. The identification of antigens to be targeted, as well as the development of effective adjuvants, is ongoing. Their potential effects on productivity must also be assessed. Another possible intervention entails transferring the rumen microbiome from low-methane to high-methane producing ruminants (differences of around 15 percent are commonly observed between individuals). The challenge of this intervention is that the effects are often temporary. Despite the emerging technical options, these are not yet ready to be fully operational and scaled up, as greater understanding is needed of the microbial ecosystem in the rumen (microbial communities taxonomy, genetics), its interaction with management and feeding practices, and on the consequences of its modification for food safety and economics.

Renewable energy and energy efficiency – There is scope for mitigation in relying on renewable energy and adopting energy efficient technology for livestock production, especially in more industrialized production systems and at energy-intensive stages of the animal protein life cycle (transport, animal housing, processing of feed and animal products). However, energy consumption has a limited contribution to livestock emission profiles, even in intensive systems, as the emission reductions are marginal.

Other sources of GHG emission reductions in the animal protein sector

The mitigation options discussed above focus on the production side of the livestock sector. There is also scope for mitigation within other animal protein

value chains, as well as on the consumption side (i.e., dietary shifts between protein sources). It is difficult to quantify mitigation actions and measures along these avenues as they are problematic to evaluate and less definitive.

There is a strong correlation between GDP per capita and protein consumption, which is mainly driven by increased consumption of proteins derived from livestock (FAO 2019a). In the lowest-income countries, the proportion of dietary proteins coming from livestock is less than 10 percent while it reaches more than 50 percent in the highest-income countries. Meat from ruminants is by far the animal protein product with the highest emission intensity (> 200 kg CO_2e/kg protein without including land use change emissions), 4 to 6 times higher than the emission intensity of dairy proteins, and 20 times higher than the emission intensity of pulses (Searchinger et al. 2019). Poultry meat and eggs are the livestock proteins with the lowest emissions per kg of protein, although their emission intensity is slightly higher than that of aquaculture (when emissions from land use change are included).

Within aquaculture, the evidence base on emissions quantification and mitigation options is much more limited than for livestock, but mitigation pathways have been identified (Robb et al. 2017). These include reducing emission from feed production and processing, improving the efficiency of feed conversion for fish, and improving fish health.

Emerging protein sources for feed and food such as insects or synthetic meat are at the experimental stage but could have the potential to reach low emission intensities. For instance, van Huis and Oonincx. (2017) report that broiler chickens are associated with 32-167 percent higher emissions intensity than mealworms based on life cycle assessment and on an edible protein basis. Housefly feed meals could decrease emissions by 61 percent compared to a soybean and fish feed meal. Few studies are available on the carbon footprint of synthetic meat; moreover, those that are available report contrasting emission intensities (see Tuomisto et al. 2014; Matick et al. 2015). Synthetic meat is very resource and energy intensive; its carbon footprint thus depends strongly on access to decarbonized energy (Lynch and Pierrehumbert 2019) and its economic cost remains an important challenge for its development.

Overall, the IPCC (2019) estimates the mitigation potential from dietary changes (0.7-8 $GtCO_2$e yr-1 by 2050) to be of similar magnitude as from changes at the primary production level (2.3-9.6 $GtCO_2$e yr-1 by 2050 from crop, livestock, and agroforestry activities). In particular, moderating the consumption of ruminant meat is likely to be essential to close the food and emission mitigation gaps (Searchinger et al. 2019). (See the section on investment opportunities [chapter 5] for more on consumption and mitigation). However, fostering dietary changes faces obstacles that are not explicitly addressed in the report, as diets are rooted in a complex web of drivers including local food production practices and agroecological potential, technical and financial conditions among communities, as well livelihoods and cultural patterns.

The triple wins of climate finance: dividends and incentives

Climate finance as defined by the UNFCC aims at reducing emissions and enhancing sinks of greenhouse gases with the objective of reducing vulnerability while maintaining and increasing the resilience of human and ecological systems to negative climate change impacts. Mitigation efforts in the livestock sector have the potential to achieve these outcomes and more. The direct mitigation outcome can be expressed in tons of CO_2 of emissions reduced or removals enhanced. Mitigation approaches essentially contribute to making systems more productive, healthy and integrated (into markets, ecosystems...), which means that they also produce indirect adaptation outcomes, such as enhanced resilience of people, production, and ecosystems. Furthermore, specific mitigation approaches can produce a wider range of positive ancillary outcomes.

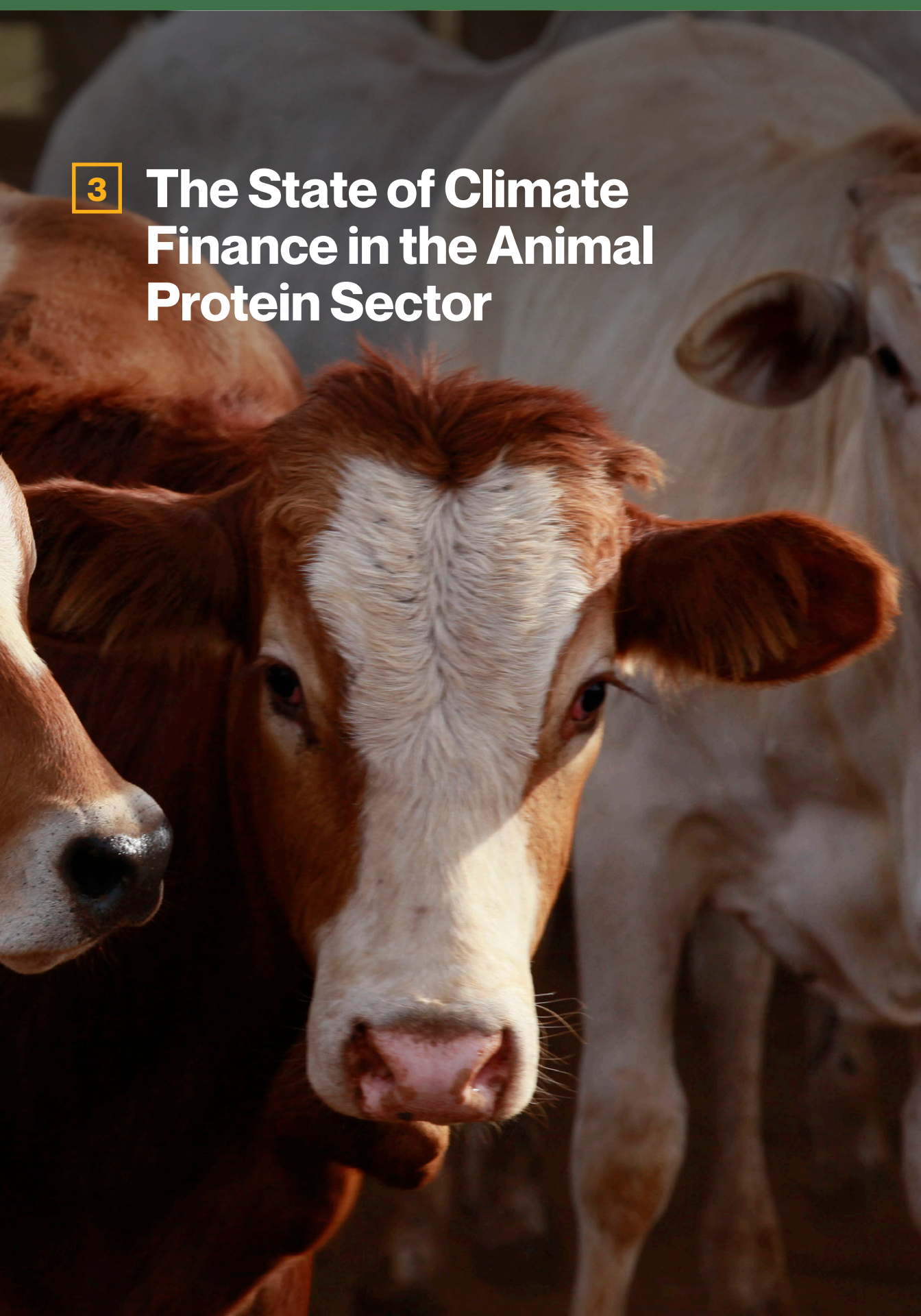
Emission intensity reduction through efficiency and productivity gains. Efficiency and productivity gains are directly related to emission intensity reduction because more output and less input per output naturally coincides with lower emissions per output. The ongoing process of productivity or yield improvements can be used to make livestock systems more efficient (FAO 2019a). Productivity gains need to be considered because they represent incentives for both producers and investors, especially in low-productivity systems across LMICs. From an investor's perspective, productivity gains imply a higher return on investment. From a global sustainable development perspective, and perhaps more importantly within the perspective of a rural poor or small-scale farmer/producer in a LMIC, productivity gains can have a significant impact: improving or sustaining livelihoods, enhancing gender inclusion, increasing income and access to market, increasing sources of direct nutrition and thus enhancing food security, providing an opportunity to improve food safety. This third mitigation outcome, enhanced socio-economic benefits through production efficiency, is both a dividend and incentive to motivate further climate finance investment. However, the three outcomes – mitigation, adaptation, and improved producers' incomes through production efficiency – can come with trade-offs. Cattle rearing in LMICs is often a resilience strategy: diversifying production to sustain livelihoods, increase food sources (i.e., food security), and to create or improve ecosystem resilience. Yet, every reared animal emits GHG emissions, thus contributing to climate change, especially if not optimally managed or fed.

Several of the **technical options to reduce direct emissions** are directly profitable, especially those related to energy use and production. Biogas digesters have proven to be profitable investments at various scales – from small digesters providing free cooking gas in remote communities not connected to the grid, to large scale biodegesters achieving economies of scale (collecting manure from large farms) and producing fuel or heat at a competitive price. Biogas digesters thus provide co-benefits for farmers' incomes, as well as to the environment beyond climate change mitigation (potentially lower release of pathogens into the environment, eutrophication, and associated biodiversity

loss). Technical options targeting energy-use efficiency and the use of renewable energy (at the farm, slaughterhouse, processing or transport levels) also could provide bankable investment.

Emission removals though land management. Carbon sequestration is generally highest in healthy agro-ecosystems, that also provide a very wide range of benefits though ecosystem services, from pest control and pollination, biodiversity conservation, water availability and quality, resilience etc. Livestock systems can offset emissions though two main types of land management: avoiding deforestation; and sustainable grassland management. Reforesting or avoiding deforestation not only restores and protects carbon sinks below and above ground, it also contributes to the conservation of biodiversity hotspots. In grasslands, a large part of the sequestration potential is in the restoration of degraded land. Land restoration is a first co-benefit in itself and it is accompanied by multiple positive outcomes, as healthy grasslands are also more productive, more resilient to climate shocks and host more plant and animal species.

As demand for animal protein is expected to grow, particularly in Africa and Asia, it is essential to consider desirable and undesirable outcomes of adaptation or mitigation efforts, and to promote and demonstrate initiatives that address climate change objectives while enhancing productivity gains in livestock systems. Acknowledging the variety of livestock production systems and the multiple functions that these provide to humans, Rivera-Ferre et al. (2016) observed several win-win strategies that effectively tackle both mitigation and adaptation, as well as food security. Such strategies may include improving herd and grazing management, farming practices and/or pasture management.



3 The State of Climate Finance in the Animal Protein Sector

Whereas the mitigation strategies for which climate finance can be mobilized, as described in previous sections, mostly relate to upstream livestock production activities, climate finance can be directed to all activities in the animal protein value chain. Downstream actors, such as processing companies, marketing, retail, and wholesale enterprises have a pivotal role to play in moving the sustainability agenda forward and in providing finance alongside other resources and services to enable this transition.

Revealing the state of climate finance flows: methodology

Investigating the state of climate finance in the animal protein sector for this report entailed a multipronged approach. Both qualitative and quantitative data using primary and secondary sources were used to assess the state of climate finance in the sector. Whereas international public finance and carbon market activities can be tracked through existing databases, private finance in the land sector remains largely unmapped (COWI, Oeko-Institute, and CIFOR 2018; CPI 2019). Notably, no institution, database, or tracker holds consistent data across all regions of the world; this is particularly lacking in the meat protein sector. To address this lack, mapping the finance flows entailed an extensive literature review (published and gray literature), complemented by expert interviews. It also drew from data sources that capture public, private, and blended finance flows of existing on-the-ground projects or projects that finance activities of microfinance providers. To track public flows, the authors used the OECD database on climate-related development finance 2012–17 (OECD 2019b). Although, the mapping does not show the complete landscape, the available information was used to distinguish the characteristics of finance flows into the sector to identify patterns and particularities. Table 3.1 summarizes the types of flow, the type of finance tracked, and the source data; Appendix B lists the interviewees and summarizes the conversations.

For carbon market activities, the Clean Development Mechanism (CDM), Joint Implementation (JI), Verified Carbon Standard (VCS), and Gold Standard provided a focused look at carbon crediting as a means for funding livestock mitigation projects, as these operate in LMICs (see example in Box 3.4).[7] All relevant projects to this analysis were selected based on availability and magnitude of information within their respective databases.

The extensive literature research generated information on finance flows from international institutional, personal, and commercial investors, including flows trickling down to farm-level interventions. Due to the overall absence of

7 There are several other carbon crediting programs that exist at a country level that credit livestock-related activities. They are not included as they are located in high-income countries and are outside of the scope of the regions presented in this report. These crediting mechanisms include the Australian Emissions Reduction Fund, the California Carbon Offset Program (United States), Climate Action Reserve (United States), Label Bas Carbone (France), and the Québec Offset Program (Canada).

TABLE 3.1 Tracking of Climate Finance Flows in the Animal Protein Sector

Type of Flow (*)	Type of Finance	Sources
Private	**Tracked** • Livestock insurance **Tracked with data limitations** • Direct financing of production by international private and blended investment management institutions, commercial banks, local financial institutions, and main international philanthropies • Company own finance toward corporate social responsibility	• ImpactAssets50 database (ImpactAssets 2020) • Investor networks such as Convergence and GIIN • FAIRR indicator – Sustainability indicator for the largest protein producers (FAIRR 2020) • Sustainability reports of the largest beef and dairy companies (turnover)
Carbon Market	**Tracked** • International and domestic carbon market activities toward the animal protein sector	• CDM Registry (UNFCCC 2019a) • Gold Standard Project Database (The Gold Standard 2019) • JI Project Database (UNFCCC 2019b) • VCS Project Database (Verra 2015)
Public Finance	**Tracked** • International public finance	• Organisation for Economic Co-operation and Development climate-related Development Finance Database 2012–2017 (OECD 2019b)

Note: See Appendix A.3 for a list of considered cases.
*Domestic public finance flows not tracked.

uniform data sources, the deficiencies in the way it is represented, and the lack of specific sector data, several challenges were revealed. Specifically, those regarding assessing the weight of private sector flows in the broader realm of climate finance directed toward the livestock sector. Addressing the challenges faced in creating a comprehensive body of data and information the (e.g., generalized lack of financial data, especially in local private transactions; the near absence of record-keeping; and the importance of informal markets in LMICs), would benefit all current and potential financial actors in the animal protein sector.

Mapping the flows highlighted several specificities. For example, some bankable projects that lead to emissions reduction are implemented primarily for productivity gains, or investors prioritize food security and poverty reduction, while the mitigation component remains neglected. The Rabo Foundation, for instance, fosters crossbreeding to enhance productivity only.[8]

8 See a Rabobank Foundation project that encourages crossbreeding in Tanzania, available at https://www.rabobank.com/en/raboworld/articles/crossbreeding-and-an-app-boost-tanzanian-dairy.html.

The analysis of the portfolios of private actors consisted of:

1. Identifying investments directed to the animal protein sector; and
2. Identifying types of outcomes that investors wish to achieve through investment.

Another integral part of the methodology included portfolio analyses of international private and blended investment management institutions, commercial banks, local financial institutions, and the main international philanthropic organizations. Based on the outcomes that investors wished to achieve, the cases were clustered in three categories (summarized in Table 3.2), which provide the structure of the overall analysis.

TABLE 3.2 Categorization of Private Climate Finance Flows into the Animal Protein Sector

Category	Explanation	Identified cases
Direct Climate Finance	Directed toward the animal protein sector Advocated climate mitigation and/or adaptation outcome	38
Indirect Climate Finance	Directed toward the animal protein sector Investments led to a climate outcome (adaptation or mitigation) which remains unmentioned/unidentified	51
Potential Future Streams	Impact Investment toward the animal protein sector, no clear relation with climate action This is funding that could support climate outcomes, but for which insufficient information exists to determine whether it is supportive or (possibly) counter-supportive	10

Main trends and potential for scaling up investments in the livestock sector[9]

Mapping direct and indirect climate finance flows toward the upstream activities of animal protein chains highlighted that there is potential for private investment, though obstacles do exist. Another result yielded the following characteristics of the current landscape:

- Five approaches to finance schemes that target GHG emissions induced by the livestock sector;
- Emission mitigation is often an unlabeled (i.e., an unsought or unforeseen) co-benefit of existing investments;
- The potential for carbon markets is promising yet challenging; and
- Six climate finance schemes seem to be most promising for future implementation.

Private investment potential: opportunities and obstacles

The list of potential public and private investors—grantors, concessional capital providers, equity providers, commercial lenders—suggests that private sources could represent the largest source of climate finance in the sector (see Figure 2.1). However, not all depicted private sources are effectively leveraging climate finance toward the animal protein sector. Despite improvements in the enabling environment and market conditions in LMICs, as well as the recent expansion of private climate finance and the emergence of innovative ways to approach climate finance, private engagement remains marginal compared to the global share of climate finance. Land-use investments are an underdeveloped investment opportunity. An estimated $300–400 billion in investment is needed yearly in order to provide protection to a wide range of ecosystems, but investors are facing a lack of investable projects that provide desirable risk-adjusted returns and conservation benefits (Lang, Rodinciuc, and Humphrey 2017, p. 23).

Private investors, and in particular, impact investors, could highly benefit from the likelihood of triple outcomes (as noted in chapters 1 and 2) in the animal protein sector, as compared to other sectors such as renewable energy low-carbon transport. However, considering both private and public flows, it seems that this comparative advantage is not used to promote climate finance toward the sector. Stressing this comparative advantage of adaptation and livelihood outcomes, refining existing project design with explicit mitigation pathways could spark interest in broader climate action within the livestock sector.

9 Appendix A contains the data and cases that informed this chapter.

Investments in land use, and more specifically investments in the livestock sector, are viewed by private investors as undervalued. The private sector is not yet interested in it as an investment opportunity, for the following reasons:

- The low profitability and high-risk profile perceived by investors;
- The difficulty and cost of measuring the economic impact of mitigation pathways;
- The low degree of technical knowledge about potential benefits associated with mitigation; and
- The context that total emissions of an investment case are likely to increase as a result of productivity gains.

Only a few livestock projects can advocate the triple-outcome nature of livestock interventions and their general bankability. Prior to attracting private sector interest, bilateral or multilateral donors, through ODA, need to take on risks and help develop and strengthen livestock value chains and develop such proof-of-concept projects.[10] Sectoral development[11]—through capacity building in the implementation and MRV of mitigation pathways; training; developing of marketing channels; extending health services; aggregating smallholders; scaling up financial services to smallholders, pastoralist communities, and other livestock-dependent livelihoods—is a necessary condition to further leverage (private) investment. Although a significant share of sectoral development can be undertaken and financed by private-sector actors, ODA and development actors are key to overcoming financial and market obstacles, building on their experience and presence as well as networks and capacities in local settings.

10 Interview conducted with Polly Ericksen of the ILRI on November 29, 2019.

11 Interview conducted with Fritz Schneider of the Global Agenda for Sustainable Livestock and Polly Ericksen of the ILRI on November 22, 2019 and November 29, 2019, respectively.

BOX 3.1 Addressing Obstacles to Investments in Mitigation Practices: The Innovative Model of Ecopec by Brazil Climate Lab

OBJECTIVE OF THE PROGRAM	TARGET BENEFICIARIES	FINANCIAL INSTRUMENTS	OBSTACLES ADDRESSED
Limiting deforestation caused by cattle ranchers in Brazil	Brazilian cattle ranchers	Equity or long-term loan combined with technical assistance	Lack of access to finance at reasonable rate, technical capacities and creation of a deforestation-free beef market

In 2017 the Brazil Climate Lab launched the pilot phase of Ecopec, an innovative financial mechanism intending to address deforestation caused by cattle ranchers in Brazil. The initiative aims to provide ranchers with the necessary financial and technical support to comply with the Brazil Forest Code.

A diagnostic phase identified four main concerns that need to be addressed simultaneously to ensure the success of such a program:

1. Ranchers have long-term financing needs, previously not met by financial products offered;
2. Ranchers do not have the collateral necessary for banks to offer them economically sustainable interest rates;
3. Ranchers often lack the technical capacities to implement intensification practices successfully; and
4. The beef processing market is highly concentrated, and ranchers lack the bargaining power to negotiate higher prices for deforestation-free beef.

To address these obstacles, the Brazil Climate Lab created The New Climate Smart Cattle Ranching Company ("The New Company") to provide ranchers with their long term needs to implement intensification practices successfully. The goal is to increase their land productivity, thereby reducing GHG emissions from degraded pastures and deforestation related to beef production.

The program works as follow:

Cattle ranchers willing to be part of the program go through a thorough screening to ensure they can undertake such investment. The New Company then surveys the land and assess, with the ranchers, the financial and technical needs and best strategy to comply with the Forest Code, while maximizing their future revenues. This action plan is detailed in a "Rural Partnership Agreement" between the New Company and the cattle rancher.

The New Company then delivers between 10 and 85 percent of upfront capital and necessary ongoing funding for 10 years, along with continuous technical assistance. Rather than land titles, traceable livestock serves as guarantees to secure loans, using the latest monitoring technology to trace animal ownership.

The New Company serves as an aggregator to negotiate better prices for inputs—such as feed and offtake agreements—with processing companies and retailers.

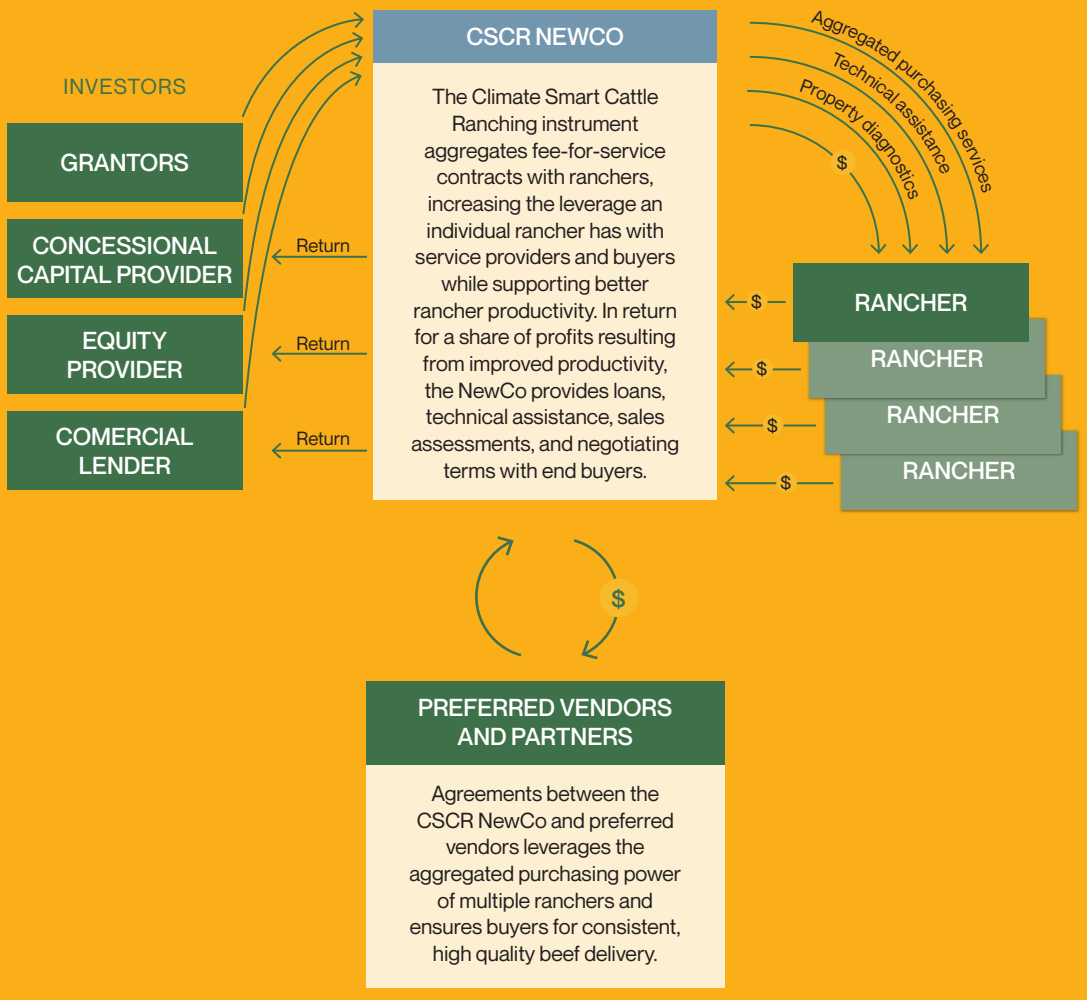
Over the ten years, the net profit is shared between the New Company and the rancher proportionally to the initial investment provided by each party. The New Company uses these dividends to pay the investors' part of the program.

The program uses several sources of funding. Grants from private foundations are dedicated to technical assistance and due diligence expenses. Concessional finance and first-loss capital serve to co-finance and guarantee the long-term pipeline of projects. Equity funds from impact investors, such as Naturvest, enable the New Company to negotiate input prices and conditions and develop a market for deforestation-free beef.

This financial instrument directly addresses the four concerns identified in the diagnostic phase. The Nature Conservancy implemented the program across 43 farms over 40,000 hectares. The results show that ranchers increased their productivity, became compliant with the Forest Code, and supplied better quality beef at better prices for meatpackers. Research demonstrates that over 100 ranchers in the region are willing to adopt sustainable practices in exchange for better access to credit.

Source: Brazil Climate Lab

FIGURE B3.1.1 Ecopec Mechanism



Targeting GHG emissions reductions in the livestock sector

The mapping of climate mitigation finance flows to the animal protein sector revealed five common finance approaches to tackle emissions reduction.

1. **Blended finance:**
   approaches that are mobilized by private sector investors, which includes some form of ODA or philanthropic investment. These are focused on sustainable intensification of cattle ranching, including silvopastoral systems and avoiding or mitigating deforestation, (Latin America model).
2. **Jurisdictional finance:**
   approaches for schemes that support sustainable sourcing of animal protein-related commodities.
3. **Self-financing:**
   approaches used by downstream actors that self-finance climate action within their value chains; these were most often inspired by business opportunities or by sustainability concerns.
4. **Livestock insurance:**
   approaches related to risk finance, such as index-based insurance, which decrease the vulnerability of livestock farmers from the negative impacts of climate change and increase long-term resilience.
5. **Carbon market:**
   finance for methane avoidance schemes financed by the carbon market.

Blended finance

The increasing number of blended finance structures—many of which are targeted as impact investments— (see Table 3.3) addressing sustainable intensification of cattle ranching in Latin America suggest that such structures can achieve economic viability (see Box 3.2). Climate-related ODA is an aspect of blended finance, though in this study, the focus is on the private sector as the main instigator, investor, or partner.[12]

Table 3.3 provides examples of private sector led blended climate finance projects. Most are in Brazil and are part of a dedicated climate fund. Mitigation pathways revolve(d) around avoiding deforestation practices, which often involve livestock systems. Such projects deliver both mitigation and adaptation outcomes, while also contributing to the improvement of communities' livelihoods.

12 Focusing on Latin America international public finance flows, this research found that the flows are substantial, with 20.3 percent of climate-related ODA within the livestock sector ($21.5 million in grants) allocated to silvopastoral systems in Colombia and another $4.4 million (in grants) to avoid deforestation from cattle ranching in Latin America (in Bolivia, Brazil, and Colombia).

TABLE 3.3 Private Sector Climate Finance toward Sustainable Intensification of Cattle Ranching in Latin America

Case	Description & Mitigation Pathways	Outcomes
Novo Campo Program, Brazil	Project under Althelia Climate Fund Avoided deforestation through sustainable intensification, grazing management	Mitigation: Avoided GHG emissions from deforestation, soil carbon sequestration from grazing management Adaptation: Ecosystem resilience due to intact ecosystems Livelihood: Increased rural incomes and productivity gains
INOCAS, Brazil	Project under Althelia Climate Fund Avoided deforestation due to offering alternative income sources, silvopastoral systems	Mitigation: Avoided GHG emissions from deforestation, carbon sequestration from trees in silvopastoral systems Adaptation: Ecosystem resilience due to enhanced micro-climate Livelihood: Increased rural incomes through income diversification
Satellite-based forest monitoring project, Nicaragua	Project under eco.business fund, local partner Lafise Bancentro Grazing management, avoided deforestation through sustainable intensification of livestock	Mitigation: Avoided GHG emissions from deforestation, soil carbon sequestration from grazing management Adaptation: Ecosystem resilience due to intact ecosystems Livelihood: Increased rural incomes and productivity gains
Climate Smart Cattle Ranching, Brazil	Project by Naturevest and the Nature Conservancy, endorsed by Climate Finance Lab Avoided deforestation due to sustainable intensification of livestock, silvopastoral systems	Mitigation: Avoided GHG emissions from deforestation, carbon sequestration from trees in silvopastoral systems Adaptation: Ecosystem resilience due to enhanced microclimate Livelihood: Increased rural incomes and productivity gains
Integrated Crop-Livestock-Forest Systems, Brazil (and Indonesia)	Project implemented by Rabobank, WWF Brazil, and UNEP Silvopastoral systems	Mitigation: Avoided GHG emissions from deforestation, carbon sequestration from trees in silvopastoral systems Adaptation: Ecosystem resilience due to enhanced microclimate Livelihood: Increased rural incomes and productivity gains

Note: Links to the programs are available in Appendix Table A.3.1 An Inventory of Private Climate Flows. GHG = greenhouse gas; INOCAS = Innovative Oil and Carbon Solutions; UNEP = United Nations Environment Programme; WWF = World Wildlife Fund.

The Livelihood Funds project in Kenya provides another example of a private sector led blended funding approach. The impact investment fund pools equity investment from private sector companies to provide upfront finance for project developers (such as NGOs or socially responsible companies) to build more resilient rural communities and ecosystems. The return on investment is achieved through carbon credits, grants from the government resulting from successful preservation of the watershed, and the fee that the partner dairy company pays for the increase in milk quality and quantity. The project is summarized in Figure 3.1.

FIGURE 3.1 Stakeholders within the Kenyan Livelihoods Funds Project

Source: Based on Livelihoods Funds 2016, https://www.livelihoods.eu/l3f/.

Jurisdictional finance

Jurisdictional programs are developed at the local level. They are blended finance approaches focusing on sustainability initiatives that bring together key stakeholders (public, private, civil society) to align their commitments and jointly realize sustainability objectives within the same jurisdiction. This approach emerged from the realization that public-private partnerships are required to scale positive results for responsible production and conservation.

For local governments, jurisdictional approaches entail the prospect of sustainable and low-carbon development for their region, along with increased investments, revenues, and economic activity. Globally, the socio-environmental impact achieved will be recognized by putting jurisdictions on the radar of international stakeholders. Actors throughout the value chain benefit from jurisdictional programs. Producers can obtain better market conditions as a result of the commitment from downstream actors, and potentially they can receive additional technical assistance and access to finance. Traders compliant with evolving environmental expectations of buyers and consumers can maintain good relations with both, as well as with the local authorities. Finally, as retail and wholesale actors are most proximate to the consumer, they are motivated to communicate sustainability efforts as marketing tools. For brands, therefore, jurisdictional programs also have marketing value.

Table 3.4 provides an overview of existing jurisdictional initiatives with programs related to the animal protein sector. To date, the focus has been on reducing deforestation and forest degradation, which are important in the context of feed production. Other mitigation pathways deserve consideration, however, particularly those regarding grazing systems and animal rearing, which, could be included alongside deforestation projects. Adjusting objectives moderately to include other aspects of the livestock sector mitigation targets would illuminate an array of mitigation pathways that can be applied in combination with deforestation initiatives.

BOX 3.2 Blended Finance in Practice: The Success of the Eco.Business Fund Structure

OBJECTIVE OF THE PROGRAM	TARGET BENEFICIARIES	FINANCIAL INSTRUMENTS	OBSTACLES ADDRESSED
Addressing conservation of natural resources in agriculture value chains	Producers or value-chain aggregators	Dedicated funds using blended-finance de-risking mechanisms and technical assistance	Obstacles addressed: Investors' risk perception, technological obstacles, value-chain integration

Eco.Business Fund created an innovative financial structure to address climate issues, such as deforestation, along with co-benefits, such as job creation. The Fund promotes sustainable practices to tackle biodiversity losses and conservation of natural resources by adopting better practices in Latin America, the Caribbean, and Sub-Saharan Africa. The Fund focuses on agriculture and agri-processing, fisheries and aquaculture, forestry, and tourism.

Eco.business fund adapted blended finance mechanisms through the use of two facilities: eco.business Fund and eco.business Development Facility. The Fund finances activities either by directly supporting the development of sustainable businesses or by using value-chain intermediaries. Intermediaries can be either financial institutions committed to providing green finance to a pool of businesses or actors seeking to increase a value chain's sustainability. An example of a value-chain intermediary would be a commodity buyer whose goal would be to improve the upstream supply-chain's sustainability by providing financial capacities to partner producers to improve their practices. Eco.business Development Facility will complement the Fund by offering technical assistance to the Fund beneficiaries, allowing for a first layer of de-risking of the Fund's investments. The second layer of de-risking consists of contributions invested in the Fund by public investors and donors that will serve as the first loss mechanism to protect private institutional investors' capital.

To address deforestation induced by cattle ranching in Nicaragua and Panama, the eco.business Development Facility provided support to financial institutions to adopt new technologies such as drones and satellite imagery to monitor forest protections and assess environmental risks during financial decision processes. In 2019, this program enabled financial institutions in Nicaragua and Panama to collect information from 175 ranches. With the information gathered, ranchers received adapted training to avoid forest losses and implement sustainable practices to preserve existing ecosystems and reforest depleted areas.

Since 2014, the eco.business Fund has contributed to developing 271,000 hectares of farmland under sustainable management and provided support to 380,000 jobs.

FIGURE B3.2.1 Eco.business Fund Blended Finance Mechanism. Source: eco.business Fund (URL: eco-business.fund)

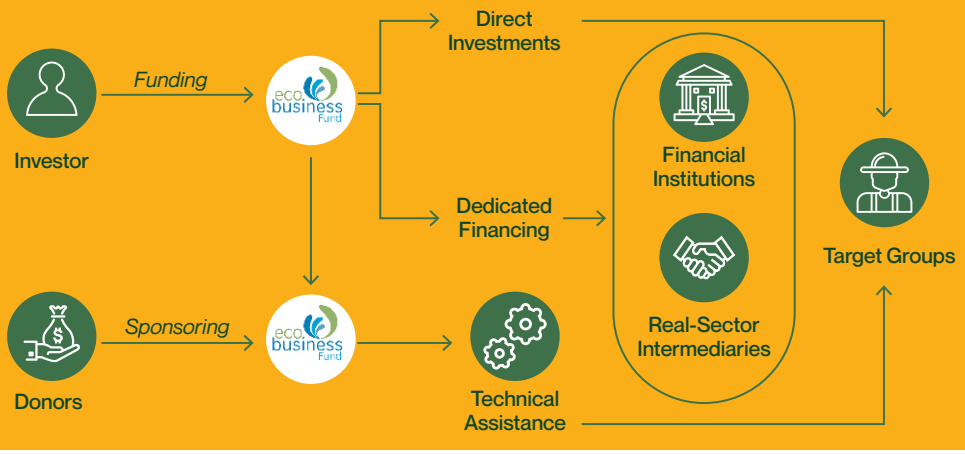


TABLE 3.4 Existing Jurisdictional Initiatives

Initiative	Description	Pilots/Jurisdictions
IFSL	• BioCarbon Fund's Initiative for Sustainable Forest Landscapes (https://www.biocarbonfund-isfl.org/) • Multilateral fund supported by governments and managed by the World Bank	• Colombia, Orinoquía region • Ethiopia, Oromia Region • Indonesia, Jambi Province • Mexico, State of Nuevo León
Verified Sourcing Areas (VSA)	• Initiated by IDH (https://www.idhsustainabletrade.com/landscapes/verified-sourcing-areas/) in 2018 • Providing a platform for committed buyers to connect to coalitions of stakeholders in sourcing areas (facilitates information & communication) • Coalitions consist of farmers, producers, government and civil society who have jointly agreed on a compact • Committed buyers can support compacts, monitor progress, and deliver on their sustainability commitments • Next steps are development of VSA business case and guidance material, Setting up MRV system and VSA platform	• Brazil, Mato Grosso
Landscape Finance Lab	• Initiated in 2016 by the WWF (https://www.landscapefinancelab.org/) • Incubator for sustainable landscapes programs • Build learning, capacity. and impact measurement via an online platform • Four-step incubation process: Discover (ideas for commercial potential, impact at scale, governance, and support structure); Structure (team, partners, technical resources, and sourcing funds business case and concept note); Develop (full-fledged proposal); Fund (coaching for investor and donor cases)	• Georgia, Adjara mountains • Paraguay, Upper Parana Atlantic Forests

Note: IDH = The Sustainable Trade Initiative; IFSL = Initiative for Sustainable Forest Landscapes; VSA = Verified Sourcing Area; WWF = World Wildlife Fund.

The initiatives highlighted in Table 3.4 each focus on different enablers. The Landscape Finance Lab places strong emphasis on the investment and financing aspect of program development. The VSA model aims to provide a platform for effective communication and facilitates stakeholder engagement. The Initiative for Sustainable Forest Landscapes (IFSL) model seeks to combine the landscape approach with paying for results, including an improvement of the carbon balance alongside non-carbon benefits.

Self-finance

Motivation may be a significant factor for instigating private sector self-finance of downstream actors in the value chain. As the entire animal protein sector is increasingly scrutinized as unsustainable, the role of value chain actors—from slaughterhouses, dairy processors, etc., all the way downstream to retailers—has become more visible. Thus, although in the minority, some value-chain actors are starting to realize the importance of sustainable business operations. By initiating projects, value-chain actors strive to become part of the solution instead of being part of the problem (see Box 3.3).

Several examples of self-finance approaches stand out. Global producers, distributors, and food franchises are motivated to encourage sustainability while providing funds for mitigation projects. The Brazilian processing company, Marfrig, installed a Sustainable Transition Bond of $500 million the objective of which is to stop all deforestation caused by its suppliers in the Amazon region (Freitas, 2019). While it is not a common financing instrument in the livestock sector, Marfrig shows how this kind of financing can be profitable for private sector actors, thus incentivizing other actors to issue future transition bonds.

Walmart is another example of a company that has launched an initiative to help eradicate deforestation. It developed a Beef Monitoring System in Brazil, which tracks the origin of the meat to ensure that suppliers are not involved in illegal deforestation from activities along their value chains (Walmart 2018). As one of the largest, if not the largest beef-purchasing company in the world, McDonalds has also entered the realm of climate self-finance. It developed partnerships with the Brazil chapter of a global NGO, Proforest, and a Brazilian agribusiness company, Agrotool, to improve the tracking of beef suppliers and their impact on deforestation (McDonald's, n.d.). Their goal is to eliminate deforestation from their supply chains.

As an alternative to land-based mitigation pathways, companies also invest in mitigation opportunities related to animal health and nutrition. DSM, a global science company in the nutrition, health, and sustainable living sphere, actively directs its own finance toward livestock R&D. It has spent ten years developing the feed additive, Bovaer®, which "reduces enteric methane emission in ruminants by approximately 30%" (DSM Website undated). Along with lowering emissions, it has the potential to incentivize sourcing as it will contribute to the emissions reduction targets of companies that may source from farms that utilize the product.[13] The international fertilizer producer Yara International presents another example of providing value chain finance and advice to potential clients of their products.[14]

13 Interview conducted with Mark van Nieuwland and Carlos Saviani of DSM, January 7, 2020.

14 Interview conducted with Bernhard Stormyr and Kevin Cunningham of Yara International, January 16, 2020.

BOX 3.3 Value-Chain Finance in Practice: The Cocoa and Forests Initiative

OBJECTIVE OF THE PROGRAM	TARGET BENEFICIARIES	FINANCIAL INSTRUMENTS	OBSTACLES ADDRESSED
End deforestation due to cocoa production in Ghana and Côte d'Ivoire.	The whole cocoa value chain	Payments for environmental services, technical assistance	Supply-chain integration, finance dedicated to smallholder farmers, policy framework

The Cocoa and Forests Initiative, introduced by the cocoa industry in Ghana and Côte d'Ivoire is a successful example of stakeholder engagement along the value chain to halt deforestation, providing relevant insights for the animal protein sector. In 2017, the governments of Ghana and Côte d'Ivoire signed an agreement with the world's major cocoa and chocolate companies to halt deforestation and support restoration and protection of forest within the cocoa value chain. The World Cocoa Foundation, the Sustainable Trade Initiative, and the Prince of Wales's International Sustainability Unit partnered with the governments of Ghana and Côte d'Ivoire to form this public-private partnership.

The initiative is committed to achieving several major goals:

- Protection of existing forests and restoration of degraded forests;
- Promote sustainable cocoa production and improve farmers' livelihoods; and
- Community engagement and social inclusion, focusing on women and youth.

The partner companies delivered their initial implementation plan in 2019 providing details on how the private sector will commit to the agreement signed in 2017. Each company provided an action plan until 2022 based on their role in the value-chain, their priorities, and their sustainability goals.

To achieve these goals, the program focused on four components:

- Driving alignment of the stakeholders;
- Integrating smallholder supports;
- Mobilizing finance; and
- Enhancing an enabling environment.

The programs aligned the interests of governments, large corporations, and smallholder producers. Innovative financial mechanisms ensured that financial burdens for implementation were not placed on producers and farmers. A payment for environmental services (PES) program was developed in partnership with the national Côte d'Ivoire REDD+ program through which farmers receive incentive payments to protect and reforest degraded areas. After one year, 1,340 farmers had signed on to be part of PES program. The design of an integrated support package for smallholder producers ensured that they were receiving the necessary technical and financial assistance to adopt climate-smart practices. The project used blended finance to lower the risks and attract private investors. It also developed a strong monitoring system using satellite imagery and strengthened the governance of forests.

The initiative aims to stop cocoa-related deforestation by 2022. As of 2020, the initiative has trained 1 million farmers in good agriculture practices, mapped 1 million farms and dedicating new technologies to the monitoring of forests, and distributed 4 multi-purpose trees to farmers to promote agroforestry.

Livestock insurance-based finance

Index-based insurance or indexed weather-based insurance, a relative newcomer in the climate finance world, is an important instrument for immediate disaster risk reduction and for reducing farmers' vulnerability to climatic events, building long-term resilience. It also has the potential to incorporate remunerations or premiums for mitigation pathways. Participating farmers who perceive the benefits from an insurance scheme might be willing to engage in activities linked to mitigation outcomes if incentivized accordingly.

Index-based insurance was identified by several interviewees as a promising way to contribute to solving climate change problems, if combined with mitigation conditionalities.[15] Some experts stated that index-based insurance is an innovative way of incentivizing behavior change, by linking it to mitigation pathways. Farmers can become part of the scheme only if they promise to engage in more sustainable rangeland management.

The most common form of index-based insurance is crop or agriculture based rather than livestock based, but it can act as an indicator of expansion possibilities. Latin America has many crop insurance schemes, but little or no Index-Based Livestock Insurance (IBLI) offerings. An IBLI has been piloted in Mongolia, however. The Kashf Foundation in Pakistan provides loans for animal insurance for livestock theft or death due to illness. In general, any region that is particularly vulnerable to increased risk of climate disaster (for example, flood, drought, disease) has the potential to adopt an IBLI.

In the early 2000s, frequent patterns of extreme weather in Mongolia caused concern from herders who were subject to major losses in their livestock. With World Bank support, the Government of Mongolia initiated a project in 2006 to provide IBLI to Mongolian herders, who make up 33 percent of the country's workforce. Five insurance companies participated, and in 2008, $340,000 was paid out to herders from which only a small portion came from the government (CDKN 2013). Since 2012, IBLI has been readily available across the country (Bertram-Huemmer and Kraehnert 2017). Lessons from the project highlight that success depends on the need for high-quality data, education, and training. In addition, keeping insurance affordable is vital to the long-term viability of any potential IBLI program to ensure that it is affordable for smallholders.

The availability of IBLI in Africa is rather low, with the most stable access in Kenya and Ethiopia. Most other countries with IBLI have pilot programs or programs based on grants.

Currently, all IBLI uses satellite imagery to measure vegetation density and level of pasture to analyze the deviation in forage availability from a given baseline in a given region. The common index used for this is the Normalized Differenced Vegetation Index (NDVI), which can predict livestock mortality rates. When the NDVI drops below a particular threshold, then policyholders will be given a pay-out. The International Livestock Research Institute (ILRI), as a leading research organization, has spearheaded and acted as a support for numerous private and public institutions in implementing index-based payment schemes in Kenya and Ethiopia.

Carbon market

Carbon markets and carbon taxes remain the only global mechanisms that attempt to valuate climate mitigation action. However, prices in compliance markets are too low to effectively trigger lower carbon balances. Countries

15 Interviews conducted with Vikas Choudhary at the World Bank Agriculture Global Practice on November 25, 2019, and Polly Ericksen of the International Livestock Research Institute (ILRI) on November 29, 2019.

would need to set a carbon price of \$40–\$80/t CO_2e in 2020, then \$50–\$100/t CO_2e in 2030 to be effective (High-Level Commission on Carbon Prices 2017).

In 2018, the 1,568 transactions recorded in the carbon market totaled only 90.7 $MtCO_2e$. Most credits have been generated within forestry and land use (50.7 $MtCO_2e$ for, on average, \$3.2 per ton) as well as renewable energy (23.8 $MtCO_2e$ for, on average, \$1.7 per ton), both relevant to the animal protein sector (Donofrio et al., 2019).

The mapping of carbon market activities revealed a general absence of project types other than manure management. Methane recovery from animal manure has proven to be a popular project type because it has cost-efficient MRV methodologies. One factor that favors methane recovery over other project types is that methane has a higher global warming potential than carbon dioxide, resulting in a higher number of credits. The most frequently seen projects are methane capture from manure, as these projects represent an incremental investment onto an already existing system. Bioenergy projects that require high investment in technology have little to no uptake under the CDM or other mechanisms despite the potential of carbon credits to close financing gaps.

Manure management is a relevant mitigation pathway for GHG mitigation and circular economy. The production of manure-based biogas is a way to turn livestock emissions into solutions for other industries—such as production of fertilizer, generation of electricity, and provision of fuel for cooling or cooking.

The Kenya Biogas Program registered under the Gold Standard provides domestic biodigesters for livestock-holding households to reduce dependence on stoves with heavy smoke and pollution from firewood. The slurry from the biodigester can be used as organic fertilizer in crops, potentially increasing rural incomes. To combat the cost of biogas technology, there are credit partnerships set up with financial institutions to aid families in the purchase of the biodigesters. The program has resulted in a 333,500 $MtCO_2e$ reduction. The cost per offset in the program is \$19 with all possible offsets already sold out, indicating a functioning transfer of funds to the project level. Yet, measurable adaptation benefits of the program have not been evaluated as the project income generated from selling carbon offset credits is said to benefit users in the form of training, after-sales support, and other useful services.

BOX 3.4 Incorporating Carbon Credits in Livestock Investment Programs in Practice: The Case of Livelihoods Mount Elgon Project in Kenya

OBJECTIVE OF THE PROGRAM	TARGET BENEFICIARIES	FINANCIAL INSTRUMENTS	OBSTACLES ADDRESSED
Decreasing the GHG intensity of dairy production in the Mount Elgon region in Kenya	Smallholder dairy producers	Value-chain finance, carbon credits, and technical assistance	Cost efficient MRV methodology, technical obstacles, creating an enabling environment

Unsustainable land-use and agriculture practices have contributed to the loss of biodiversity and soil erosion in the Mount Elgon region and the watershed of Lake Victoria in Kenya. These practices affect farmers' revenues as crop yield and milk production per animal are low, and farmers do not have viable connections to markets.

In 2016 Livelihoods Funds, in partnership with Vi Agroforestry and Brookside Africa, initiated a 10-year project that aims to implement sustainable agriculture practices in the Mount Elgon region to preserve the watershed and avoid soil erosion, improve production and livelihoods, and sequester 1 million tons of CO_2 throughout the project.

As a multi-pronged project with several related components delivered to 30,000 smallholder dairy farmers the objectives are many, with aims to:

- Increase milk production per animal from 3 to 6-9 liters per day;
- Implement fodder production in dairy farms to improve the access and quality of feed year-round,
- Enhance breeding through high-quality artificial insemination;
- Stabilize farmers' incomes with a guaranteed buyer (Brookside Dairy for the whole milk production for ten years).

Notably, these livelihood objectives are implemented alongside climate mitigation objectives, including nutrient management such as mulching and composting, soil, and water conservation such as retention ditches; agronomic practices such as crop rotation and intercropping; and agroforestry by growing trees alongside crops and livestock.

To achieve these objectives, the project uses an innovative finance mechanism. Livelihood funds is specialized in large-scale investments in Africa, Asia, and Latin America, where it partners with local public institutions and NGOs to reduce its risks and ensure programs are adapted to beneficiaries. The fund provides upfront payment to implementing partners and, in exchange, receives high quality certified carbon credits when the environmental results are met. Twelve large companies are investing in the fund (Danone, Schneider Electric, Crédit Agricole S.A., Michelin, Hermès, SAP, Groupe Caisse des Dépôts, La Poste, Firmenich, Voyageurs du Monde, Mars Inc., and Veolia). Through investment in the fund operations, they can offset their activities using carbon credit mechanisms.

In Mount Elgon's case, Livelihood provides the upfront capital for the project's implementation and operations. Brookside will co-invest and commit to buy the whole milk production for ten years. Vi Agroforestry is in charge of the implementation and monitoring of the project.

Carbon sequestration is tracked through the increase in cow efficiency and crop productivity due to the adoption of Sustainable Agricultural Land Management practices. Farmers themselves fill in a simple farm activity monitoring form every season. This data is then computed by Vi Agroforestry and Unique Land Use and Forestry. The quantity of carbon sequestrated is used as an indicator of the results delivered by the project. This first of its kind carbon measurement, approved by the Gold Standard, has been specially designed for the Livelihoods Mount Elgon project.

The project provides additional co-benefits to the dairy farmers. The project aims to strengthen existing cooperatives and empower women by giving them an active decision-making role in the dairy value chain. Through Brookside's involvement, the project creates long-term connections of smallholder farmers to the dairy market.

Unlabeled climate finance

The mapping of private climate finance flows revealed that although some investments and grants from both private investors and ODA have a direct impact on GHG emissions, these results are often not measured. This happens for two reasons: monitoring other outcomes such as poverty alleviation or food security is more straightforward and does not require complicated methodology; and tracking the effects of a project in emission reduction is costly and requires additional funding, or it could undermine the profitability of the project. As a result, some projects will not be labelled as climate-related investments, although they clearly have a direct impact on emission reductions.

However, these projects could be an interesting point of entry for climate finance to have an impact on the animal protein sector. For example, the outcomes of many companies' CSR investments have had indirect climate benefits suggesting untapped potential for climate investments.

Some of the largest beef and dairy companies self-finance a wide range of business practices, dealing with sustainability and yet not explicitly presenting activities as climate related. However, they could get involved in financing mitigation pathways.

For example, New Hope Liuhe Co. Ltd., a Chinese company among the top ten feed producers in the world, targets poverty reduction through its CSR strategy. The company provides animal feed to smallholder farmers, coupled with training toward increasing the efficiency of the production. These activities can have an impact on the emission intensity of the livestock, but so far only outcomes related to poverty alleviation are considered. Additionally, Nestlé promotes sustainable rural production of dairy by purchasing at the local level. The company also provides training to promote better understanding of the transport and infrastructure networks. With support from Nestlé, a processing factory in Moga, India has grown its production from 2,000 to 300,000 tons of milk and has introduced tree planting programs. Other than income support for smallholders, this initiative is able to mitigate GHG emissions indirectly through carbon capture in tree planting and a more rational transport of production.

The mapping of the climate finance flows in the animal protein sector showed that impact investing is the second key investor for which environmental outcome are not systematically measured.

Impact investment asset managers are crucial private actors in the livestock climate finance architecture because they can take on the higher risks in livestock ventures and can identify and access smaller-scale projects compared to other private actors.[16] The mapping of private finance flows further revealed that investment in agriculture and forestry are strongly related sectors with a similar risk profile to livestock. Out of the 74 impact investment funds listed

16 Interview conducted with Zoe Knight of the World Economic Forum and the HSBC Centre of Sustainable Finance on December 17, 2019.

under ImpactAssets50, 18 are labeled "agriculture" and 14 labeled "natural resources"[17]— mobilizing actors who already operate within agriculture or rural micro finance can expand their portfolios toward sustainable livestock.

Table 3.5 contains some examples of impact investment in ruminant production systems, at small and medium scales in Sub-Saharan Africa. The mitigation component for these cases is not explicitly communicated. All investors reportedly sought a wider sustainable development objective. These examples highlight the feasibility of such production systems as investment opportunities. Most of the listed investments include technical assistance, opening the opportunity to include mitigation pathways related to animal husbandry.

TABLE 3.5 Private Investments toward Ruminant Value Chains

Funding Source	Recipient	Description	Location and Value Chain
Bill and Melinda Gates Foundation (philanthropy)	SAHEL Consulting Agriculture & Nutrition Ltd. (private equity firm)	$14,999,972 grant to enhance the productivity of smallholder dairy farmers, particularly amplifying the economic empowerment of women and improving nutrition, by helping to strengthen public-private partnerships	Smallholder dairy farming in Nigeria
Rabo Foundation and Achmea (philanthropy)	Mruazi Heifer Breeding Unit Fostering (value chain company)	The breeding unit aims to increase per animal productivity the dairy sector in Tanga region by producing heifers. Mruazi has the ambition of developing its farm into a regional center for fodder production, training, and innovation	Smallholder dairy breeding and farming in Tanzania
UFF African Agri Investments (blended finance)	Eastern Cape Boerbok	Establishment of two irrigation farms to be used as pasture lands and four farms for sheep, cattle, angora, and, in particular, boerbok goats. This investment will create a large livestock enterprise in the area based on superior animal genetics, sustainable feed production, an inclusive management strategy, and optimal resource usage	Sheep, cattle, angora production in South Africa
SilverStreet Capital (impact investor)	Cattle Ranching	502 hectares of pivot irrigation for pastures and silage production, a feedlot serving 6,000 cattle per annum, and has completed planting 70 hectares of pecans, which is set to increase in the coming years. To raise productivity and income in the area, Silverlands Ranching established an extension service and built several cattle dipping stations in the community area. Providing access to dips has reduced calve mortality and cattle disease and increased smallholder cattle farmers' incomes	Cattle ranching in Zambia

17 Five impact investments funds are labeled as both sustainable agriculture and natural resources.

Projects related to poultry value chains have also been identified (the complete list is available within Appendix A.3), whereby mitigation pathways are linked to local sourcing of feed and the replacement of emission-intensive proteins in diets. Some PPPs at the most local level did not include a mitigation component because they prioritized the most urgent needs of local population such as food security, poverty alleviation, health improvement, and livelihoods creation in poor communities. The inclusion of a mitigation component in PPPs is dependent on "marketability". Furthermore, the costs associated with MRV, leveraging further private flows, level of private sector engagement, size, transaction costs, real and perceived risks, and perception of profitability from climate mitigation affect considerations.

Microfinance institutions investing in real assets—such as ownership of farmland, forest, cattle, and others—could be a relevant vehicle for climate finance toward animal protein value chains. Initiatives such as KIVA, Livestock Wealth, SV Capital, and other crowdsourcing initiatives,[18] allow investors to buy shares or ownership of cattle, providing local smallholders with an alternative source of income and an incentive to adopt sustainable farm practices to increase the quality, health, and environmental impact of the cattle. Investor networks have a huge potential to scale up sustainable opportunities in livestock[19] through networking with various investors. Other approaches to scale up sustainable livestock initiatives include co-investing and creating new private equity funds. ImpactAssets is an investor network that provides data on other impact investors and other private actors. It is also an impact investment fund manager, offering different short- and long-term investment vehicles, focusing on local communities and other actors undertaking grazing management interventions.

The role of livestock GHG emission reduction in the carbon markets

Carbon markets remain the only global mechanism—be it voluntary or compliance-based—that attempts to valuate climate mitigation action. Despite unclear policy signals and related low carbon prices, projects and methodologies are still being developed, some of which are related to the animal protein sector.

There is a general heterogeneity of opinions due to policy uncertainty and limited scope in the agriculture, forestry, and other land use (AFOLU) arena. Expectations on the role of carbon markets vary as a result of different experiences. Some project developers had negative experiences with the CDM, leading to a decline in future interest. Such experiences were often connected to high transaction costs inherent to methodology/project development or MRV.

Most livestock projects in the carbon market are limited to manure management (see section 3.2.2). Opportunities for crediting schemes are limited and

18 Crowdfarming combines crowdfunding or sourcing and farming, as it denotes a model where a number of investors share risks and own shares in a farming venture or in real assets such as livestock.

19 Interview conducted with Ruaraidh Petre of the Global Roundtable for Sustainable Beef on November 28, 2019.

thus unable to spark inspiration, while project descriptions are vague and seldom show mitigation pathways. For the private sector to comprehend the nature of triple outcomes and replicate successful strategies, project developers need to state explicitly how outcomes can be achieved. The unconcise description of mitigation pathways in the OECD Development Assistance Committee reporting and other communication platforms hinders the replication of successful models and discourages research in publicly available databases.

The majority of CDM projects fall under the UNFCCC methodology *AMS-III.D Methane recovery in animal manure management systems*,[20] which currently has around 130 registered projects. There are other methodologies related to livestock, but they contain few or no registered projects. *UNFCCC's AMS-III.BK: Strategic feed supplementation in the smallholder dairy sector to increase productivity methodology,*[21] completed in 2014 had only one project, due to the price crash of certified emission reduction (CER) that occurred around the same time. In developing this methodology, a primary concern that surfaced was the lack of bankability for projects and high investment costs. The Dairy Feed Uganda Project, which started in 1999 and went through several iterations before reaching CDM, had upfront costs of around $2 million associated with feasibility studies, feeding trials, and methodology development. After the project was ready to generate credits in 2014, the price of CERs was roughly €0.35 (down from €20 in 2008). With such high initial costs and even with a €30,000 credit a year potential, the economic viability of the project was extremely low, hence it was never implemented.[22]

Project types in the CDM and Gold Standard vary although replicability is possible through available methodologies. There is a huge offset potential for feed supplements, but the investment financing for these types of projects can be difficult to justify in a carbon market that has low and unsteady prices.[23] However, there is evidence that the highest uptake for the CDM, the VCS, and the JI is in manure management due to high credit potential at low initial cost. A swine manure system project in Brazil had an initial investment of $672,000 with 78,000 expected CERs/year, while a biogas project in Armenia from poultry manure treatment had an initial investment of $2,530,000 and expected 62,800 CERs/year (OECD 2007). This latter example shows a key setback in carbon markets for financing livestock projects because there are numerous mitigation pathways that could result in tangible emission reductions but are unable to operate under the carbon market as the carbon price is too low. The absence of nearly all mitigation pathways in carbon crediting outside of manure management is a key observation as it highlights a gap in funding flows.

20 A methodology defines the parameters and operations required for calculating the mitigation outcome of a project during its lifetime—that is, methodologies for baseline setting and monitoring. For this methodology, see https://cdm.unfccc.int/methodologies/DB/H9DVSB24O7GEZQYLYNWUX23YS6G4RC,

21 For the AMS-III.BK methodology, see https://cdm.unfccc.int/methodologies/DB/XI8MS5YYSGRSISWLADHND28QPJN6YA.

22 Interview with Richard Bowman of RuMeth International Ltd. on November 29, 2019.

23 Interview with Richard Bowman of RuMeth International Ltd. on November 29, 2019.

One of the central conclusions of this study is the need to have additional funding and mechanisms in place that can assure investors of the bankability of projects. Filling the void of potential projects that require technological investments can be one way in which to see uptake in carbon markets.

Another recent mitigation pathway in the carbon market is soil carbon sequestration through sustainable grazing systems (see example in Box 3.5). The Australian Carbon Farming Initiative, part of the Australian Emission Reductions Fund, developed a methodology to generate first credits. The French National Research Institute for Agriculture, Food and Environment (INRAE) developed a whole-of-farm approach for the French Label Bas Carbone (Low Carbon Certification). Soil carbon sequestration has already entered the methodology for sustainable agriculture land management (SALM) under the VCS.

Although carbon markets are vital to the promotion of climate finance, their future post-2020 is uncertain due to pending decisions on Article 6 of the Paris Agreement. Article 6 includes three mechanisms for voluntary cooperation; two of these are market-based. Article 6.2 allows for bilateral and plurilateral cooperation among countries, and Article 6.4 establishes a Sustainable Development Mechanism, perceived to be the successor of the CDM. Discussions on operationalization of markets at COP25 (the 25th Conference of the Parties to the UNFCCC) in 2019 remained inconclusive due to differences between countries on issues such as adjusting transfer of mitigation outcomes and whether CDM credits should be eligible for transfer. While proponents see opportunities for new and innovative forms of voluntary cooperation and in the flexibility of Article 6.2, some critics express concern that Article 6 may hinder increased ambition. Regardless, a high carbon price achieved through ambitious environmental regulation is a basic requirement in making carbon markets a viable proposition for the sector.

Potential climate finance options in the animal protein sector

As discussed previously (See section 3.2.2), the review of climate finance flows and existing initiatives in the animal protein sector identified several approaches for financing adaption and mitigation schemes. The scope for innovative financing approaches, whether supplemental to initial schemes or standalone endeavors, is evidenced by the creativity already apparent. Similarly, the diversity among the adaption and mitigation initiatives highlighted herein, speak to the many possibilities for intervention along the animal protein value chain. Solving the financial preference conundrum of investors—mitigation/adaptation pathway, scale of intervention, position of the recipient and target beneficiary on the value chain, preferred delivery model, etc.—may solve the conundrum of what financial approach is possible, or even be the most advantageous. For example, jurisdictional finance approaches have gained

BOX 3.5 Carbon Markets in Practice: Microsoft $500,000 Carbon Credits Purchase from Australian Cattle Rancher

OBJECTIVE OF THE PROGRAM	TARGET BENEFICIARIES	FINANCIAL INSTRUMENTS	OBSTACLES ADDRESSED
Sequestration of soil organic carbon using regenerative grazing systems for grass-fed beef production	Wilmot Cattle Company, Australia	Carbon credits	Adapting carbon credits to the livestock sector, MRV methodology.

From 2017 to 2020, the Wilmott Cattle Co. sequestered more than 40,000 metric tons of CO_2 equivalent through managed grazing practices. The company was able to sell these carbon credits to Microsoft for more than $500,000.

Wilmot Cattle Company, in New South Wales, Australia, with the adjoining ranch, Woodburn, manage over 4,000 hectares combining breeding, trading, and grazing operations applying regenerative, ecologically sustainable management practices.

The company's approach for carbon soil sequestration includes time-controlled rotational grazing and high-rate stocking in smaller lots. These practices improve the ground cover, the volumes of biomass, and the ground water-holding capacity. Moreover, they have made it more resilient, as the land's organic carbon rates increased from 2.5 percent in 2017, to 4.5 percent in 2021, with intent to reach 6 percent by 2023.

The carbon credits were verified by Regen Network and are the first transaction of its "CarbonPlus" scheme. Besides carbon sequestration, such carbon credits also comply with other environmental co-benefit objectives such as animal welfare, and ecosystem and soil health. Regen Network significantly reduced the costs related to MRV by using remote sensing to measure and monitor the soil organic carbon, a pioneer technological achievement in the field of grassland MRV methodology.

This purchase was part of Microsoft's objective to reduce its carbon footprint with goals to be carbon negative by 2030, after which the company aims to eliminate carbon emitted since it was created in 1975 by 2050.

Carbon credit schemes, such as this, offer an actual payment for environmental services to cattle ranchers willing to improve their practices through nature-based solutions and leverage other sectors' ecological commitment.

Source: Wilmott Cattle Company via Beef Central

recent popularity, especially for the commodities soy and beef. Replication of approaches to other commodities or value chain actors may be one way to advance the agenda.

Whether it is energy, transport, livestock, or any other agribusiness sector, over 70 percent of climate finance provided or enabled by multilateral development banks (MDBs) in 2018 was in the form of investment loans. Over the years, new instruments have been scaled up; these include bonds, guarantees, lines of credit, and results-based financing. However, all these instruments individually represent less than six percent of climate finance provided or enabled by MDBs in 2018. The implication is that traditional loans will remains a core instrument in the short term. Despite this reality, there are possibilities for financing alongside traditional loans or stand-alone financial approaches. Table 3.6 groups these according to the mapping results.

TABLE 3.6 Emerging Approaches from the Mapping of Climate Finance

Emerging Approach	Funding Source/Flow	Recipient	Mitigation Pathway
1. Concessional or blended finance for sustainable cattle ranching in Latin America	• ODA grants • MDBs • Impact investment vehicles; two-layered approach: A first layer of an initial base/ risk cushion of public investors and donors and a second layer/ financial cloud of private institutional investors	• Local project level farms and communities • Financial intermediaries with rural outreach	• Avoided deforestation through sustainable intensification and grazing management • Silvopastoral systems and avoided deforestation through alternative income sources
2. Value-chain actors self-financing action to reduce deforestation	• Corporations • Own finance, FDI	• Upstream value chain actors, including producers	• Avoided deforestation through sustainable intensification and grazing management
3. In supply chain credit provision tied to capacity building with the case of feed additive and fertilizer producers marketing their products	• Corporations • Own finance, FDI	• Local producers that purchase products and services	• Animal health & nutrition/ feed additives • Grazing management
4. Livestock insurance programs to reduce vulnerability and increase long-term resilience	• Insurance scheme financed by governments budgets, international public finance, insurance fees	• Insurance companies as financial intermediaries	• Animal health & nutrition/ feed additives • Grazing management • Silvopastoral systems
5. Emission reduction projects in emerging economies financed by carbon crediting	• Carbon market • Supplementary funding sources possible, for example, own finance or project finance	• Project owners potentially through financial intermediaries	• Manure management
6. Climate mainstreaming conditionalities into financing of production systems	• Private impact investors	• Local project level farms and communities • Financial service providers for rural producers (MFIs)	• Animal health & nutrition/ feed additives • Grazing management • Silvopastoral systems

Note: FDI = foreign direct investment; MDBs = multilateral development banks; MFIs = microfinance institutions; ODA = official development assistance.

BOX 3.6 The Republic of Kazakhstan Program for Sustainable Livestock Development

OBJECTIVE OF THE PROGRAM	TARGET BENEFICIARIES	FINANCIAL INSTRUMENTS	OBSTACLES ADDRESSED
Development of an environmentally sustainable, inclusive, and competitive beef production in Kazakhstan.	Beef sector	Program for Results	High costs of servicing spatially widespread smallholders; weak or counterproductive policy frameworks for animal protein and climate change; competition with traditional financing operating without GHG conditionalities and lack of MRV system.

In July 2020, the World Bank approved a $500 million loan for the Sustainable Livestock Development Program to support the development of environmentally sustainable, inclusive, and competitive beef production in Kazakhstan. The Program responds to several national high-level priorities, including: contribute to the diversification of Kazakhstan's exports away from minerals and oil; boost small and medium business growth; create opportunities for socio-economic development in rural areas; increase agriculture productivity; foster environmentally friendly production; and improve the use of Kazakhstan's vast pasture and grassland resource potential.

The Program will target GHG emissions reduction and environmental sustainability by promoting better environmental outcomes of the State Program, improving farm advisory systems, and by instituting monitoring mechanisms for GHG emissions. In particular, the program will support a progressive repurposing of public expenditure dedicated to beef production for green growth and sustainability improvements. This will involve the introduction of environmental performance requirements for producers wanting to access public support, and a greater share of public support dedicated to supporting the adoption of GHG emission reduction practices. In line with the World Bank "Program for Results instrument", progress on these indicators will be a condition for the disbursement of the related part of the loan.

The project includes a component to adapt strategies to support climate-smart livestock systems to reduce carbon emissions, such as those implemented or in trial phase elsewhere. This focus is also in line with Kazakhstan's Nationally Determined Contribution (NDC) toward the Paris Agreement, that sets an economy-wide target of 15-25 percent reduction in greenhouse gas emissions by 2030 compared to 1990.

The estimated net mitigation potential of the program is 5.6 million tons CO_2e over the 5 years, despite a 2.5-fold growth in beef output. Three mitigation pathways are combined to achieve this ambitious objective:

1. Increased productivity and decreased GHG emissions per unit of product through improved livestock management practices (feed management and winter feeding, genetics and animal health improvements, offtake and fattening strategies).
2. Increased soil carbon sequestration through improved grazing management practices (adaptative grazing, restoration of degraded lands).
3. Adoption of energy-efficient equipment for cooling and production of renewable energy (solar and wind) to reduce and displace fossil fuel energy consumption.

The program will also improve the national environmental information system.

4 Obstacles to Mobilizing Climate Finance: Analyzing the Determinants

Understanding how best to catalyze public and private investment is a priority requirement to mobilize climate finance for the animal protein sector. Obstacles are often determined by the implementation setting—that is, in the geography into which the climate finance is to be channeled.

Analyzing the determinants (the geography) that present obstacles to climate finance details the connections along the animal protein value chain—between actors, instruments, and mitigation pathways—revealing the breadth of the sector and the multiple diverse mitigation and finance pathways. For each determinant, there are obstacles; knowing of their presence and understanding the reasons underlying them is crucial to mobilizing climate finance in the sector.

The obstacle analysis provides a detailed overview of most of the connections between actors, instruments, and mitigation pathways along livestock value chains and considers several types of obstacles encountered when applying climate finance to the sector (Table 4.1).

The nature of obstacle analysis is global and general, and it captures findings and inputs from literature and interviews with sector actors, lenders, and experts. The obstacles are not specific to the emerging approach identified in the climate finance mapping and trend analysis in chapter 3.

TABLE 4.1 Potential Obstacles Related to Mitigation Pathways and Instruments

Type of Obstacle	Example
Technological Obstacles	Technological and methodological constraints related to climate mitigation pathways within the livestock sector. This category includes the constraints that come from MRV requirements
Financial & Regulatory Obstacles	All economic, financial, policy-related, regulatory, and governance constraints in the sector that may hinder readiness to access climate finance
Implementation Obstacles	The intrinsic socio-cultural, capacity-related, and collective action obstacles unique to livestock-related communities

Note: MRV = measurement, reporting, and verification.

Technological obstacles

Technological obstacles include all potential methodological and technology-related challenges or constraints associated with each mitigation pathway. These problems may originate from the readiness level of a certain technology or be associated with the field implementation of a technology. Obstacles may also relate to potential environmental impacts of a mitigation pathway, as well as the process of measurement, reporting, and verification (MRV) associated with each mitigation pathway.

Livestock-related environmental impacts are challenging to measure in a detailed and consistent way. Not only do the MRV procedures differ with each impact pathway, but the potential impact depends on other project- and geography-related variables such as management systems, dietary patterns, and other economic activities in the landscape. These differences make standardized baseline setting complex and require a level of data collection that private actors may not be willing to undertake. The high variability of emissions by breed, feed characteristics, and region, means it is often not accurate to use national averages (e.g., in the context of feed additives use, see Sirohi and Michaelowa, 2008). To measure the mitigation impact of a project effectively, livestock operations must address multiple sources of GHG emissions. Beyond enteric fermentation, manure, dung, and urine deposit emissions, data on emissions also stem from feed production, grassland and soil degradation, land use change and bioenergy production. For countries that increasingly aim to measure GHG mitigation from the livestock sector for either NDCs, carbon markets or within Nationally Appropriate Mitigation Actions (NAMAs), there is no consistent sector-wide approach to MRV but a multitude of system- and location-specific approaches. This inconsistency not only complicates comparison and baseline setting, but also drives up costs.

Uncertainties, complex biogenic processes, and the diversity of production systems render precise MRV challenging for livestock-related environmental impacts and mitigation pathways. Manure management, for example, comprises multiple sources of GHG emissions including methane emissions[24] from waste treatment and storage, venting and collection, effluent ponds, and incomplete combustion; each of these sources has a specific effect. Nitrous oxide emissions might also counterbalance the reduction of methane emissions. Large uncertainties are associated with the measurement of soil carbon stock changes associated with activities along agricultural value chains. Measuring soil carbon sequestration can be done in a multitude of ways, and there is no consensus on a method that would strike the right balance between reliability and cost-effectiveness. Most methods are costly to implement, which is a obstacle in itself. The development of a comprehensive MRV system for GHG emissions is sometimes not feasible at the project level or for the project

24 Interview conducted with Hayden Montgomery of the Global Research Alliance (GRA) on Agricultural Greenhouse Gases, New-Zealand on December 10, 2019.

owner, and in many developed countries the public sector has partially driven and funded the development of default factors and measurement protocols. Such research will be needed even more for LMICs, where years of research and progress on testing and refinement of methods and emission factors will be needed to establish a reliable system. Until then, the Food and Agriculture Organization of the United Nations (FAO) guidelines on measuring soil carbon stocks and stock changes specifically in livestock production systems can guide work and system design (FAO 2019c). Other research projects funded by the World Bank are looking into MRV development for emission reduction from livestock intensification at the forest-pasture interface. A conceptual framework is being produced to review methods and describe the analytical core of the MRV system, covering direct livestock emissions, SOC sequestration, indirect land-use change and reduced deforestation. This conceptual framework could complement recommendations produced in this report and offer an opportunity to develop a full MRV system.

The implementation of MRV systems may require investment in technology or infrastructure that is out of reach for smallholders, micro, small, and medium enterprises (MSMEs), and local communities. Knowledge, access, and continuous operating costs also represent a challenge. One example can be seen in Brazil, where the main beef producers in the Amazon region are implementing GPS tracking technology with the objective of fully sourcing cattle from sustainable rangelands or areas free of illegal deforestation. However, the cost of implementing this kind of technology makes it available only to the biggest producers and puts it out of reach for the many smallholder ranchers in the region.[25] In California's Carbon Offset Program, cost obstacles are the main explanation for the small number of livestock projects, despite a dedicated Livestock Protocol. Most manure management, treatment, and storage-related mitigation pathways can be adopted only in indoor enclosures and have significant infrastructure requirements. This obstacle is connected to broader ethical considerations around these systems—that is, to whether smallholders in poor communities should bear the costs of MRV and technology deployment despite the problem's largely originating from the Global North.[26]

Optimized feeding strategies, such as feed ration balancing or the use of feed additives and nutritional supplements, despite being one of the most promising mitigation pathways in terms of marketability, still require further technological testing and long-term-effect research to assess its mitigation potential.[27] In any case, the mitigation potential of optimizing feeding strategies will most likely not match the current level of emissions from deforestation as a consequence of producing soy and other protein feed crops, leading to the observation that feeding strategies and traceability and sustainability of feed must be assessed together.

25 Interview conducted with Ruaraidh Petre of the Global Roundtable for Sustainable Beef on November 28, 2019.

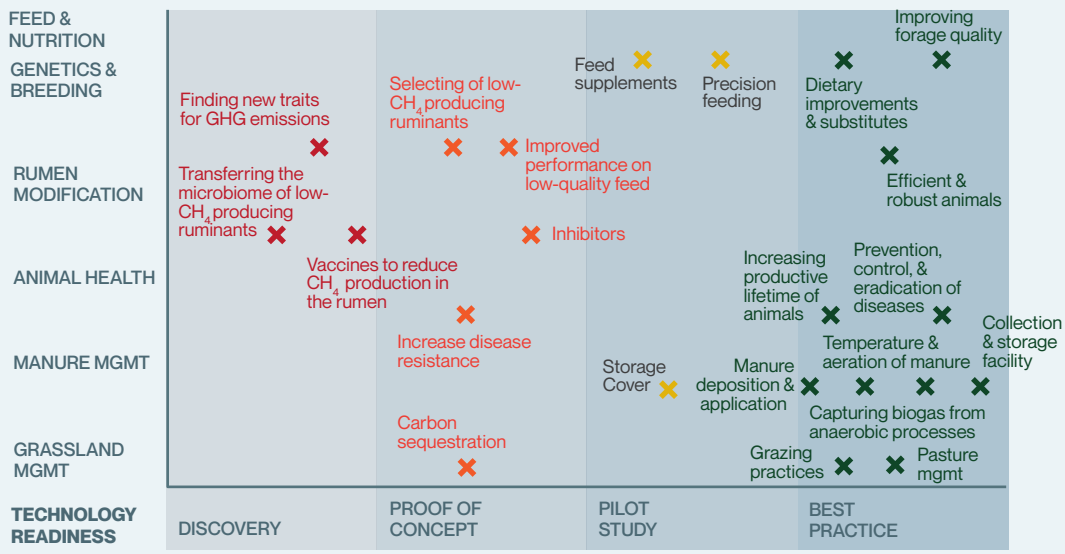
26 Interview conducted with Fritz Schneider of the Global Agenda for Sustainable Livestock on November 22, 2019.

27 Interview conducted with Ruaraidh Petre of the Global Roundtable for Sustainable Beef. on November 28, 2019.

Among the observed technological obstacles of feed additives is that their effectiveness in decreasing methane emissions can be reduced in the long term because the rumen microbial ecosystem adapts to the additives. Certain specific feed additives, such as molasses-urea blocks, can even be toxic to livestock and ineffective in decreasing methane emissions, revealing the need for proper technological testing before implementation. This represents another obstacle, since only companies with sufficient capital to conduct research and testing over an extended period can bring feed additives onto the market; the process is both time and capital intensive.

Many of the mitigation pathways relating to management practices have become accepted as best practice and result in significant impact. Some pathways, however, depend on technologies that are in different phases of implementation readiness (Figure 4.1). Technologies to enable climate-smart manure management are already applicable, but at substantial cost and not always capable of resolving the trade-off between methane reduction and nitrous oxide emissions. Pathways that are dependent on technologies in genetics and breeding and rumen modification are not yet commercially viable. Some technologies, however, are close to commercialization; an example is the use of methane inhibitors for ruminant feedlots developed by the Dutch company DSM.[28] The company is currently seeking market registration for a launch in 2023.

FIGURE 4.1 Summary of Mitigation Pathways and Readiness for Implementation



Source: Adapted from interview with Montgomery, October 2019 (See appendix B).
Note: CH_4 = methane; GHG = greenhouse gases.

28 Interview conducted with Hayden Montgomery of the Global Research Alliance (GRA) on Agricultural Greenhouse Gases, New-Zealand, on December 10, 2019.

Economic, financial, and regulatory obstacles

Financial and regulatory obstacles refer to the different kinds of economic, financial, policy-related, regulatory, and governance constraints that may hinder the readiness of the sector to access climate finance.

Economic and financial obstacles

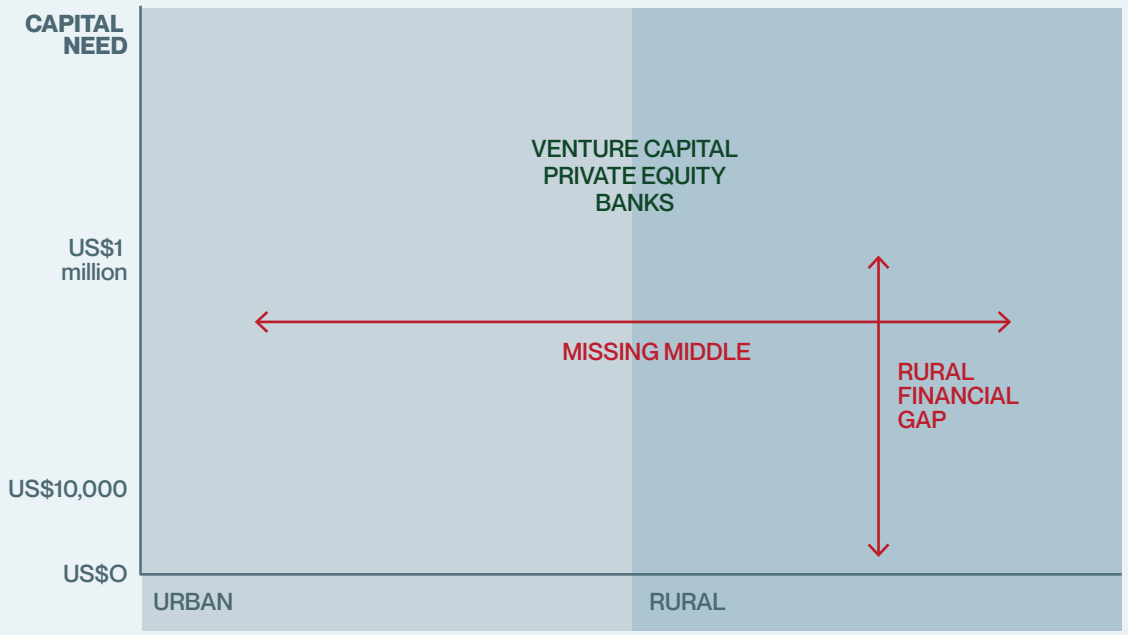
Economic obstacles include the intrinsic characteristics of livestock-related activities that may affect their economic performance, productivity, or investment feasibility: their bankability. The characteristics can act as a constraint to accessing climate finance or may make the sector appear less attractive to investors. These obstacles are relevant at the smallholder level but appear across all parts of the value chain and across every size of institution.

The *missing middle* refers to a gap in access to certain types of finance in many producer geographies in LMICs. While many farmers and MSMEs can access climate-relevant finance through their cooperatives or via rural banks, or even through microfinance, many are too small to be able to access climate finance in the form of venture capital, foreign direct investment (FDI), or private equity. The size distribution of farms in the recipient geography is an important indicator of the feasibility of different levels of climate finance. Especially for farmers located in remote areas, access to commercial lending is difficult (Mtimet and Dube 2018). The limitations of farms' production structures and processes act as an important restraint to scaling up livestock-related mitigation initiatives because they limit access to finance, in general, climate and traditional alike. A second layer of the missing middle challenge is that the more innovative—and thus the more risk-taking investors (of both types of finance)—tend not to find their way to remote areas because of the difficult combination of high risk and remoteness. This can be combated in part by aggregated lending to communities or groups of livestock farmers. However, this type of lending is uncommon (Figure 4.2).

With lower population densities and wide distances between smallholders, the access costs alone can create increased risks for potential lenders. Climate risks are also important for commercial lenders in regions that may be more likely to experience natural disasters, with the increased likelihood of defaults and overdue payments. This type of financial obstacle can, in part, be tackled through index-based insurance programs (see section 3.3). Other economic obstacles relate to the demand side—that is, obstacles that are more connected to the interaction of these actors with domestic and international markets and investors.

The dispersion of smallholder farms over a vast space, weak domestic markets for livestock-related products, lack of or poor condition of marketing channels, and other problems related to health and sanitary monitoring increase the transaction costs of livestock products from smallholders in developing

FIGURE 4.2 An Illustration of the Missing Middle in Finance



Source: Adapted from Mtimet and Dube 2018.

countries. Such smallholder systems do not provide a viable business case for the commercial investor and also make for a difficult business case for an impact investor or climate finance institution. This situation effectively rules out most types of finance except loans and ODA, but it can also be an argument for greater use of PPPs.

Contract farming is one way to combat this obstacle in that it creates interdependency and commitment between producer and processor. Often this commitment can create a formal link between actors that allow for long-term planning and provides assurance for investors. Under certain conditions, this arrangement can also be conducive for FDI by processors or other downstream actors. Nestlé, for example, reaches small dairy producers in India through intermediary agents with whom they have a formal contract. In addition, the Verified Sourcing Area (VSA) model can help to scale up responsible production by maintaining the competitiveness and pricing of sustainable commodities. Although they do not constitute sources of climate finance, per se, contracting and value chain integration can strengthen the business case of producers and make groups of farmers more attractive to investors.

Financial obstacles refers to the concurrence of problems that smallholders, MSMEs, and other stakeholders along livestock value chains face when applying for loans, credit, or other financial support (demand side); or the limitations that financial institutions face when funding them (supply side) (World Bank

2016). It is important to point out that many of these obstacles are specific to smallholders, with much less effect on larger institutions along the value chain such as retail giants and major distributors. Demand side obstacles include:

- *A weak and vulnerable income base and difficulty accessing collateral:* This is a major obstacle, especially for smallholders in rural areas or for pastoralist communities, where livestock is the main economic activity and source of income, but where land titles and registration are weak or missing. Individuals may encounter difficulties accessing collateral to get funding because they lack any recognizable valuable assets. Livestock can be used in some cases, but this can also place too much pressure on the farmer's sole source of income because of the lack of diversification of the farmers' economic activity. Implementing other sources of income—for example, integrated pasture cropping, silvopastoral systems, or on-farm production of fodder, among others—can help to address this. Adapting or changing long-held traditional production systems in geographies with weak or insecure land tenure is, however, a slow and delicate matter and cannot deliver speedy access to climate finance.
- *There is a disconnect between traditional funding instruments and livestock sector characteristics:* Some financial instruments are not tailored to the specific needs and constraints of local smallholders and MSMEs. Credit instruments can have detrimental effects on rural famers. For example, Mtimet and Dube (2018) analyze the effects of rural financial services on livestock production in Ethiopia and show that using credit instruments has a negative impact on poor households' assets, since it can lead or force poor households into selling their livestock to pay back their loans, ultimately driving those households further into poverty. These instruments can be replaced through subsidies, concessional finance, guarantees, or additional support for accessing credit.
- *Risk aversion reduces producer willingness to invest in production inputs:* Farmers are more willing to invest in protection against adverse conditions via insurance with low upfront down payments, than they are in technology that might result in higher day-to-day efficiency but would demand upfront payment, possibly training, more workers, and a more complicated business. For livestock, this attitude results in the selling off of cattle prior to an impending drought, which reduces the long-term profitability of herds (Hansen et al. 2019).

One common characteristic of livestock-related smallholder and MSME activities is limited financial skills—poor bookkeeping, late or missing loan repayments, and other inconsistencies in reported value and revenue—which makes them less bankable. Such issues can often be addressed by relatively simple technical assistance or accounting training in programs that can be extended to include an environmental perspective to give them some limited capacity to measure the environmental impact of their economic activity.

These obstacles limit the willingness of lenders to provide livestock-based activities with traditional finance.

The supply side main obstacles to agricultural and livestock lending are inadequate enabling environments, lack of intermediate financial infrastructure, the intermediaries' limited capacity or willingness to manage the risk related to livestock activities, and high transaction costs. The supply side specifically refers to the financial intermediaries that act as a source of funding for the smallholders, MSMEs, and other stakeholders (the demand side). In addition to these obstacles, value-chain actors mention that there is an apparent widespread misunderstanding that the main investable mitigation actions in the livestock sectors concern protein alternatives (i.e., the reduction or elimination of meat protein consumption) and not the livestock producers themselves.

- *Given the high transaction costs associated with the livestock sector, commercial lenders also exhibit a lack of interest, particularly in developing the information and capacity-building element.* The low banking readiness of many smallholders and small-herd farmers drives up additional preparatory and information costs for any investor. Those farmers applying for loans do not have the technical knowledge and capacity to meet the requirements that intermediaries expect in order to assess loan requests with climate elements or services, which is another example of the "missing middle" mentioned earlier.
- *Especially among commercial lenders and private-sector actors, there seems to be a general perception that financing livestock-related activities in rural areas is not profitable and lacks the appropriate scale to engender wider interest, since such investments generate lower returns than other activities.* The cash flow of smallholder and small herd dairy and meat livestock systems is unattractive compared to their levels of risk and transaction costs. First, the size of the income stream is closely tied to access to aggregators and dairy facilities/slaughterhouses, as well as to markets beyond the local. These factors are all outside the control of the investor and resolving them cannot easily form part of the investment. Secondly, the reliability and frequency of the income streams of the two main livestock-farming systems are inadequate for investors. For dairy farmers, the income stream is constant, but small, while in the beef cattle market the timing of slaughter related to demand is crucial and careful planning is needed, which requires market understanding. Farmers may have intrinsic understanding of local markets but know little of demands or trends in more distant markets, making planning difficult. In any case, the frequent low troughs in the income stream are difficult for a non-bankable farmer to match to fixed installments or dividends, which calls for short term or more flexible financial instruments or for aggregation mechanisms.
- *Increased risk-related costs and a greater perception of risk by lenders—due to physical obstacles, such as spatial dispersion among farmers and low population density—hinder risk assessment and monitoring.* Spatial

dispersion makes risk assessment and infrastructure development more costly, translating into higher investment risks and lower return on investment. Accessing widely dispersed rural farms for the assessment, development, and MRV of livestock-related projects requires an extensive network of specialists and close contact with farm owners, making financing these initiatives more costly and longer term. To attenuate this problem, public climate finance is key to catalyzing private sector investment, since it can take on risks that the private market will not. Blended finance mechanisms can also combat these obstacles through public grants, low interest loans, or guarantees to smallholders involved in private funding mechanisms, thereby reducing the risk exposure for the private investor (this has been the case for pilot programs for weather-based insurance).

- *There is a lack of a homogeneous framework for funding regardless of geography.* Lending may be cheaper than other forms of finance in some countries and, therefore, may be a more desirable option. Another example is that developing specialized lending products for rural areas is more costly than developing them in more densely populated areas, raising per-loan costs. Culturally, regions will differ, and a reliable financial framework should be adapted to cater to different contexts. One example of this is in index-based payments in Ethiopia, where there was concern over uptake because of Muslim livestock producers within the population who may see insurance as a form of gambling, which is forbidden by Sharia Law.
- *The importance of the informal sector, combined with the absence or weakness of domestic capital markets in developing countries, acts as a obstacle to private-sector finance by increasing uncertainty.* In a study of the beef value chain in Ghana, it was observed that informal contractual relationships dominate the sale of cattle. Hence, there is a lack of standardized measuring scales, of health and veterinary examination services, and of transaction bookkeeping, for example. This poor market infrastructure can act as a major obstacle to private investment in developing countries (Mtimet and Dube 2018).

An important finding behind both the demand side and the supply side of climate financing for the meat protein sector is that the issue of low bankability of smallholders or small-herd farmers in rural areas is not directly related to climate finance alone, but to all types of finance. This finding, however, can be turned into an opportunity if policy makers, institutional investors, and other high-level actors work systematically to connect these farmers to regional and global finance. While in many other sectors—for example, in energy, industry, and land use—climate finance must compete with traditional finance, which has fewer constraints and higher returns; in the livestock sector climate finance has the potential to define the norm and get a head start.

Finally, a cross-cutting obstacle concerns terminology and thus reporting of results and disbursement. Climate finance is largely driven by MFIs. The

World Bank, along with other MDBs and IFIs, have agreed a taxonomy of project types that are eligible to be counted as climate mitigation and adaptation projects. Within this harmonized MDB category system, eligible livestock categories only fall into a single category (see Table 4.2).

TABLE 4.2 Activities Eligible for Classification as Climate Mitigation Finance, Category 4

Category 4.	**Agriculture, aquaculture, forestry, and land use**
Subcategory	Eligible Activities
4.1. Agriculture	Reduction in energy use in traction (such as efficient tillage), irrigation, and other agricultural processes Agricultural projects that improve existing carbon pools (such as rangeland management; collection and use of bagasse, rice husks, or other agricultural waste; reduced tillage techniques that increase carbon content of soil; rehabilitation of degraded lands; peatland restoration, and so on) Reduction of non-CO_2 GHG emissions from agricultural practices and technologies (for example, paddy rice production, reduction in fertilizer use) Resource efficiency in agricultural processes and supply chains
4.2. Afforestation and reforestation and biosphere conservation	Afforestation (plantations) and agroforestry on non-forested land Reforestation on previously forested land Sustainable forest management activities that increase carbon stocks or reduce the impact of forestry activities Biosphere conservation and restoration projects (including payments for ecosystem services) seeking to reduce emissions from the deforestation or degradation of ecosystems
4.3. Livestock	Livestock projects that reduce methane or other GHG emissions (for example, manure management with biodigesters, and improved feeding practices to reduce methane emissions)
4.4 Biofuels	Production of biofuels, including biodiesel and bioethanol (only if net emission reductions can be demonstrated)
4.5. Aquaculture	Reduction in energy use or resource efficiency in aquaculture

Source: AfDB, ADB, EBRD, EIB, IDB, ISDB, and World Bank 2019.
Note: GHG = greenhouse gas.

This taxonomy would require expansion to include new and innovative livestock project types. To do so, any new project type would need to demonstrate quantifiable and demonstrable GHG reductions, and then other MDBs and IFIs would need to agree jointly to expand this list of eligible project types. It is worth stressing that the taxonomy above only relates to climate mitigation finance.

Regulatory obstacles–policy and governance

These relate to those variables that can negatively affect the capacity of the sector to access climate finance for institutional or regulatory reasons. For example, missing policies or negative policies, political factors or decisions that lead to instability, and a lack of support to farmers and MSMEs are all obstacles to raising the capacity to access climate finance.

Policy and governance obstacles include variables that may hinder the sector in two ways: making business along the value chain less productive and more costly, and lack of national frameworks and strategies to support sustainable development of the livestock sector.

Data obstacles (or, in this case, the lack of data) are related to the low availability of bankable projects; these include climate mitigation projects in the livestock sector that:

- have a clear, consistent, and reliable presentation of data regarding the amount and destination of monetary flows (public and/or private);
- demonstrate economic, environmental, and social outcomes of the project in all project areas;
- demonstrate the climate impact of the project (both the impact of the activity and the benefits of the activity, like carbon sequestration, for example); and
- provide systematic and detailed information on investors (who has participated and how much?).

A broader availability of this kind of information would leverage an organized private sector in the form of impact investment funds, bonds, value chain finance, or private mitigation/adaptation finance. A key element needed to leverage private sector involvement is the establishment of robust and reliable MRV systems.

One key issue that is observed across regions is the impossibility at a national level of providing accurate and reliable data on herd sizes, which is essential information for private investment, as evidenced from experiences in Uruguay and the Dominican Republic.[29] Lack of data and census information on bovine farms is a basic requirement for scaling up projects. Dedicating grants and technical assistance to filling this analysis gap would make a substantial impact in attracting and mobilizing more private investment money.

The lack of data partly stems from cross-sectoral policies that are not being integrated or not being coordinated in the livestock sector. In certain contexts, farmers do not trust the public authorities and suspect they will face increased tax charges and regulation if they share their production data. The lack of policies also means that no agencies or institutions are dedicated to providing

29 The projects are the Climate-Smart Livestock Production and Land Restoration in the Uruguayan Rangelands and Promoting Climate-Smart Livestock Management in the Dominican Republic projects.

official data, inventories, and information for stakeholders.[30] While many countries have sectoral strategies and/or alignments with supranational strategies (such as the Paris Agreement, for example), there is still a lack of coordination and information-sharing between the ministries of environment and the ministries of agriculture. The stakeholder consultation process revealed that environmental goals may not have been tied with agricultural goals.

Another policy-related obstacle arises from the coordination between national governments and ministries and other multilateral organizations or nongovernmental organizations (NGOs) funding the projects. There is no common platform on climate change, deforestation, or biodiversity loss that drives action within the livestock sector. Despite the tremendous progress that has been achieved on sustainable sourcing of forest risk commodities, the global animal protein sector is arguably the least advanced. Roundtables are usually the platforms driving this agenda. However, the Global Roundtable on Sustainable Beef (GRSB) is relatively recent[31] and has limited influence (Veit and Sarsfield 2017). In South America, national roundtables are emerging in Argentina, Brazil, and Paraguay. Once they are stronger, more mature and have enough representation, roundtables can potentially play an important role (IDH 2020).

In many cases, such as the Global Environment Facility (GEF), project funding is tied to certain activities or target areas (in this case, climate mitigation). Therefore, projects related to climate mitigation in the livestock sector can access only a specific type of finance (in the case of the GEF, they were all grant resources). This specificity can limit the potential outreach or target of the project (in the case of the Uruguay project, it would target only 60 smallholder farms out of the more than 1,000 Uruguayan smallholders, because coordination and information sharing between actors and institutions constrain outreach).

A possible limitation to action and projects funded by multilateral organizations and NGOs is the interest (or lack thereof), at a national level, to developing mitigation projects within livestock. The many obstacles and low profitability (perceived and actual) within the livestock sector, compared to mitigation in other sectors such as renewable energy, means that projects in the sector are often overlooked or not prioritized. For example, the GEF, despite leveraging a very substantial amount of funding for climate mitigation projects,[32] is developing only a few projects in the livestock sector, because projects are supposed to be country driven and livestock, as a sector, has not been prioritized by the countries themselves. Other policy and governance obstacles include the following:

30 Interview conducted with Melina Gonzalez Vasquez of the Global Environment Facility and Ruaraidh Petre of the Global Roundtable for Sustainable Beef on November 26, 2019.

31 In March 2021.

32 The seventh GEF replenishment, including funds for mitigation, for the period 2018-2022 was US$4.1 billion; the sixth replenishment (2014-2018) was $4.43 billion and the fifth replenishment (2010-2014) amounted to $4.34 billion.

- Some financing instruments could force up global food prices, resulting in negative impacts on food security.
- Focusing policies on methane emission overall can discount areas where animal manure is used as fuel and enteric methane is the only significant emission source. Timing between emission reductions and financial reward can also be a policy obstacle.
- Lack of multisectoral strategies at a national level; a lack of policy or policy issues that encourages business at a national, regional, and local level; and poor coordination between different government ministries and agencies, and between government bodies and private sector associations, all constitute obstacles.

Implementation obstacles are the intrinsic sociocultural, capacity-related, and collective-action obstacles unique to livestock value chains and related stakeholders. Many traditional livestock-based farming systems, both smallholder systems and larger-scale ones, are closely attached to a livestock farmer culture and business operation where cattle raising is either extensive or pastoralist and where returns are cash paid immediately at the dairy, slaughterhouse, or trader's gate. Changing long-held practices and mindsets is a cross-cutting cultural obstacle.

In pastoralist, as well as other livestock production-related communities, capacity obstacles can be related to furthering knowledge and skillsets. Advances in methods, technologies, and inputs—feed additives, husbandry, animal breeding, manure management, for example—do not trickle down to the in-situ traditional farming methods; farmers have limited capacity and no knowledge of how to implement the new practices. Even if affordable technologies or best-practices are in use in peri-urban settings, there may not be a communications vehicle for remote rural livestock producers to access evolving methods, technologies, and inputs. Capacity obstacles also refer to a lack of the entrepreneurial and business skills smallholder farmers may need in order to make more efficient use of resources and investment; or they can refer to the lack of appropriately sized infrastructure, which limits the amount of economic activity (and therefore output) of smallholder farmers and MSMEs. Furthermore, infrastructure constraints limit the capacity of smallholders to have larger herd sizes, access own feed and water resources, storage capacities, availability of stock, and other items that can lead to economies of scale.

One obstacle related to technical and management interventions, as well as increased livestock productivity interventions, is that there is a potential "rebound effect" when carrying out these activities. This means that the increased productivity achieved by the implementation of the mitigation practices, new technologies or techniques may result in higher attractiveness and incentive to expand livestock production activities, which, in turn, leads to an increase of absolute GHG emissions. In terms of results-based payments, this means that a financial mechanism that works with an intensity baseline (i.e., emissions

per unit of product) can reward a project even though the project effectively led to an increase in absolute emissions.

A key element that deters private sector investment in climate mitigation projects in the livestock sector is that many of these projects, especially in LMICs, require a great deal of training (normally based on a peer-to-peer learning and co-innovation approach); capacity building; smallholder aggregation; and parallel development of extension services to increase the necessary quality, profitability, and scale. These processes are usually long term, and this long-term continuous investment (in many cases combined with regulatory instability) is a substantial obstacle to private investment. Moreover, the livestock sector in developing countries is characterized by other constraints that limit the development of the sector: disease prevalence (for example, foot and mouth disease in Mongolia),[33] lack of production skills, and insufficient or lacking access to health and veterinary services.

One obstacle, often overlooked, may be the limited capacity of private and public actors to assess effectively what is needed to finance climate mitigation in the livestock sector because it is a relatively unexplored side of climate finance. At a local level, the capacity of local intermediaries to assess, implement, and monitor livestock activities related to mitigation pathways is limited and usually focused on other areas of action such as reducing inequality and poverty, and enhancing food security. These obstacles can be addressed by strengthening the cooperation and knowledge sharing between stakeholders and promoting practices that enhance reductions of GHG emissions while increasing productivity and quality of output. This could be done through capacity building and extension services, by private and/or public sector entities.

Sociocultural norms can also create "inherent" obstacles. arising from cultural perspectives and views regarding the livestock sector. There are many examples of obstacles created vis a vis the weight of sociocultural norms from negative views on nomadic grazing, including tensions with sedentary producers, to perceptions toward land use and livestock's productivity and potential. Livestock ownership is a cultural signifier of wealth and status in some societies, which creates its own subset of obstacles, such as those faced by women or marginalized groups. In societies where legal access to land title is denied to women or legal rights of ownership (including to livestock) do not exist, gender-specific programs, grants, or microfinance schemes within the meat protein sector that target empowerment or livelihood enhancement for women encounter barriers. Inherent obstacles can deter potential investors (public and private) and challenge policy makers when creating policies and programs that are to benefit the whole sector.

Livestock rearing in certain areas is not simply for market production. For example, a study included in the International Conference on Livestock Value Chain Finance and Access to Credit (Mtimet and Dube 2018) revealed that

33 Interview conducted with Fritz Schneider of the Global Agenda for Sustainable Livestock on November 22, 2019.

smallholder farmers may rear for household consumption and traditional or religious ceremonies. Focusing on the market participation of Zambian smallholder goat farmers, it noted that farmers also rear goats for household consumption or ceremonies such as paying the bride price (Mtimet and Dube 2018). Investment obstacles may arise when adaptation or mitigation proposals include herd husbandry and management practices that are antithetical to the traditional ones, such as the early offtake of animals in the herd to improve meat production efficiency.

- Although collective action in cooperative or communal farms and grasslands has many advantages, it can actually become an obstacle to securing finance. Complicated group dynamics can affect decision making determinations, which can be particularly hindersome in determining beneficiaries of finance; resolving management-related conflicts, such as those decisions about common goods, grazing approaches, shared grasslands; and where to use limited resources.

Overview of main obstacles

Table 4.3 provides an overview of main financial, economic, policy and regulatory obstacles, categorized by demand side, supply side, and policy frameworks, and indicates the affected stakeholders and regions.

TABLE 4.3 Main Financial, Economic, Policy and Regulatory Obstacles

Main Financial, Economic, Policy, and Regulatory Obstacles	Affected stakeholders	Geographical relevance
Finance Demand Side (Farmer and Proximate Supply Chain)		
The missing middle (obstacle 1)	Smallholder farmers and supply chain MSMEs	Sub-Saharan Africa, Southwest Asia, Central Asia, Andes
Climate risks (obstacle 2)	All types of farmers, but smallholders without insurance and any farmer in regions of pronounced climate change may be most vulnerable	All
Insufficient financial infrastructure and limited banking services (obstacle 3)	Farmers and supply chain MSMEs Farmers in areas without agro-banks or cooperatives and with weak market development, such as SSA	Sub-Saharan Africa

Main Financial, Economic, Policy, and Regulatory Obstacles	Affected stakeholders	Geographical relevance
High transaction costs due to dispersed farmers and difficult access (obstacle 4)	Farmers and supply chain MSMEs Especially in mountain areas, flood plains, and forest-farming system in marginal regions, such as the Andes region, parts of Central Africa, and the Sahel region	Sub-Saharan Africa, Andes, Central Asia
Limited or difficult market access (obstacle 5)	Subsistence farmers Farmers in LMICs and regions subject to unrest and instability Farmers not connected to regional or international supply chains	Sub-Saharan Africa, Andes
Low supply chain integration (obstacle6)	Farmers who service dominant local aggregators, where limited cooperation prohibits market pricing based on differentiated production or quality Farmers in regions with weak supply chains or low connectivity to global markets	Marginal parts of all regions
Weak income base leaves no security for investors (obstacle 7)	Smallholder farmers	Sub-Saharan Africa, Andes, Southwest Asia, but found in all regions
Finance Supply Side		
Underdeveloped taxonomy, weak definitions, and inconsistent reporting (obstacle 8)	Any donor or institutional investor subject to internal reporting on climate mitigation or other benefits	Specific to animal protein sector
Prohibitive transaction cost levels for dispersed smallholder producers (obstacle 9)	Rural and remote areas with low banking service	In all regions, but mostly Sub-Saharan Africa, Andes, Southwest Asia
Competition with cheaper informal or non-climate ("traditional") finance (obstacle 10)	For all farmers and supply chain actors traditional finance, will often be more attractive as it is offered with fewer constraints and/or lower cost	In all regions
General perception among lenders that financing livestock-related activities in rural areas is not profitable (obstacle 11)	Concerns no single group or actor	Widespread
General perception among lenders that livestock offers little climate mitigation potential (obstacle 12)	Concerns no single group or actor	Many commercial actors in all regions

Main Financial, Economic, Policy, and Regulatory Obstacles	Affected stakeholders	Geographical relevance
Policy Frameworks		
Uncertain, unclear, or counterproductive regulation introduces uncontrollable risks (obstacle 13)	Constrain ability of investors to develop and evaluate business cases and understand trends and risks in the sector May become a constraint in application or permitting processes	Investors directly, but indirectly those not being able to access finance
Insufficient data on sector, actors, economic development, or business activity (statistics) (obstacle 14)	Constrain ability of investors to develop and evaluate business cases and understand trends and risks in the sector	Investors
Lack of national strategic frameworks or policies or regulation (obstacle 15)	Complicated to assess and understand national legislation Creates uncertainty around risks and possible support May become a obstacle in application or permitting processes	Individual countries across regions
Absence of active platform on climate change, deforestation, or biodiversity loss as driver of action (obstacle 16)	Makes it difficult to raise attention and awareness by project developers and NGOs/Farmer organizations Little pressure on legislators to change any of the above policy framework constraints	Individual countries across regions

Note: The number of each obstacle is referenced in Table 3.4. LMICs = low- and middle-income countries; MSMEs = micro, small, and medium enterprises.

Seven key obstacles specific to climate finance flows to the animal protein sector emerge from this analysis (Table 4.4).

TABLE 4.4 Key Obstacles Restricting Climate Finance Flow into the Animal Protein Sector

Key Obstacle
1. High costs of servicing smallholders that are often spatially widespread
2. Absent, weak, or counterproductive policy frameworks for animal protein and climate change, in combination with the absence of a sense of climate action urgency among some supply chain actors
3. Weak or disconnected pricing signals along animal protein value chains
4. Animal protein sector perceived as highly controversial, with weak business case for investment and lower-balance potential
5. Competition with traditional financing operating without GHG conditionalities or terms
6. Lack of shared data and approaches for MRV makes conditional finance (result-based payments) difficult
7. Lack of data and statistics complicates due diligence, making assessment of possible investment opportunities unreliable and difficult to compare

Another way to assess obstacles is to look at the constraints existing for each of the main technical mitigation pathways. This is summarized in Table 4.5.

TABLE 4.5 Collection of Obstacles per Pathway

Mitigation Pathway	Technological Obstacles	Financial/Regulatory Obstacles	Implementation Obstacles
Animal Feeding & Health	• Information on feed quality and balanced feed rations is lacking • Access to improved feed materials or to simple feed transformation technologies is lacking • Insufficient access to advisory and veterinary services	• Seasonality or cash flow issues prevent investment in beef and dairy cattle	• Perceived lack of financial return from addressing production diseases leads to low willingness to pay for veterinary services among farmers • If not accompanied by other mitigation pathways, intensification of livestock may lead to a growth in animal populations and thus to increased GHG emissions • There is a lack of data on feed sources and flows • Health challenges vary widely by region and species, there is no one-fits-all solution
Avoided Deforestation	• There is difficulty in accessing and controlling land conversion frontiers in remote areas	• As the mitigation outcome comes from avoided emissions rather than emission reduction, its quantification is inherently difficult, dissuading most commercial investors	• Alternative livelihood strategies are lacking for communities living at the forest/pasture interface. • Sustainable sourcing of feed requires high levels of traceability and coordination along complex supply chains
Feed Additives	• The effects of feed additives to decrease methane emissions are often reduced in the long term because of the adaptation of the rumen microbial ecosystem • Some additives can be toxic to livestock or ineffective, revealing the need for proper testing before implementation	• Investor interest is low because of scale and transaction costs, as long as tested additives are not available on the market • Productivity gains from feed additives are lacking, resulting in a net continuous cost of supplying the additive to animals	• Access to this technology by rural farms requires an extensive network and close contact with farm owners • This approach is not applicable to grazing systems, thus is limited to confinement favoring large-scale operators and contributing to animal-welfare concerns

Mitigation Pathway	Technological Obstacles	Financial/Regulatory Obstacles	Implementation Obstacles
Genetic Selection & Breeding	• There is a lack of knowledge and access to specific breeds	• There is a lack of targeted investment by major stakeholders in the animal genetic space • Rural and smallholder communities may be out of reach of private sector breeding-based initiatives because of the lack of consistent ways to report value	• There is often a trade-off between breed productivity and their resilience/adaptation to local conditions • For achieving their full production potential, improved breeds need specific conditions and the implementation of a set of specific practices • Biotechnology (CRISPR/Cas9) faces societal resistance and regulatory obstacles
Grazing Management	• A lack of baseline field data due to the costs associated with collecting, processing and storing soil samples • Diversity of methods and lack of consensus to assess SOC stocks and changes • When grasslands are intensified or new grass species are introduced, biodiversity issues are derived from habitat change and introducing foreign seeds/crops (invasive species, modifications of the grassland ecosystem)	• Little perceived benefits of grazing management practices among investors (and possibly in local communities, as well) • Access to rural farms for MRV requires an extensive network and close contact with scientists and with farm owners • Smallholders can be excluded due to transaction costs associated with MRV	• There is a lack of knowledge regarding sustainable grazing management techniques; best practices vary locally • Attribution and coordination issues can occur when grazing occurs in communal pastures • Spatial distribution of grazing pressure on a large scale requires significant infrastructure investments (roads, access to water)

Mitigation Pathway	Technological Obstacles	Financial/Regulatory Obstacles	Implementation Obstacles
Manure Management	• Methane and nitrous oxide emissions are influenced by many parameters, including feed composition, manure management and microclimate, making baseline setting relatively complex • Nitrogen emissions may be displaced from one manure management step to the other (for example, from storage to application on crops), rather than suppressed • Emissions may also be displaced from one gas to another (for example, from N_2O associated to aerobic storage to CH_4 associated with anaerobic storage)	• There is difficulty in accessing finance to build new infrastructure for manure management • The contribution of manure management to methane emissions is relatively limited compared to enteric fermentation. Programs focusing on methane emission reduction will predominantly address the latter	• There is a lack of knowledge regarding manure management • Most manure management-, treatment-, and storage-related pathways can be adopted only in situations where animals are housed or kept in paddocks
Silvopastoral Systems	• MRV constraints in effectively monitoring the carbon sequestration potential of silvopastoral systems – a rather specific system with carbon sequestration occurring both below-ground (grassland soil) and above ground (trees)	• The perceived mitigation potential is low and slow • Silvopastoral systems often occur near the deforestation front and can act as a buffer, or as a pioneering stage in the moving deforestation front if the regulatory framework does not prevent it	• Need for technical assistance to support producers as they redesign their production systems • If not accompanied by other mitigation pathways, intensification may lead to a growth in pasture areas and thus to increased GHG emissions • Issues with beneficiary identification in the case of shared land resources
Whole Supply Chain Approach	• Need to draw on several MRV systems to monitor GHG emissions and carbon sequestration along the supply chain • Requires coordinating action along the supply chain, involving multiple stakeholders	• Costs are associated with implementing MRV systems along the supply chain	• Issues with stakeholder coordination and beneficiary identification as mitigation effects are re/distributed along the supply chain • Risk of emissions displacement (leakage) if coordination is not sufficient or if MRV systems are not adequately articulated

• Note: GHG = greenhouse gas; MRV = measurement, reporting, and verification.

5 Investment Opportunities

Climate finance clearly has a role to play in helping to reform the livestock sector in ways that reduce its impact on the environment and on climate change. There are many ways in which climate finance can intervene but it is useful to focus on specific actions - or investment opportunities - that can be particularly practicable and effective, with returns both for actors in the sector and for those investors in the public and private sectors that choose to become involved in the animal protein value chain.

Foundations

The successful leveraging of additional finance flows to reshape animal protein value chains will depend on the ability of the sector to exploit opportunities and overcome obstacles. This could entail: better communication on mitigation pathways to convince investors of the mitigation potential – the evolution of livestock markets in LMICs toward higher-profitability; the scaling-up of lower-risk strategies; the increased integration of livestock value chains to foster better price setting and transmission of price signals; and the leveraging of new financial flows through blended finance structures and PPPs. In other words, it depends on making investors look at animal protein value chains in LMICs as viable business opportunities with climate mitigation potential.

Many of the obstacles identified in this report are not exclusive to the animal protein sector's readiness to access climate finance. Lessons learned from developing and applying climate finance approaches in other sectors are thus extremely relevant to the design of investment opportunities for animal protein value chains (Table 5.1).

A key part of a convincing business case for directing climate finance toward the livestock sector is the incorporation of, and adaptation to, the local circumstances of economic structures, markets, culture, and production systems in the business proposal, namely, the enabling environment.

TABLE 5.1 Lessons from Outside the Livestock Sector and Relevant Key Obstacles

Learning	Key Obstacle Addressed
Project aggregation helps address MDB high appraisal costs and other due diligence	High costs of servicing smallholders that are often spatially widespread
Policy-based loans at the national level can unlock most forms of climate finance	Absent, weak, unclear, or counterproductive legislation or policy framework without a common platform for supply chain actors
Increasing transparency and higher climate standards reduces investor risk perception	Weak or disconnected pricing signal in the market
To reduce risk, adapt existing infrastructure to climate mitigation; and use simple approaches and instruments to develop more tailor-made approaches after the pilot phase	Livestock farmers are perceived as high risk, with weak business cases and low GHG mitigation potential
Investment loans and credit lines can be linked to mitigation standards and technologies; project aggregation through local financial intermediaries will help link GHG conditions to lending practices	Traditional financing approaches supply the missing middle without GHG conditionalities or terms
Increasing transparency and elaborating categories reduce investor uncertainty and perceived risk	Lack of clear and concise taxonomy and low transparency make results measurement and conditional finance difficult
Increasing transparency and standardizing investment standards reduces data needs while increasing available data; Project aggregation and standardization helps reduce data needs for due diligence	Lack of data and statistics makes due diligence difficult

Note: GHG = greenhouse gas; MDB = multilateral development bank.

Six investment opportunities

This section proposes six investment opportunities that combine financial practices and mitigation pathways that could be developed and tested to showcase climate finance mainstreaming into the animal protein sector. These opportunities can be used to demonstrate feasibility in future initiatives (Table 5.2).

The challenge is to develop innovative technical and climate financing practices that not only reach and serve clients in animal protein value chains, but that also address obstacles, achieve significant mitigation goals, are financially viable, and can mobilize climate finance – often competing with traditional finance.

TABLE 5.2 Overview of Key Elements of Potential Financial Practices

Financial Practice	Funding Source/Flow	Potential transformative levers	Recipient
1. Sector-specific credit line with climate conditionalities	• MDBs/IFIs ideally as mezzanine or risk bearing capital blended with: • Local rural banks • Local green banks and strategic investment funds • Microfinance • IFIs or similar • Government credit lines • Philanthropic funds	• Sector policies • Financial sector reform • Climate intelligence and data	• Local project level farms and communities • Local FIs and second tier banks • Financial intermediaries with a good rural outreach
2. Value chain finance promoting native ecosystem protection	• Corporations • Own finance, FDI • Local green banks and strategic investment funds • Consumer crowdfunding or blockchain smart contracting • Philanthropic funds	• Project-based policy • Fiscal policy • Innovation and tech transfers	• Upstream value chain actors, including producers
3. Animal protein sector participation in emissions trading schemes	• Carbon market finance from private operators or government • Supplementary funding sources possible, for example, own finance or project finance, such as an innovation fund supplied by share of proceeds or allowance auctioning	• Carbon markets • Climate intelligence and data	• Project owners (farmers) potentially through financial intermediaries such as offset providers and traders • Funding stream depends on market design, for example, who owns the resulting credits
4 Programmatic support for policy changes	• ODA grants from donor countries MDBs • IFIs	• Project-based policy • Fiscal policy • Trade policy • Innovation and tech transfers	• Budgets of authorities or policy areas owning legislation

Financial Practice	Funding Source/Flow	Potential transformative levers	Recipient
5. Sourcing deforestation-free feed from Verified Sourcing Areas (VSAs)	• Grants, precommercial loans, or concessional loans by MDBs • Technical assistance and know-how by supply chain operators and local authorities • Own finance of relevant offtakers, traders, or supply chain actors	• Fiscal policy • Financial sector reform • Sector policies • Climate intelligence and data	• Local VSA specific special purpose vehicles operated and controlled by relevant actors
6. Prize-based climate finance programs for technical innovation	• Private impact investors • Microfinance • Competition managers (e.g., AgResults) • Philanthropic funds	• Innovation and tech transfers • Climate intelligence and data	• Local project level farms and communities • Financial service providers for rural producers (MFIs)

Note: FDI = foreign direct investment; FIs = financial institutions; IFIs = international financial institutions; MDBs = multilateral development banks; MFIs = microfinance institutions; ODA = official development assistance; VSA = Verified Sourcing Area.

Condition credit lines on climate mitigation actions

Efficiency gains by low-productivity cattle, sheep and goat producers in mixed crop-livestock systems offer a promising avenue for sustainability gains. They enable concomitant reduction of GHG emission intensity and improvement of financial returns, as well as other benefits, such as food safety and natural resource use efficiency. Achieving these efficiency gains requires the adoption of practices such as feed ration balancing, year-round feed and water management, animal health and reproductivity management, and nutrient and organic matter recycling. Especially among smallholder farmers, lack of skills in finance and markets, as well as knowledge gaps limits access to finance to reduce GHG emission intensity. Climate finance can help address these constraints.

Climate finance can contribute to improving smallholders' access to financial and knowledge resources that will enable the adoption of practices that generate mitigation outcomes. This may take the form of concessional loans, de-risking investments, provision of technical assistance, or a combination of those.

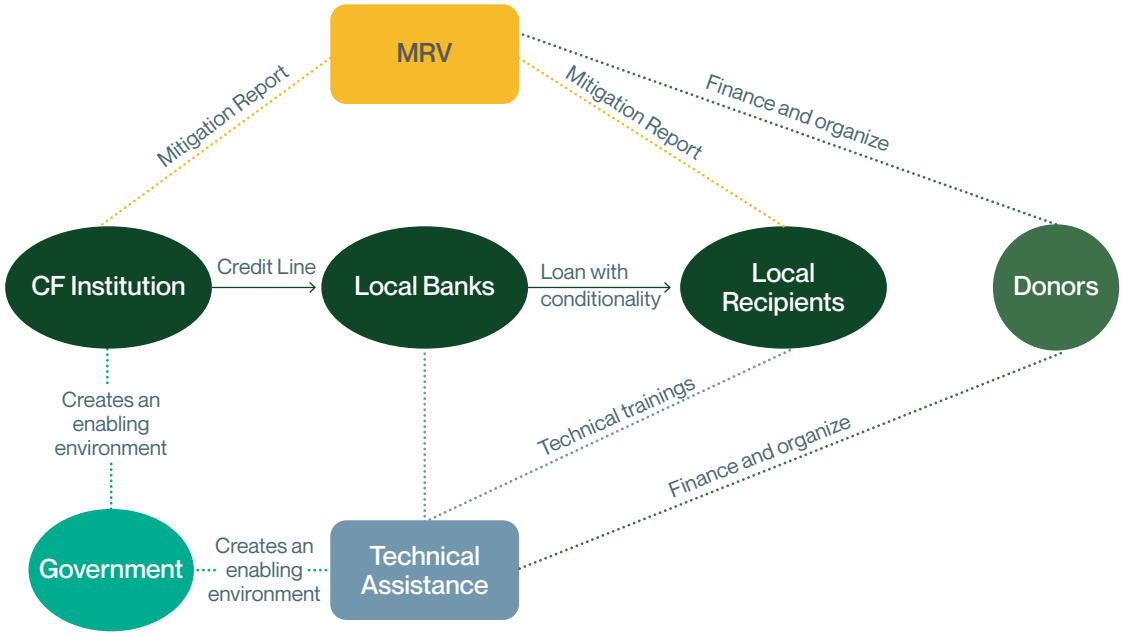
Climate mitigation finance embedded in commercial financial products—such as credit lines conditional on mitigation actions/outcomes accompanied by technical assistance delivered through a value-chain approach—can be a powerful tool for simultaneously tackling multiple adoption obstacles. This would increase farmers' access to credit while providing the technical assistance

necessary to build farmer capacity such as expertise in farm management and animal husbandry technologies and practices with climate change mitigation potential. It would also lead to multiple and significant co-benefits using a packaged approach (increased productivity, record keeping, quality control, sanitary standards, traceability) and advance farmers' integration into commercial aggregated value chains.

In one potential general arrangement (Figure 5.1.), a Climate Finance institution provides a credit line to one or several local banks. This credit line has a concessional component such as a low-interest rate, a longer term, or a grace period. The local bank can use the credit line to provide loans to specified beneficiaries (producer organizations, dairy processors, farmers). This credit line is only used for a specific type of loan for defined activities that will limit the GHG intensity of a given livestock production smallholding while ensuring additional co-benefits.

Several mechanisms can contribute to de-risking the credit offered to beneficiaries. The local banks access favorable credit conditions from the Climate Finance institution, which lessens their refinancing risk. Technical assistance will be required to reduce risk, such as farmers' training, or to lower

FIGURE 5.1 Credit Line with Conditionality.



Source: Authors' conceptualization.

the disbursement costs, such as sourcing of beneficiaries and help with due diligence. The initiative would closely partner with the government to create an enabling environment for the beneficiaries to succeed in their project. Monitoring and evaluation are organized between the beneficiaries and the Climate Finance institution to report the mitigation results.

To be successful, such an initiative would count on several types of financing. With access to a low-cost credit line, private banks can offer concessional loans to farmers conditional to implementing some environmental practices. Technical assistance may be financed by ODA grants, rather than the private element, to ensure the profitability of the project. The combination of ODA and favorable institutional credit lines would allow some leverage of private investments from local banks.

Areas, such as Sub-Saharan Africa, characterized by increasing demand for milk and meat products, relatively low productivity, and rising access to markets and financial products for producers, would offer the best conditions for this type of investment opportunity. It may contribute to enable sustainable intensification to meet expected growth in demand for dairy and meat products, at lower emission cost than business as usual growth.

This approach addresses two main obstacles to efficiency gains in smallholder ruminant-based systems: a shortage of financing infrastructure that can bridge international finance institutions' access to such farmers; and a weak and vulnerable income base together with irregular cash flows and inadequate collateral that often prevent access to finance.

The investment approach also effectively removes some of the obstacles to climate finance flow in the animal protein sector: by involving local financial institutions, it resolves potential issues of competition between climate finance and traditional financing. The involvement of local financial institutions and producers' organizations also allows a reduction in the costs of servicing numerous and widespread smallholders.

Aggregation and Technical Assistance. In order to leverage access to financial instruments, stakeholders need to encourage and facilitate smallholder aggregations into cooperative systems or as participants in PPPs to enhance efficiency, increase market power, and raise economic output. The role of local and regional aggregators and post-farm processors is key because they can also provide smallholders with advisory services and link them to input and service providers, serving as a catalyst for the introduction of new technologies in rural areas and in smallholder pastoralist communities. The role of ODA is central to any offer of technical assistance required for the preparation and implementation of the project. This will limit the risk for the lenders and ensure the environmental conditionality of the credit scheme.

Financial design. Such financing mechanisms should offer flexible installments, make use of simple infrastructure for aggregation, and could use indexed

approaches linked to local downstream industry performance, prices, and markets. This requires specific designs adapted to local needs and conditions.

Alignment with the institutional and policy framework. The conditional credit line approach will only be successful if formulation takes account of the prevailing policy and regulatory environment. It may be the case that negative policies or those that do not facilitate this approach will have to be modified or abandoned altogether and replaced by regulations and standards directed toward low-carbon and climate resilient transformation of the sector.

Data and monitoring. It is important to close data gaps regarding baseline emissions. Specific MRV systems can be adapted from existing versions or modified to suit the requirements of this approach.

Encourage value-chain finance for native ecosystem protection

Latin America continues to have the highest area of deforestation in absolute terms. Forest clearance is most often driven by animal protein value chains, be it conversion to farmlands for feed production or expansion of pasture for grazing. Deforestation especially threatens the Brazilian Amazon and Cerrado; the Gran Chaco shared by Argentina, Bolivia, Brazil, and Paraguay; and the Atlantic forest in Paraguay. The expansion of the cattle product market in South America beyond southern Brazil and central and northeastern Argentina started mainly in the late 1990s, in part due to increased demand from China. The governments of the countries within Latin America and the Caribbean have begun and expanded upon initiatives to combat deforestation led partially by consumer demand for sustainable beef.

Halting deforestation in Latin America requires the adoption of different practices by cattle ranchers, beef aggregators and processors, and regulators in equal measure. One relevant policy approach is through the NAMA plans. For example, the Resource Efficiency Program for Brazil's Beef Supply Chain NAMA forms part of the NDC to restore 15 million hectares of forest by 2030 and to reduce national emissions by 37 percent below 2005 levels by 2025 (NAMA Facility).[34]

A specific financial obstacle related to the mitigation pathway of avoiding deforestation is the challenge of pricing the protection of an asset and integrating this price into products consumed at the end of a complex global value chain far from the asset. The asset is tropical forests, but the product range potentially causing deforestation (or degradation) is wide, with products originating from livestock production only part of the responsible agents. Compared to many of the other forest risk commodities,[35] livestock products have very low certification rates, making it even more difficult for buyers (processors,

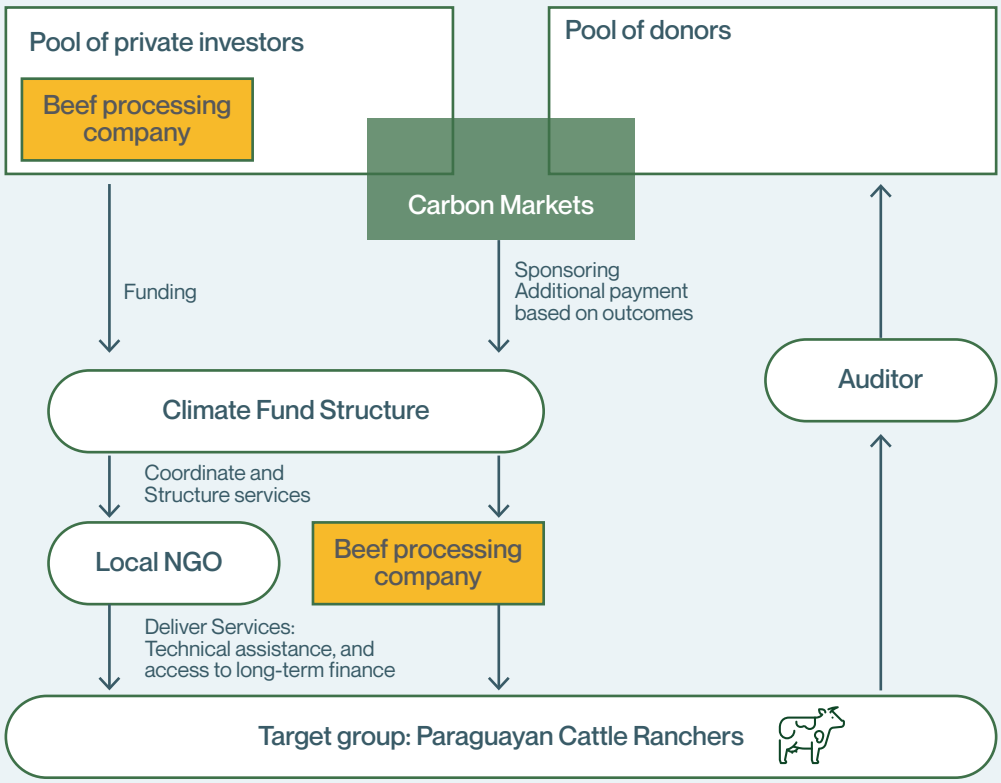
34 See https://www.nama-facility.org/projects/brazil-resource-efficiency-program-for-brazils-beef-supply-chain/

35 See, for example, the CDP website's information on forests at https://www.cdp.net/en/forests and Pendrill et al. 2019.

retailers, and end-users) to transfer market preferences and price signals upstream to farmers (IDH 2020). The economic intervention needed to avoid deforestation must change incentives for landowners and farmers so that productivity improvements without expansion of rangeland are preferred and more attractive. From a farmer's point of view, access to finance to enable the uptake of new technologies, improve practices, or achieve productivity gains is crucial. In addition, increasing transparency and accountability across the entire value chain can help to strengthen low-carbon efforts on a global scale. Demand from consumers for low carbon beef will encourage producers to join agreements or associations that promote collaboration toward sustainable beef.

The whole beef value chain needs to be engaged in limiting the GHG emissions induced by the sector. A possible structure to allow this to happen would use a debt or equity instrument or a mix of both (Figure 5.2) for the potential use of carbon finance through crediting schemes, such as VCS or Gold Standard.

FIGURE 5.2 Potential Blueprint Set-Up



Source: COWI, 2020.

The involvement of the main beef processors is essential, and the potential investment should leverage their apparent willingness to limit deforestation. These stakeholders can act as aggregators and financial intermediaries who can also provide value chain finance to upstream partners/producers (see the cocoa sector example, Box 3.3). In 2009, Brazil's largest meatpacking companies (Marfrig, Minerva, JBS, and Bertin), which are also part of the larger Global Roundtable on Sustainable Beef, agreed to stop purchasing meat grown on lands that were deforested after October 2009 by signing the G4 zero-deforestation agreement (Gibbs et al. 2015). The G4 agreement goes further than the Termo de Ajuste de Conduta (Term of Adjustment of Conduct agreement) (TAC), which only prohibits buying meat from ranchers involved in "illegal deforestation" as specified by the forest code.

A pool of donors would finance the technical assistance required to make this structure viable. Their allies in a pool of investors will serve to fund the sector's intensification to generate additional revenues. Both financing activities will be coordinated and structured by a central Climate Fund structure. The Climate Fund will invest in processing companies to finance the transformation of the sector. The processing companies will have the responsibility to incentivize cattle ranchers to improve their production processes and reduce their production's GHG intensity. Several mechanisms can be used, such as price incentives, technical assistance, and financing capacities. The structure provides flexibility in how these mechanisms can be used and combined to offer sufficient incentive to cattle ranchers to improve their practices.

Such an arrangement could enable a regional fund to help the transition of beef production in other South and Central American countries. An initial case could serve as a pilot project under this funding arrangement. Based on the success and learning from the pilot, a mechanism could be built to enable extension to other situations. A regional fund dedicated to animal protein value chains would leverage the impact of scale, particularly concerning the deforestation-beef production nexus.

Relying on value chain coordination and engagement, the approach directly addresses two of the obstacles identified above: the involvement of many smallholders that are often spatially widespread but all participating in the value chain, and the transmission of pricing signals along the chain.

The value chain approach, and the mobilization of private capital is also potentially an effective way to improve consumers' perception of the sector's commitment to GHG emission reduction and environmental sustainability goals, in general.

Traceability. A reliable traceability system is the cornerstone of this investment opportunity, in particular, to be able to trace cattle that have potentially been sourced from illegally deforested areas. However, tracking schemes—from birth to the sale of cattle to slaughterhouses—are rarely consistently implemented in the region. In addition, it is difficult to track the emissions related to feed production. Uruguay's Animal Identification and Registration System

(SEIIC) is a notable exception and has indeed enabled the country to access high-end markets with environmental requirements.

Advances in remote sensing, information technology, and approaches such as block-chain or cross-analysis of statistical databases offer avenues to develop such traceability systems. Once they are operational, climate-smart and deforestation-free practices can be imposed through value-chain contracts—between breeder-rancher-slaughterhouse-processors—that ensure effective monitoring of livestock, including their emissions. Financial incentives (a higher price for deforestation-free beef) and technical assistance will be required to foster the adoption of such practices, along with a robust legal framework (with inspectors) to enforce adherence.

Global traders or retailers that control parts or all of the value chain are among the best-positioned actors to incentivize such development and enable value chains to demand price premiums.

Stakeholder alignment. Related to the above, an important aspect when developing such investment opportunity will be the identification of points of convergence and common interest among stakeholders in the value chain. This will involve building trust through the sharing of information, margins and risks along the value chain, and the identification of practical areas of collaboration.

Deforestation regulation. To be effective this approach must be aligned with national policy frameworks and national climate commitments that will provide the overall regulatory framework and support infrastructure to the transitioning of the beef value chain. These include measures that halt deforestation (e.g., forest codes, land registry, remote and on-site surveillance and policing), and support to sustainable intensification (R&D, extension and advisory services, subsidy programs).

Drive clean investment through Emissions Trading Schemes

Rationale and justification

Emissions trading schemes (ETS) constitute a rapidly developing market-based approach to controlling GHG emissions. They operate at various scales; the largest schemes currently operating are the European Union Emission Trading Scheme, the California scheme, and the New Zealand Emissions Trading Scheme. In essence, a central authority allocates a limited number of GHG emission permits, and emitters are required to hold permits in amounts equal to their emissions. Polluters who want to increase their emissions must buy permits – or credits – from others willing to sell them.[36] The revenues from the sale of carbon credits provide financial incentives to invest in and implement low-carbon emission practices or carbon sequestration activities.

36 https://parlinfo.aph.gov.au/parlInfo/download/library/prspub/2501441/upload_binary/2501441.pdf

While ETS have been successfully developing worldwide for many sectors (clean energy and transportation), the agriculture sector has been mostly excluded. Agriculture, and livestock, in particular, represents a marginal part of existing schemes because carbon crediting can be perceived as an insufficient incentive for implementing carbon reductions, and the agriculture sector has resisted ETS from fear of adverse effects on food security and rural livelihoods.

However, new technologies, such as remote sensing and satellite imagery, can lower the MRV cost and make ETS more applicable to the livestock sector. Mitigation and sequestration practices also attract more interest from livestock producers because of their perceived long-term profitability, while carbon credits could provide additional financial support for their implementation. Hence, in 2019, the New Zealand Interim Climate Change Committee proposed integrating the agriculture sector into the New Zealand ETS by 2025. This would put a price on livestock and fertilizer emissions requiring farmers to pay for them.

Investment opportunity

As more ETS operators consider the agricultural sector for full inclusion (thus placing the sector under the overall ETS GHG emission cap), or as a simple provider of credits (outside the cap), there is an opportunity for the livestock sector to generate credits that can then be marketed as part of an offset of the trading system.

Emissions eligible for trading could follow the IPCC categories of manure management and enteric fermentation. Well-established practices exist for their mitigation. Manure management is already included in the methodology of the CDM on methane recovery in animal manure management systems.

Regenerative agriculture has also proved to be a valuable carbon sequestration option and could be included in ETS. Soil organic carbon has been tested and proved profitable for livestock producers, both for the quantity of carbon credits generated and for additional benefits in the long term (see Box 3.5).

An essential element of any ETS is the MRV system and its protocols, allowance allocation principles, registry systems, and a governance system of laws and statutes to regulate all of these. There are significant financial considerations for an ETS and its expansion because it requires regulated entities to implement new technologies, which may be costly. Implementation costs of methane capture technology, for example, could be prohibitive for smallholders. In many of the LMICs in question, the livestock sector is dominated by smallholders. In the pilot phase of the Kazakhstani ETS, support from the World Bank could be crucial in achieving success and uptake. Once a market is established and a scheme is self-enforcing, support can be eased, eventually operating independently. However, reliance on a consistent carbon price can prevent a successful ETS.

On a policy level, an ETS may cause overlap with mechanisms already in place to mitigate emissions, such as subsidies. For example, subsidies or payments

delivered to farmers for environmentally friendly practices could cause a decrease in their emissions, thus creating allowances under the cap for firms in other sectors to increase their emissions. Taking this as a type of leakage must be considered when analyzing the viability for a new or expanded scheme to operate in a given geography. Countries that may already have low mitigation efforts on a policy level could be strong candidates for a well-functioning ETS that integrates livestock value chains (OECD 2011).

Integrating the livestock sector into any ETS could provide additional incentives to livestock farmers to implement mitigation strategies and further improve the livestock sector's climate benefits.

Obstacles addressed

Integrating the livestock sector into an ETS would address several bottlenecks that currently limit climate finance flows. The rigor of the GHG accounting would send a clear signal of the mitigation potential of the sector. It would also contribute to mainstream MRV methodologies and allocate the required research to lower their costs.

Carbon crediting provides additional incentives to implement mitigation strategies in the livestock sector and can reduce the perceived lack of financial attractivity of such projects. Depending on the per-ton carbon price, carbon crediting can contribute to making some costly mitigation practices profitable. It is also a way to involve the private sector in financing the transition of the livestock sector toward more environmentally sustainable practices.

Finally, developing an ETS at the national level will provide the stimulus needed to generalize and scale up low-emission livestock production practices.

Next steps-business development

Implementing a national ETS for the animal protein sector should draw lessons from successful carbon crediting schemes, such as those found in the clean energy sector.

When developing an ETS, it will be essential to evaluate the sector's mitigation and sequestration potential and determine realistic caps and baselines. A business case should be developed to assess the carbon credit prices required for the set of mitigation and sequestration strategies to be implemented, including an assessment of potential implication for food output and food prices. It is also essential that the credits generated in the livestock sector match the level of certainty of those generated and spent in other sectors under the ETS. There is, for example, a need to address the (im)permanence of carbon stocks in soils and biomass, compared to the immediate and irreversible release of carbon dioxide from fossil fuel consumption.

Cost-efficient MRV methodologies remain crucial for the success and relevance of integrating the livestock sector into an ETS. The use of new data acquisition and management technologies will be essential to reach this goal.

Reward proactive policy commitments through ODA

Rationale and justification

Many of the facilitators that can improve the financial and technical feasibility of investments in a sustainable and low-GHG-emission livestock sector are under the influence of governments and operate within the policy, institutional, and regulatory context established by the public authorities. Hence, enabling the transformation of animal protein value chains and enhancing the viability of climate finance opportunities requires strategic work with governments, research institutions, and industry organizations through policy-based lending or grants.

Some examples of enabling policies in the livestock sector include Mongolia's National Livestock Program, which sets limits on the number of animals based on the carrying capacity of the grasslands. In Nepal, the Forest Policy regulates livestock access to forested land based on fodder production estimates, to improve forest management and increase fodder production by community efforts (Alves-Pinto et al. 2015). Some countries have also set up policy frameworks and strategies to promote efficiency gains and market linkages along the value chain, such as Burkina Faso's 2010–2015 National Sustainable Development Policy for Livestock, and Ethiopia's and Rwanda's Livestock Master Plans (Enahoro et al. 2019).

Potential investment opportunity

Repurposing national livestock policies and associated subsidies toward greater sustainability and climate benefits can be a crucial part of a country's climate-change agenda. Governments can provide the necessary incentives for producers to adapt their practices. Such programs can be part of sectoral strategic plans, NDC road maps, NAMAs, or broader national development planning.

Through such programs, governments can redirect public support to producers, build capacities, improve access to resources and information, and establish governance structures and MRV systems while providing coordinated, synergistic and systemic responses to climate change and more efficient investments in the sector. Working at the government level prevents the duplication and fragmentation of action on climate change.

When new and innovative means to finance mitigation and adaptation activities are being rolled out, they need to be done in parallel with changes to the national enabling environment that are required to scale-up climate activities in the livestock sector: combining policy-based levers with fiscal and trade policy instruments will transform the animal protein sector at the country level. The World Bank's Program for Results (PforR) and Development Policy Operations (DPO), as well as budget support provided by the EU under the Global Public Goods and Challenges thematic program, are instruments that can support this kind of approach. See Box 3.6 on Kazakhstan.

Obstacles addressed

Policy-based climate finance directly addresses one of the obstacles identified previously in this report: the weak or counterproductive policy frameworks for the animal protein sector and climate change, in combination with the absence of a sense of climate action urgency among some supply chain actors.

Providing a clear policy vision and implementation pathways is an important signal of political commitment toward climate change actions. It will lay the groundwork for additional private investment flows.

It also provides an opportunity to address some of the other obstacles more effectively; in particular, the cost of servicing smallholders that are often spatially widespread, and the lack of shared data and information.

Next steps

Repurposing policy frameworks involves a number of interdependent stages, as with any policy formulation process: climate-related problem identification, policy agenda setting, policy formulation analysis and consultation, policy adoption, and policy implementation and evaluation. The preparation of policy-based lending may involve all of these stages or be limited to identifying and refining objectives for support within existing national programs.

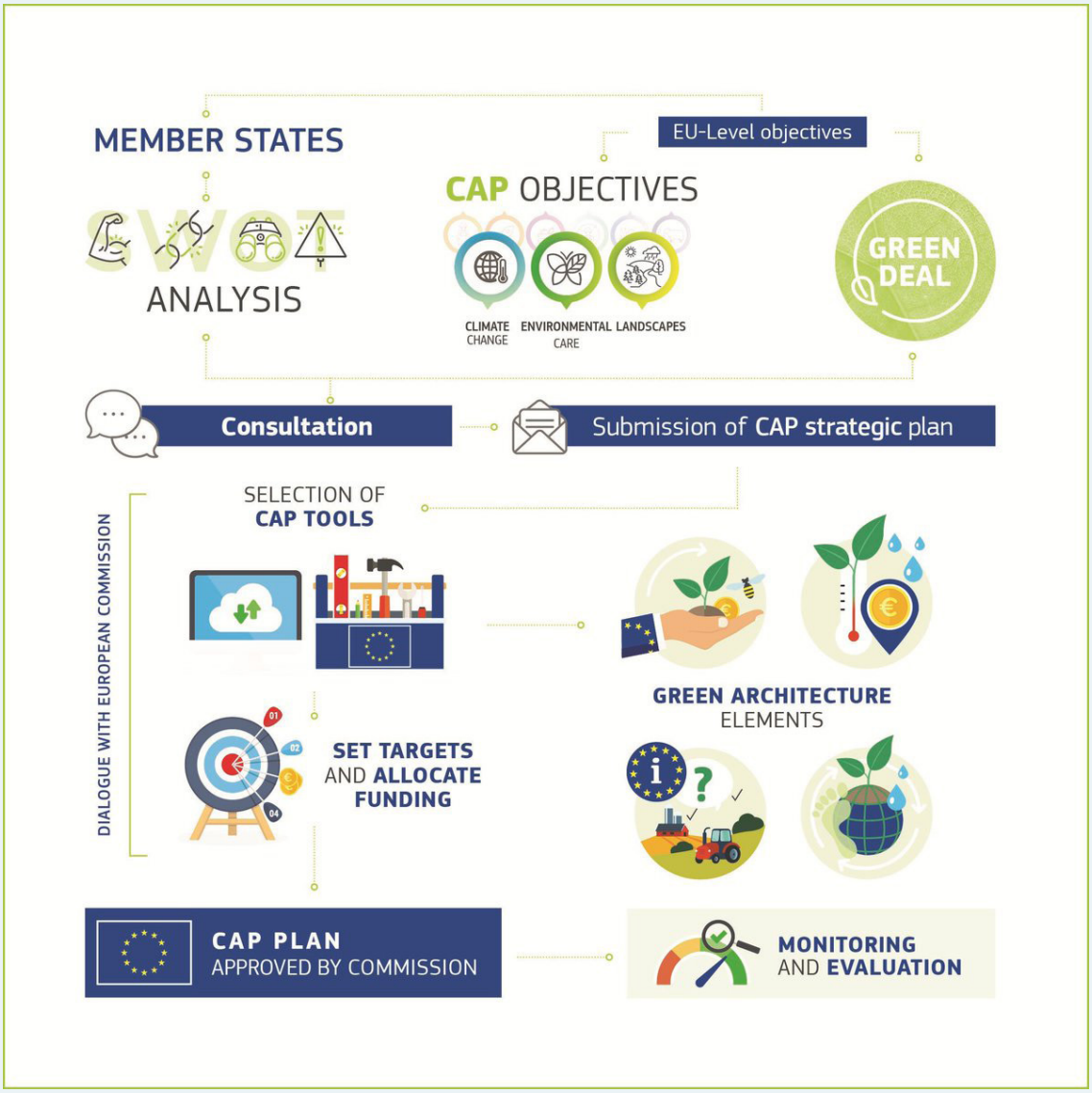
Developing such programs can leverage lessons learned in the implementation of similar initiatives. The EU programmatic approach to tackling climate change is one example that can be used to define the architecture of policy changes at the country level (Figure 5.3).

The EU has defined a new structure to facilitate the integration of climate objectives into its post-2020 Common Agricultural Policy (CAP). The green architecture of the new CAP sets some specific mitigation and adaptation objectives and makes environmental conditionality mandatory for farmers. Regulations ensure a mandatory minimum level of environmental protection through obligations related to climate issues, such as the maintenance of a portion of permanent grassland or a ban on burning arable stubble. In return, the CAP strategic plan offers support options, such as rewards for the the introduction and maintenance of wet agriculture and assisting the transition of water-dependent farming systems toward water-efficient systems.

Member states are invited to prepare CAP strategic plans after their analysis of the potential of several climate strategies. These strategic CAP plans are required to set quantifiable objectives in line with the green architecture established by the EU. The European Commission then approves the CAP plan and implements MRV strategies.

Such program architectures can be replicable in the livestock sector in LMICs and can play an essential role in the sector's transition toward low-emission practices.

FIGURE 5.3 Green Architecture of CAP



Source: European Commission

Verify sustainable sourcing of livestock feed

Rationale and justification

Livestock production systems, especially those where farms rely on external feed, produce several types of emissions: both direct (on-farm) and indirect (off-farm, associated with the production of feed and other inputs). Investments into improvements in one part of the system might lead to leakage, including an increase in GHG emissions, impacts on biodiversity, and livelihoods elsewhere in the local, regional, or global agricultural production system. In particular, improving animal productivity through feeding efficiency can drive up the demand for internationally traded feedstuffs, such as soybean and palm kernel cakes, that are cultivated in deforested areas.

Potential investment opportunity

The key to addressing these interactions is to extend the scope of the system or geographical area that can benefit from the financing. This is the principle behind Verified Sourcing Area (VSA) initiatives. A VSA is a confined jurisdiction in which all farmers, processors, stakeholders, authorities, and relevant businesses are included in a verification system. With a VSA approach, the goal is to validate mitigation results (or other outcomes) achieved by the system, to justify eligibility for financing. Through this mechanism, any interested party (buyers, traders, or other actors) can access information on the region of origin of feed, as well as the impact and progress of related sustainability measures, thus providing a better understanding of impacts along the feed value chains. This approach is limited to value chain integration and finance: points where consumer-side companies or downstream processors invest in processing or aggregation facilities and target farm-level investments.

The VSA mechanism also acts as a connector between multiple stakeholders within a region to promote collaboration on setting targets and objectives leading toward sustainability. Beyond deforestation, the VSA system also focuses on labor and land tenure, as well as livelihoods, involving not only the production environment but also demand along the supply chain. Climate finance instruments, such as concessional loans, can support a sector-based approach. Grants should be deployed to foster the development of climate intelligence and data adapted to the VSA.

Obstacles addressed

This opportunity mainly addresses methodological and implementation obstacles. On the methodological side, the combination of public and private data collection at the VSA level, including through digital technologies, can be a way to overcome obstacles associated to the lack of information to support MRV mechanisms. On the implementation side, stakeholder coordination at the local level is embedded in the development of VSAs.

Next steps – business development

Digital technologies have a strong potential to support the development of VSAs and the inclusion of smallholder farmers by reducing the cost and inequity in access to information markets. Other considerations for creating and maintaining an effective VSA model include: building in targeted support for skill development, ensuring a clear role for the public sector in minimizing entry obstacles to the VSA systems, as well as maintaining good data governance; these can all be additional benefits.

Major overlaps exist between the business development of a VSA set up in part to attract investment and the value chain finance of low-carbon beef. In particular, operationalization at the VSA level (on data collection or stakeholder coordination, for example) needs to be combined with traceability downstream in the value chain (see Section 5.2.2).

The conditions for climate finance for VSAs are twofold: a legal entity serving as aggregator and candidate for investment must be present; and indicators and indices must be available and able to monitor improvements in GHG emissions (and other impacts). The opportunity for a climate financing approach to this setup will depend on secure land tenure, a functioning governmental system, and a jurisdiction with available data. VSAs represent a very promising mechanism for shifting global agricultural production toward sustainable practices, especially in LMICs and where agricultural and livestock production is tied to environmental risks such as deforestation, soil erosion, and water pollution, among others.

Innovate in livestock climate finance through prize-based programs

Rationale and justification

The research and development (R&D) into new technologies, products, and practices is essential to advancing mitigation pathways, both in accessing technical potential for mitigation and enhancing the cost-effectiveness of mitigation in the livestock sector (see Figure 4.1).

Research undertaken in the livestock sector of selected African countries shows that GHG emissions intensity and other environmental externalities are lower when public investments in agricultural R&D are higher (Spada et al. 2019). Data from the Agricultural Science and Technology Indicators (ASTI), however, shows that agricultural research in Africa suffers from underinvestment; total regional investments in agriculture actually declined between 2014 and 2016 (Carden et al. 2019).

Where risks are high and commercial viability seems remote, R&D into new technologies is generally publicly funded (TEC 2017). Innovation to reduce GHG emission reductions through better animal feed and improved health, or to lower emissions from farm machinery and equipment could offer

considerable opportunities but it depends on engagement from private sector manufacturers. Attracting private sector R&D to research into the identification of technical developments that would result in mitigation in the livestock sector depends on increasing the prospects for decent returns on such investments in the short to medium term. Where market leaders have been working on pilots and prototype equipment, there have been no commercial launches of new products or practices (Ahmed et al. 2020).

Investment opportunity

Investing in R&D would increase research efforts into mitigation pathways for the livestock sector. It could be done through prize competitions, which encourage innovation and technology transfer, overcome obstacles to bringing technology to market, and contribute to catalyzing change in the sector.

Philanthropists and governments have used prizes to produce societal benefits through innovation, engagement, and implementation of improved practices. A promising approach is Program-for-Results (PfR) in R&D, encouraging the private sector to harness the power of the market to promote the adoption of technologies with a high-yield development impact. The advantages of PfR prizes are: heightened awareness along the value chain of global problems; results-based funding where prizes are won only after pre-defined results are achieved (partial failure does not, necessarily, mean full loss of funding); and process-agnosticism – funders of the initiative do not need to predict or prescribe the actions to produce the desired result because prizes are awarded based on achievements not on how they were obtained (AgResults, 2020a; 2020b, see also https://agresults.org/learning/56-takeaways-from-seven-years-of-using-prize-competitions-to-transform-markets/file).

Prize competitions outshine traditional ODA grants to R&D for several reasons:

- They are results-based.
- They encourage competition between innovators and manufacturers/and/or innovators.
- Only one company may win the prize, but several new products can be launched as a result of the competition.
- They have a strong marketing and communication value, due to open, competitive, and media-friendly attributes.
- By stirring competition, PfR prize competitions profit from market dynamics to promote the adoption of innovative mitigation technologies in a highly leveraged and results-focused way (McKinsey & Company 2009).

In addition to the prize-competition mechanism, at the demonstration stage, venture capital funding can accelerate climate-related R&D activities (TEC 2017).

Obstacles addressed

This investment opportunity primarily leverages new technologies and innovation to address technological and methodological obstacles on mitigation pathways, but also to lower the cost of mitigation for value chain stakeholders, as well as to increase the availability and reduce the cost of data for MRV. Some of the specific obstacles addressed include lack of technological readiness for mitigation; absence of models and approaches for the quantification of mitigation potential; unavailability of cost-efficient MRV systems, and related data acquisition procedures; and lack of traceability systems.

Next steps – business development

Prize competitions can be a means of overcoming technology-unreadiness or market obstacles in a confined geography. The prize could be implemented by relevant institutions or organizations, in cooperation with agriculture, science, and technology networks, and financed by donor agencies or philanthropies.

International development organizations with on-the-ground implementation experience could support this opportunity by providing a market for developed products. Prize competitions may involve the entire value chain and act as a market mechanism through competition between actors.

6 Concluding remarks

The animal protein sector is critical to livelihoods and food security. However, it also contributes 14.5 percent of global anthropogenic GHG emissions through enteric fermentation, feed production, manure management, fossil fuel consumption, and land use change.

Climate change impacts the sector directly through animal mortality and lower productivity, and indirectly through feed and pasture productivity, disease patterns and changes to water and feed resources, which then impacts livelihoods and food security.

Yet, there is a vacuum in integrating climate finance to the sector or seizing additional opportunities in animal protein investments that can lead to environmental, economic, and social benefits. Indeed, the livestock sector offers large and bankable mitigation options.

Transforming the sector toward a low-carbon and climate resilient development path may take time, but it is possible if sustainable practices are adopted—ideally with a value-chain approach. Fortunately, cost-effective and quick-win practices—such as improving manure management, feeding and animal health—are available. Moreover, they can result in triple outcomes: mitigation through reduced emission intensity; adaptation through resource use efficiency and nutrition improvements; and increased incomes or higher returns on investment through productivity and efficiency gains. Longer term shifts also exist – such as land management, breed improvement and herd management – that can deliver large scale reduction of net emissions together with further progress on resilience and economic outcomes.

Climate finance can trigger a faster transformation toward low-carbon development, in this emission-intensive sector, and with larger emission reductions. It can enable the adoption of known best practices as well as encourage innovation and research, with additional environmental and economic benefits.

This report explored investment opportunities and addressed financial mechanisms and levers that can be used toward achieving climate goals. It argued that simple financial practices can be implemented in current business models and demonstrated how climate change can be mainstreamed through both traditional finance mechanisms within the existing infrastructure.

The IPCC's Fifth Assessment Report (2014) stated that intersections of climate change with livestock systems are crucial, yet understudied research areas. This report stimulates further research and initiates dialogue among experts and practitioners about the mitigation potential of the sector and the climate finance and relevant investments needed to realize such potential. It is part of a wider global reflection on the transformative potential of climate finance. In the development of the report, consultations with a variety of experts and stakeholders took place, bringing together a group of interested and engaged communities in the climate finance and animal protein sectors.

Measurement, reporting, and verification (MRV) capacities remain an obstacle for directing finance toward the mitigation of GHG emissions produced by

the animal protein sector. However, several tracking and monitoring systems adapted to the sector exist and are scalable, and rapid developments in the area of digital technologies are a source of new opportunities. The World Bank, together with its partners, is currently addressing this gap and exploring the development of financial instruments adapted to the protein sector.

This report is also the point of departure in the World Bank's development of blueprints or designs for emission reduction projects within the animal protein sector. Advised by a community of experts, the World Bank is currently developing workplans for two pilot projects involving climate finance flows whose aim is to initiate a sectoral transformation. The first pilot project is being prepared for the Kenyan dairy sector, developing a concessional credit line with environmental conditionality. The second pilot project will address the protection of a native eco-system in Latin America through the development of a value chain finance mechanism.

A lot more needs to be discussed in the climate change and animal protein sectors—overcoming challenges, testing opportunities, advocating technology, exploring potential or scaling up solutions, and encouraging innovation—to generate the GHG emissions reductions that can be produced by the sector. The development of impact investing and blended finance in the last decade offers a new type of financial mechanism that can be adapted to the livestock sector and offer solutions for existing obstacles. In addition to the growing demand to commit to climate neutrality, there is an equally growing engagement of private companies and investors to address climate change. It is an opportune moment to start looking into the means that justify the end. Let us count the ways.

References

AfDB, ADB, EBRD, EIB, IDB, ISDB, and World Bank (African Development Bank, Asian Development Bank, European Bank for Reconstruction and Development, European Investment Bank, Inter-American Development Bank, Islamic Development Bank, and World Bank. 2019. *2018 Joint Report on Multilateral Development Banks' Climate Finance.* https://publications.iadb.org/en/2018-joint-report-multilateral-development-banks-climate-finance.

AgResults. 2017. *The Case for Iterative Design: Lessons from the Uganda Improved Legume Seed Challenge Project. AgResults Lessons Learned Series* #2. file:///C:/Users/CRSC/Desktop/AgResults%20LL2_Uganda%20Redesign_Sept2017.pdf.

AgResults. 2020a. Innovation in Research and Delivery. https://agresults.org/.

AgResults, 2020b, *Takeaways from Seven Years of Using Prize Competitions to Transform Markets.* https://agresults.org/learning/56-takeaways-from-seven-years-of-using-prize-competitions-to-transform-markets/file

Ahmed, J., E. Almeida, D. Aminetzah, N. Denis, K. Henderson, J. Katz, H. Kitchel, and P. Mannion. 2020. *Agriculture and Climate Change: Reducing Emissions through Improved Farming Practices*. McKinsey & Company. https://www.mckinsey.com/~/media/mckinsey/industries/agriculture/our%20insights/reducing%20agriculture%20emissions%20through%20improved%20farming%20practices/agriculture-and-climate-change.pdf.

Alves-Pinto, H. N., P. Newton, and L. F. G. Pinto. 2015. "Reducing Deforestation and Enhancing Sustainability in Commodity Supply Chains: Interactions between Governance Interventions and Cattle Certification in Brazil." Tropical Conservation Science 8 (4): 1053–79.

Bertram-Huemmer, V. and K. Kraehnert. 2017. "Does Index Insurance Help Households Recover from Disaster? Evidence from IBLI Mongolia." *American Journal of Agricultural Economics* 100 (1): 145–71.

Bloomberg NEF. 2019. *The Clean Technology Fund and Concessional Finance: Lessons Learned and Strategies Moving Forward.* CIF (Climate Investment Fund). https://data.bloomberglp.com/professional/sites/24/BNEF_The-Clean-Technology-Fund-and-Concessional-Finance-2019-Report.pdf.

Carden, F., N. Beintema, A. Admassie, L. Katera, T. Mboghoina, and C. Onyekwena. 2019. "Informing Policy with Agricultural R&D Evidence: An ASTI Pilot Project in Ethiopia, Nigeria, and Tanzania." IFPRI Discussion Paper 01860. International Food Policy Research Institute.

Cargill. 2019. *Progress Report 2019: South American Soy.* https://www.cargill.com/doc/1432155385605/south-american-soy-action-plan-dec-2019.pdf.

Carrefour Foundation. n.d. *'Zero Deforestation' Beef Meat Production in Brazil.* http://www.fondation-carrefour.org/content/zero-deforestation-beef-meat-production-brazil. [16-02-2020].

CDKN (Climate & Development Knowledge Network). 2013. Index-Based Livestock Insurance: The Case of Mongolia. https://cdkn.org/wp-content/uploads/2013/03/Mongolia_InsideStory_Pr4Final_WEB.pdf .

Cencosud. 2018. *Carta de Compromisso: Compra Sustentavel de Carne.* https://www.oeco.org.br/wp-content/uploads/2019/02/Carta-de-compromisso-carne.pdf

CISL (Cambridge Institute for Sustainability Leadership). 2016. *Incentivising the Trade of Sustainably Produced Commodities.* A Discussion Paper prepared for the Banking Environment Initiative's Sustainable Trade Finance Council. https://www.cisl.cam.ac.uk/resources/publication-pdfs/incentivising-the-trade-of-sustainably-produced.pdf

Convergence. 2018. *The State of Blended Finance 2018*. https://www.oecd.org/water/OECD-GIZ-Background-document-State-of-Blended-Finance-2018.pdf.

COWI, Oeko-Institute, and CIFOR (Center for International Forestry Research). 2018. *Study on EU Financing of REDD+ Related Activities, and Results-Based Payments Pre and Post 2020.* Brussels, Belgium: European Commission, DG CLIMA.

COWI, ecologic, and IEEP (Institute for European Environmental Policy). (in press). *Analytical Support for the Operationalisation of an EU Carbon Farming Initiative Lessons learned from existing result-based carbon farming schemes and barriers & solutions for implementation within the EU*. Brussels, Belgium: European Commission, DG CLIMA. [Expected of publication in 2020].

CPI (Climate Policy Initiative). 2017. *Global Landscape of Climate Finance 2017: Methodology.* https://climatepolicyinitiative.org/wp-content/uploads/2017/10/GLCF-2017-Methodology-Document.pdf.

CPI (Climate Policy Initiative). 2019. *Global Landscape of Climate Finance 2019.* https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2019/.

Donofrio, S., P. Maguire, W. Merry, S. Zwick. 2019. *Financing Emissions Reductions for the Future State of the Voluntary Carbon Markets 2019.* Washington, DC: Forest Trends' Ecosystem Marketplace

Enahoro, D., N. Njiru, P. Thornton, and S. S. Staal. 2019. "A Review of Projections of Demand and Supply of Livestock-Derived Foods and the Implications for Livestock Sector Management in LSIL Focus Countries." Mid-Project Research Report of the Feed the Future Innovation Lab for Livestock Systems (LSIL) Futures Foresight Component, Module I (Quantitative Scenario Modelling). CCAFS Working Paper No. 262. Wageningen, the Netherlands: CGIAR Research Program on Climate Change, Agriculture and Food Security (CCAFS). www.ccafs.cgiar.org

FAIRR. 2020. A *Global Network of Investors Addressing ESG Issues in Protein* Supply Chains. https://www.fairr.org/

FAO (Food and Agriculture Organization of the United Nations). 2009. The state of food and agriculture. Livestock in the balance. Rome: FAO. http://www.fao.org/3/i0680e/i0680e00.htm

FAO (Food and Agriculture Organization of the United Nations). 2010a. *Grassland carbon sequestration: management, policy and economics*. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 2010b. *Land degradation assessment in drylands*. LADA. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 2017. *Livestock solutions for climate change.* Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 2018. *Shaping the future of livestock, sustainably, responsibly, efficiently.* Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 2019a. *Five Practical Actions toward Low-Carbon Livestock*. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 2019b. *Developing Sustainable Value Chains for Small-Scale Livestock Producers*. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 2019c. *Measuring and Modelling Soil Carbon Stocks and Stock Changes in Livestock Production Systems: Guidelines for Assessment (Version 1)*. Livestock Environmental Assessment and Performance (LEAP) Partnership. Rome: FAO.

FAO (Food and Agriculture Organization of the United Nations). 2020. *GLEAM 2.0 - Assessment of Greenhouse Gas Emissions and Mitigation Potential.* http://www.fao.org/gleam/results/en/.

Freitas, G. "Beef Giant Looks to Go Green With $500 Million Foreign-Bond Sale." Bloomberg, July 29, 2019. https://www.bloomberg.com/news/articles/2019-07-29/beef-giant-looks-to-go-green-with-500-million-foreign-bond-sale.

Gerber, P. J., H. Steinfeld, B. Henderson, A. Mottet, C. Opio, J. Dijkman, A. Falcucci, and G. Tempio. 2013. *Tackling Climate Change through Livestock – A Global Assessment of Emissions and Mitigation Opportunities.* Rome: FAO.

Gibbs, H. K., J. Munger, J. L'Roe, P. Barreto, R. Pereira, M. Christie, T. Amaral, and N. F. Walker. 2015. "Did Ranchers and Slaughterhouses Respond to Zero-Deforestation Agreements in the Brazilian Amazon?" *Conservation Letters* 9 (1): 32–42.

GIIN (Global Impact Investment Network). 2019. *What You Need to Know about Impact Investing.* https://thegiin.org/impact-investing/need-to-know/#what-is-impact-investing.

The Gold Standard. 2019. *Impact Registry.* https://www.goldstandard.org/resources/impact-registry.

GRA (Global Research Alliance On Agricultural Greenhouse Gases) and SAI (Sustainable Agriculture Initiative) Platform from LRG (Livestock Research Group). 2015. *Reducing greenhouse gas emissions from livestock: Best practice and emerging options.* https://www.ccacoalition.org/en/resources/reducing-greenhouse-gas-emissions-livestock-best-practice-and-emerging-options.

GRSB (Global Roundtable for Sustainable Beef). 2018. *GRSB Sustainability Report*. https://grsbeef.org/resources/Documents/WhoWeAre/GRSB_Sustainability_Report_2018.pdf.

Hansen, J., J. Hellin, T. Rosenstock, E. Fisher, J. Cairns, C. Stirling, ..., and B. Campbell. 2019. "Climate Risk Management and Rural Poverty Reduction." *Agricultural Systems* 172: 28–46.

Henderson, B. et al. 2021. "Policy strategies and challenges for climate change mitigation in the Agriculture, Forestry and Other Land Use (AFOLU) sector", *OECD Food, Agriculture and Fisheries Papers,* No. 149, OECD Publishing, Paris. http://dx.doi.org/10.1787/47b3493b-en

Herrero, M., B. Henderson, P. Havlík, P. K. Thornton, R. T. Conant, P. Smith, S. Wirsenius, A. N. Hristov, P. Gerber, M. Gill, and K. Butterbach-Bahl. 2016. "Greenhouse Gas Mitigation Potentials in the Livestock Sector." *Nature Climate Change* 6 (5): 452.

Herskovits, M. 1926. "The Cattle Complex in East Africa." *American Anthropologist* New Series 28 (1): 230–72. www.jstor.org/stable/660813.

High-Level Commission on Carbon Prices. 2017. *Report of the High-Level Commission on Carbon Prices.* Washington, DC: World Bank. License: Creative Commons Attribution CC BY 3.0 IGO.

IDH. 2020. "The Urgency of Action to Tackle Tropical Deforestation." February 2020. Prepared for IDH by FACTS Consulting, COWI A/S, and AlphaBeta Singapore. IDH: Utrecht, NL.

IFC (International Finance Corporation). 2019. *Blended Finance at IFC.* Washington, DC: World Bank.

ILRI (International Livestock Research Institute). 2019. "Meat: The Future Series Options for the Livestock Sector in Developing and Emerging Economies to 2030 and Beyond." White Paper. Geneva: World Economic Forum.

ImpactAssets. 2020. ImpactAssets 50 database. https://www.impactassets.org/ia50_new/?filters=.

IPCC (Intergovernmental Panel on Climate Change), 2014: Climate Change 2014: Mitigation of Climate Change. Contribution of Working Group III to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change [Edenhofer, O., R. Pichs-Madruga, Y. Sokona, E. Farahani, S. Kadner, K. Seyboth, A. Adler, I. Baum, S. Brunner, P. Eickemeier, B. Kriemann, J. Savolainen, S. Schlömer, C. von Stechow, T. Zwickel and J.C. Minx (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

IPCC, 2019: Climate Change and Land: an IPCC special report on climate change, desertification, land degradation, sustainable land management, food security, and greenhouse gas fluxes in terrestrial ecosystems [P.R. Shukla, J. Skea, E. Calvo Buendia, V. Masson-Delmotte, H.-O. Pörtner, D. C. Roberts, P. Zhai, R. Slade, S. Connors, R. van Diemen, M. Ferrat, E. Haughey, S. Luz, S. Neogi, M. Pathak, J. Petzold, J. Portugal Pereira, P. Vyas, E. Huntley, K. Kissick, M. Belkacemi, J. Malley, (eds.)].

Kilimo. 2018. *Executive Seminar on Index Based Livestock Insurance: Summary Report.* http://www.kilimo.go.ke/wp-content/uploads/2018/09/Nairobi_KLIP-Executive-Semiars-Final-Report_IM.pdf.

Knaepen, H. Rampa, F., Torres, C., and P. Bizzotto Molina. 2017. *Options and opportunities to make food value chains more environmentally sustainable and resilient in Sub-Saharan Africa*. New York: UNDP https://www.thegef.org/sites/default/files/publications/UNDP-GEF_VC_Study_Engl.pdf

Lang, K., A, Rodinciuc, and J. Humphrey. 2017. *Impact Investing in Sustainable Food and Agriculture across Asset Classes: Financing Resilient Value Chains through Total Portfolio Activation*. Portland: Trillium Invest.

Livelihoods Funds. 2016. *Livelihoods Fund for Family Farming.* https://www.livelihoods.eu/l3f/ .

Lynch, J. and R. Pierrehumbert. 2019. "Climate Impacts of Cultured Meat and Beef Cattle". *Frontiers in Sustainable Food Systems* 3(5).

Marfrig Global Food. 2019. *Annual Sustainability Report 2018*.

Mattick, C. S., A. E. Landis, B. R. Allenby, and N. J. Genovese. 2015. "Anticipatory Life Cycle Analysis of In Vitro Biomass Cultivation for Cultured Meat Production in the United States". *Environ Sci Technol* 49(19):11941-11949.

McDonalds. n.d. *Conserving Forests.* https://corporate.mcdonalds.com/corpmcd/scale-for-good/our-planet/conserving-forests.html.

McKinsey & Company. 2009. *"And the Winner Is ..." Capturing the Promise of Philanthropic Prizes.* https://oecd-opsi.org/toolkits/and-the-winner-is-capturing-the-promise-of-philanthropic-prizes/.

McKinsey & Company. 2013. *Pathways to a Low-Carbon Economy Version 2 of the Global Greenhouse Gas Abatement Cost Curve.*

Mottet, A., Henderson, B., Opio, C., Falcucci, A., Tempio, G., Silvestri, S., ... & Gerber, P. J. (2017). "Climate change mitigation and productivity gains in livestock supply chains: insights from regional case studies". *Regional Environmental Change*, 17(1), 129-141.

Mtimet, N. and S. Dube, editors. 2018. *International Conference on Livestock Value Chain Finance and Access to Credit: Proceedings Book from the Livestock Finance Conference, Ezulwini, Swaziland, 21–23 February 2017.* Nairobi, Kenya: ILRI.

Netting, R.M. 1993. "Smallholders, Householders: Farm Families And The Ecology Of Intensive, Sustainable Agriculture". American Ethnologist, 24, 494–497.

OECD (Organisation for Economic Co-operation and Development). 2007. *Overcoming Barriers to Clean Development Mechanism Projects.* http://www.oecd.org/environment/cc/38684304.pdf.

OECD (Organisation for Economic Co-operation and Development). 2011. *Interactions Between Emission Trading Systems and Other Overlapping Policy Instruments.* General Distribution Document. Paris: OECD. www.oecd.org/env/taxes.

OECD (Organisation for Economic Co-operation and Development). 2019a. *Blended Finance.* http://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/blended-finance.htm.

OECD (Organisation for Economic Co-operation and Development). 2019b. *Climate-Related Development Finance at the Activity Level: Provider Perspective 2012–2017.* http://www.oecd.org/dac/financing-sustainable-development/development-finance-topics/climate-change.htm, accessed February 25, 2020.

Pendrill, F., M. Persson, J. Godar, and T. Kastner. 2019. "Deforestation Displaced: Trade in Forest-Risk Commodities and the Prospects for a Global Forest Transition." Environmental Research Letters 14 (5). https://doi.org/10.1088/1748-9326/ab0d41

Rabobank. 2020. *Global Animal Protein Outlook 2020.* https://www.pluimveeweb.nl/site/assets/files/0/02/26/213/191113_rabobank_global_animal_protein_outlook_2020.pdf.

Ramankutty, N., Evan, A.T., Monfreda, C. & Foley, J.A. 2008. "Farming the planet: 1. Geographic distribution of global agricultural lands in the year 2000". *Global Biogeochemical Cycles* 22, GB1003.

Reuters Agency. *JBS S.A. Company Profile*. https://www.reuters.com/companies/JBSS3.SA/profile.

Rivera Ferre, M. G., F. López i Gelats, M. Howden, P. Smith, J. F. Morton, and M. Herrero. 2016. "Re Framing the Climate Change Debate in the Livestock Sector: Mitigation and Adaptation Options." *Wiley Interdisciplinary Reviews*: Climate Change 7 (6): 869–92.

Robb, D.H.F., MacLeod, M., Hasan, M.R. & Soto, D. 2017. "Greenhouse gas emissions from aquaculture: a life cycle assessment of three Asian systems." *FAO Fisheries and Aquaculture Technical Paper* No. 609. Rome, FAO. 110 pp.

Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., Dumas, P., Matthews, E., & Klirs, C. (2019). *Creating a sustainable food future: A menu of solutions to feed nearly 10 billion people by 2050.* Final report. WRI.

Seré, C. & Steinfeld, H. 1996. FAO. 1996. "World livestock production systems: current status, issues and trends." *FAO Animal Production and Health Paper 127*. Rome, Food and Agriculture Organization of the United Nations (FAO).

Sirohi, S. and A. Michaelowa. 2008. "Implementing CDM for the Indian Dairy Sector: Prospects and Issues." *Climate Policy* 8 (1): 62–74.

Smith, P., Soussana, J. F., Angers, D., Schipper, L., Chenu, C., Rasse, D. P., ... & Klumpp, K. 2020. "How to measure, report and verify soil carbon change to realize the potential of soil carbon sequestration for atmospheric greenhouse gas removal." *Global Change Biology*, 26(1), 219-241.

Soussana, J.F., Loiseau, P., Vuichard, N., Ceschia, E., Balesdent, J., Chevallier, T. and Arrouays, D. 2004. "Carbon cycling and sequestration opportunities in temperate grasslands." *Soil Use and Managemen*t, 20(2): 219-230.

Soussana, J. F., Tallec, T., & Blanfort, V. 2010. "Mitigating the greenhouse gas balance of ruminant production systems through carbon sequestration in grasslands." *Animal*, 4(3), 334-350.

Spada, A., M. Fiore, U. Monarca, and N. Faccilongo. 2019. "R&D Expenditure for New Technology in Livestock Farming: Impact on GHG Reduction in Developing Countries". *Sustainability* 11 (24): 7129.

TEC (Technology Executive Committee). 2017. "Enhancing Financing for the Research, Development and Demonstration of Climate Technologies." Working Paper. UNFCCC. https://unfccc.int/ttclear/docs/TEC_RDD%20finance_FINAL.pdf.

Tuomisto, H. L., M. J. Ellis, and P. Haastrup. 2014. "Environmental impacts of cultured meat: alternative production scenarios." *in Proceedings of the 9th international conference on life cycle assessment in the agri-food sector*.

UNCCD (United Nations Convention to Combat Desertification) and Mirova. 2019. *Land Degradation Neutrality (LDN) Fund.*

UNFCCC (United Nations Framework Convention on Climate Change). (2013). *Distribution of registered projects by Host Party.* https://cdm.unfccc.int/Statistics/Public/files/201301/proj_reg_byHost.pdf.

UNFCCC (United Nations Framework Convention on Climate Change). 2019a. *Introduction to Climate Finance.* Retrieved from Topics: https://unfccc.int/topics/climate-finance/the-big-picture/introduction-to-climate-finance. [Accessed 21-05-2019].

UNFCCC (United Nations Framework Convention on Climate Change). 2019b. *Joint Implementation.* https://ji.unfccc.int/index.html

UNFCCC SCF (United Nations Framework Convention on Climate Change Standing Committee on Finance). 2018. *Biennial Assessment and Overview of Climate Finance Flows.*

van Huis, A., & Oonincx, D. G. 2017. "The environmental sustainability of insects as food and feed. A review." *Agronomy for Sustainable Development,* 37(5), 1-14.

Veit, P. and R. Sarsfield. 2017. *Land Rights, Beef Commodity Chains, and Deforestation Dynamics in the Paraguayan Chaco*. Washington, DC: USAID Tenure and Global Climate Change Program.

Verra. 2015. *Verified Carbon Standard Project Database*. https://www.vcsprojectdatabase.org/#/projects.

Walmart. 2018. *2018 Global Responsibility Report Summary*. https://corporate.walmart.com/media-library/document/2018-grr-summary/_proxyDocument?id=00000162-e4a5-db25-a97f-f7fd785a0001.

WFP (World Food Programme). 2018. *R4 Rural Resilience Initiative Annual Report*. https://reliefweb.int/sites/reliefweb.int/files/resources/WFP-0000104178.pdf.

WFP (World Food Programme). 2019. *Evaluation of the Satellite Index Insurance for Pastoralists in Ethiopia (SIIPE).*

World Bank. (2016). *Making Climate Finance Work in Agriculture*. Washington, DC: World Bank.

World Bank. 2019. "MDB Climate Finance Hit Record High of USD 43.1 Billion in 2018." *Press Release* no. 2019/2020/CCG, June 13, 2019. https://www.worldbank.org/en/news/press-release/2019/06/13/mdb-climate-finance-hit-record-high-of-us431-billion-in-2018

World Bank. 2020. *Transformative Climate Finance: A new approach for climate finance to achieve low-carbon resilient development in developing countries*. Washington, DC: World Bank

World Bank Group and FAO (World Bank Group and Food and Agriculture Organization of the United Nations). 2020. *Investing in Sustainable Livestock (ISL) Guide.* https://www.sustainablelivestockguide.org.

Appendices

APPENDIX A

The Mapping of Direct and Indirect Private Finance Flows

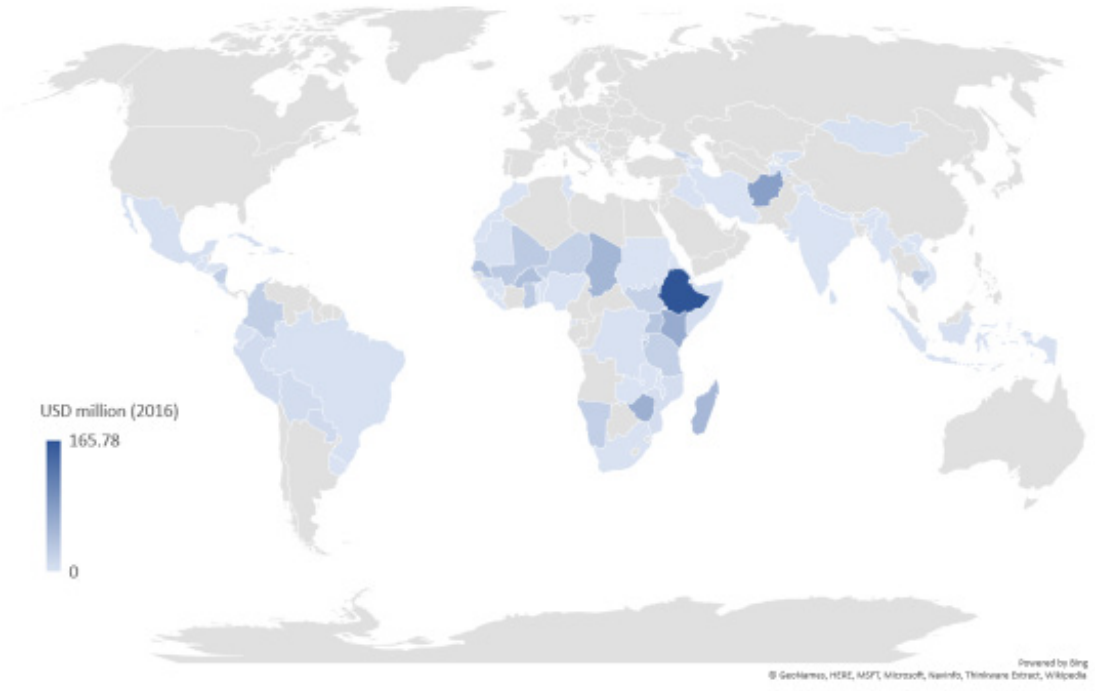
A.1 The Mapping of Climate-Related ODA Flows Directed to the Animal Protein Sector

Climate-related official development assistance (ODA) flows between 2012 and 2017 with relation to livestock are mapped to provide a picture of international public finance flows. The Organisation for Economic Co-operation and Development (OECD) climate-related ODA database captures bilateral and multilateral climate finance flows on the project level. Between 2012 and 2017, US$185.8 billion were dedicated to climate-related development projects worldwide, with only 0.57 percent (US$1,055,105,646) related to the livestock sector. Over the years, livestock-related ODA finance increased, from US$145 million in 2012 to over US$250 million in both 2016 and 2017. All of the mapped projects make use of grants, except for one adaptation project that France financed via a debt instrument, targeting the Senegalese agriculture and livestock sector. Food security dominates the narrative of the mitigation projects in the project descriptions of all climate-related ODA within the livestock sector, with 37.5 percent of the flows containing the term in their descriptions.

The donor countries with the highest share of livestock-related ODA in their portfolio are Canada (6.0 percent), Belgium (4.7 percent), and Denmark (3.0 percent). Map A.1 shows total climate-related ODA flows, revealing that most ODA climate-related funds are directed toward the Ethiopian livestock sector. In relative terms, Zimbabwe (25.4 percent), Paraguay (14.6 percent), and Chad (14.2 percent) have the highest shares of livestock-related projects in their portfolios. The geographical distribution stands in great contrast with the size of countries' livestock sectors and their contribution to climate change.

In line with the importance of livestock activities for smallholder farmers in the Global South (WEF 2019), there is a clear focus on adaptation objectives and 95.1 percent of the funds are spent with either a principal or a significant adaptation objective. Some 42.5 percent of the ODA finance between 2012 and 2017 had an underlying mitigation objective and 6.0 percent had a principal mitigation objective. Table A.1 shows the identified mitigation pathways. Silvopastoral systems in Colombia received most ODA mitigation flows, followed by improved feeding and avoided deforestation projects in Brazil, Indonesia, and Bolivia, among others. The majority of flows do not specify the mitigation pathway in their description, and the descriptions of two flows imply de facto a principal adaptation objective.

MAP A.1. Recipient Countries of Climate-Related ODA Directed to the Livestock Sector



Source: Based on OECD 2019b.
Note: US dollars assume 2016 as the base year.

TABLE A.1.1 Summary of ODA Flows with Principal Mitigation Objective

Mitigation Pathway	ODA (US$, thousands)	Recipients (ODA in US$, thousands)
Avoided deforestation related to animal proteins	6,223.55	Brazil (1,978.92), Indonesia (1,635.46), Bolivia (1,330.75), Colombia (1,097.75), Kenya (27.73), unspecified (152.94)
Breeding	31.30	Kenya (31.30)
Grazing management	99.79	Mongolia (99.79)
Manure management	754.02	Indonesia (754.02)
Silvopastoral systems	21,861.65	Colombia (21,499.95), Cuba (271.83), Malawi (89.87)
Improved feeding	10,384.81	Burkina Faso (2,740.86), South of Sahara (regional, 313.26), Malawi (181.74), Kenya (96.12), Ethiopia (26.87), unspecified (7,025.96)
Whole-farm approach	226.44	Brazil (101.15), Nicaragua (71.88), Cabo Verde (50.71), Burkina Faso (2.71)
Adaptation focus	767.16	—
Not specified	23,130.59	—

Source: OECD 2019b.
Note: ODA = official development assistance; — = not available.

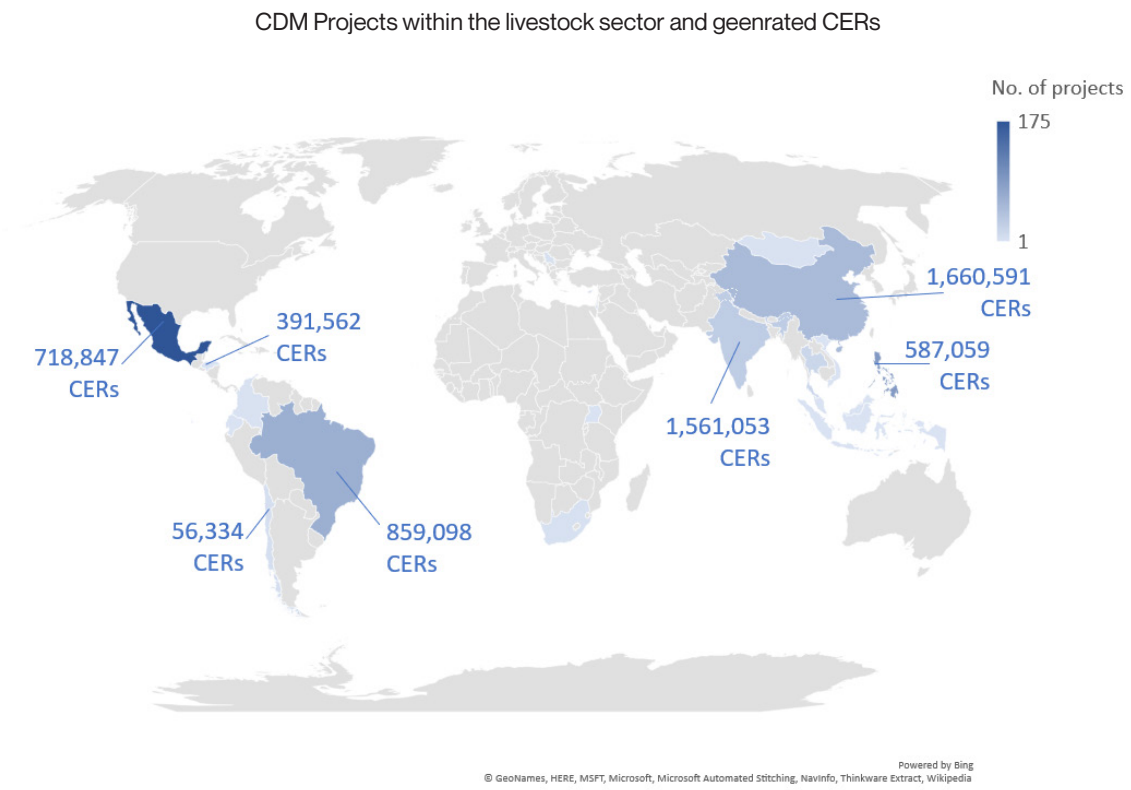
A.2 The Mapping of Carbon Market Activities

Currently, there are 454 livestock-related projects registered under the Clean Development Mechanism (CDM), mostly related to manure management. When mapping these projects and relating them to their certified emission reductions (CERs), it becomes clear that a number of projects are registered in the CDM database, yet without generating credits. Looking at the host countries, the geographical distribution of livestock-related projects is in line with the general trend of only a few countries hosting the majority of CDM projects. As of 2013, China, India, and Brazil accounted for about 82 percent of all CDM projects (Map A.2) (UNFCCC 2013).

The majority of CDM projects fall under the United Nations Framework Convention on Climate Change (UNFCC) methodology AMS-III.D Methane recovery in animal manure management systems, which currently has some 130 registered projects. There are several other methodologies relating to livestock, but they contain few or no registered projects. Among these methodologies is AMS-III.BK: Strategic feed supplementation in the smallholder dairy sector to increase productivity; this was completed in 2014 had only one project, in part due to the CER price crash that occurred around the same time. In the development of this methodology, one of the main concerns with CDM that emerged was the lack of bankability for projects with high investment costs. The Dairy Feed Uganda Project, which started in 1999 and went through several iterations before reaching CDM, had upfront costs of US$2 million associated with feasibility studies, feeding trials, and methodology development. After the project was ready to generate credits in 2014, the price of CERs was roughly €0.35 (down from €20 in 2008). With such high initial costs and even with a 30,000 CER credit a year potential, the economic viability of the project was extremely low, and it was never implemented.

The Gold Standard is a voluntary mechanism through which private capital reaches certified projects, including multiple pathways for mitigation outside manure management. The Gold Standard—unlike the CDM, the VCS, or the Joint Implementation (JI)—coordinates multiple projects that go beyond manure management to silvopastoral systems and increased livestock and pasture productivity, as well as a whole-farm approach targeting indirect emissions. By providing a platform for direct investment and setting an internal price based on project quality, the projects within the Gold Standard are not subject to a fluctuating carbon price as is the case in the CDM and the JI. The cost per ton for GS projects varies on average between US$2 and US$11, depending on abundance of project type and additional benefits delivered, as well as a multitude of other factors that influence the quality of emission reductions.

MAP A.2. Livestock-Related Projects under CDM



Data source: UNFCCC 2019a.

BOX A.2.1 Examples of Gold Standard Projects within the Animal Protein Sector

The Biomass Based Steam Generation Plant at Chanakya Dairy Products Limited, a project in India, aims to utilize rice husk within the region to generate steam to be used by the milk plant. This project highlights the ability for Gold Standard to support a private sector flow of finance while promoting the use of undervalued waste within the region. This project example, though involving a dairy plant, does not seek to generate energy from its dairy suppliers, but rather sources biomass-based steam from local sources, highlighting the additional capacity for dairy farms to seek mitigation methods outside of traditional manure management.

The Kenya Biogas Program provides domestic biodigesters for households that have livestock to reduce dependence on stoves with heavy smoke and pollution from firewood. The slurry from the biodigester can also be used on crops as organic fertilizer, potentially increasing rural incomes. To counter the cost of biogas technology, there are credit partnerships set up with financial institutions to aid families in the purchase of the biodigesters. The program has resulted in 333,500 $mtCO_2e$ reduction. The cost per offset in the program is US$19; all possible offsets are already sold out, indicating a functioning transfer of funds to the project level. On the other hand, the income generated from selling carbon offset credits simply states that the project users gain training, after-sales support, and other useful services. One thing to note is the vague mention of "other services," indicating a lack of transparency for where money ends up.

The ACP Sustainable Forest Cover Establishment Project aims to promote reforestation and biodiversity conservation as well as to protect rural livelihoods and silvopastoral systems in Panama. The project covers a wide range of ecosystem services, among which is the restoration of degraded land and push-back of an invasive grass species, as well as income generation for local farmers. The project will also help to protect the main watersheds that provide water within the region. Although this project targets numerous services outside of mitigation in the livestock sector, it brings the additional indirect benefits that can be engendered within livestock mitigation pathways to the forefront. Livestock play a minor role in this type of project, but other key benefits make this type of funding necessary in the consideration of climate finance. The project covers 10,000 hectares of degraded land, has an annual estimated amount of 17,024 $mtCO_2e$ reductions, and has been consistently generating credits since 2014.

Note: Gold Standard projects can be found at https://registry.goldstandard.org/projects?q=&page=1.

A.3 The Mapping of Private Flows

The mapping of private flows is based on identified cases through keyword search, subsequent portfolio analysis, and a review of the annual statements of stakeholders along animal protein chains, as well as interviews with experts and snowball sampling (interviewees selected from earlier participants' contacts). The identified cases can provide only a snapshot of the private finance landscape, as a complete mapping is not possible because of data constraints (Table A.2). Of the 23 cases directly related to mitigation projects, 9 were flows that originated from asset management institutions; the remainder were through foundations, not-for-profit organizations, MFIs, and value-chain actors such as feed producers. Equity and debt are the main instruments observed, either in the form of shares of impact funds or other products marketed by asset managers, or in credit and loans to farmers, PPPs, or cooperatives in local contexts. These instruments are the most widespread because they make it possible to cope with livestock risks or give the opportunity for shareholders to contribute toward mitigation without having to put large sums of money into risky ventures. Another main instrument used is self- or value-chain finance. In some cases, companies, foundations, and other personal investors may use grants to develop commercial and institutional capacity in the sector. For example, the Bill & Melinda Gates Foundation has given grants to the International Livestock Research Institute (ILRI), the Food and Agriculture Organization of the United Nations (FAO), and national governments with the objective of advancing the understanding and research of sustainable livestock.

TABLE A.3.1 An Inventory of Private Climate Flows

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
Direct Climate Finance Flows toward the Animal Protein Sector									
1	CAMBio II Green Climate Fund (GCF) private sector facility (Central American Bank for Economic Integration)	Financed by a GCF facility dedicated to financing private sector projects relating to mitigation and adaptation activities at all levels. Provision of concessional loans and technical assistance to encourage MSMEs with agriculture, livestock, and forest to invest in adaptation. Grant component will provide financial rewards to MSMEs and intermediary financial institutions for their successful implementation of adaptation activities (activity-based).	✓		✓	✓	Blending of debt, equity, and guarantees with concessional funding, as well as promoting PPPs for infrastructure resilience projects	Latin America and the Caribbean	Link
2–3	Althelia Climate Fund Mirova Natural Capital	The Althelia Climate Fund invests in projects that reduce deforestation, mitigate climate change, protect biodiversity, and provide a fair and sustainable living to rural communities, while offering investors a fair return on capital. Projects: Novocampo Programme and INOCAS: Improving pasture management to generate sustainable vegetable oil. The focus is on grazing management, avoided deforestation due to sustainable intensification of livestock, avoided deforestation due to offering alternative livestock-production–related livelihoods, silvopastoral systems.	✓	✓	✓	✓	Althelia Climate Fund GP Sarl is an independent management company established to manage the fund, bridge loan, blended finance through cooperation with several DFIs Local project-level farms and communities	Brazil	Link
4	Sustainable Ocean Fund Mirova	The Sustainable Ocean Fund creates investor value and social impact by providing growth capital to companies that harness the ocean's natural capital. Its aim is to reduce demand of emission-intensive protein sources and support mangrove conservation.	✓	✓	✓	✓	Blended finance	Global	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
5	Lafise Bancentro eco,business Fund managed by Finance in Motion	The eco.business Fund provides dedicated financing and technical assistance to financial institutions and businesses committed to environmental practices in unique ecological landscapes. The fund focuses on sustainability in four economic sectors: agriculture and agri-processing, fishery and aquaculture, forestry, and tourism. Since its launch in 2015, the eco. business Fund has successfully built a portfolio of US$333 million in cumulative investments (as of December 31, 2019) in Latin America and the Caribbean and expanded to Sub-Saharan Africa in 2019. Project: Satellite-based forest monitoring to ensure sustainable livestock production. Its aims are grazing management, avoided deforestation through sustainable intensification of livestock, avoided deforestation through offering alternative livestock-production related livelihoods, silvopastoral systems, and efficient livestock processing.	✓	✓	✓	✓	Blended finance invested either via intermediaries committed to promoting green finance or directly in businesses that pursue sustainable production and consumption Grant element support, technical assistance, and capacity building	Nicaragua	Link Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
6	Livelihoods Fund	Impact investment funds' mission is to build more resilient rural communities and ecosystems alongside sustainable businesses. Development of large-scale, impactful, and replicable solutions for ecosystem restoration and sustainable farming in emerging economies (Africa, Asia and Central/South America). Twelve major companies have invested in the Livelihoods Funds so far: Danone, Schneider Electric, Crédit Agricole S.A., Michelin, Hermès, SAP, Groupe Caisse des Dépôts, La Poste, Firmenich, Voyageurs du Monde, Mars Inc. and Veolia. Project: KENYA (Mount Elgon): agroforestry & sustainable dairy cycle with 30,000 farmers. The project simultaneously tackles poverty and environmental degradation, promotes a sustainable supply chain and aims at restoring 20,000 hectares through agroforestry. An innovative partnership has been signed with Brookside, a local milk company, in which Danone owns a stake, for the sale of milk produced by the farmers over 10 years. The project will be implemented by NGO partner VI Agroforestry.	✓	✓	✓	✓	Private companies invest equity to the funds. The Livelihoods Funds finances project developers (for example, NGOs) upfront. Projects further generate carbon credits	Kenya	Link
7	Climate Smart Cattle Ranching Naturevest and the Nature Conservancy	Idea endorsed by the Climate Finance lab 2015–16, commencement in March 2018. This is an innovative business model for cattle ranchers to adopt more sustainable and efficient practices. It plans to co-invest in 30 rural properties, and scale up to 100 properties by 2022, covering potentially 300,000 hectares and mobilizing US$205 million in the state of Pará alone.	✓	✓	✓	✓	Blended finance	Brazil	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
8	Conexus Impact Fund Conexus	The project is in development, in the market testing stage. The platform has three main pillars: business assistance, community-led enterprises, and new market opportunities, operated by the Instituto Conexsus, and appropriate finance mechanisms to ensure viable and scalable businesses, led by the Conexsus Impact Fund. It already involves more than 1,000 community-led enterprises, more than 80 private companies, several leading banks and credit cooperatives, and a range of other impact investment instruments.	✓	✓		✓	Credit guarantees, convertible debt, credit recovery, private equity, and other types of impact investments	Brazil	Link
9	Solidaridad International	Solidaridad International is an NGO that aims at implementing sustainability along the value chains, working with producers, key stakeholders, and producers. It has programs on livestock and dairy in 10 countries.	✓	✓	✓	✓	Grants	Global	Link
10–11	BlueOrchard	BlueOrchard is a leading global impact investment manager and first commercial manager of microfinance debt investments worldwide. It provides examples of recipient clients in Mongolia (animal financing through loan) and Philippines (microloans for productive assets).	✓		✓	✓	Blended finance, debt, and equity financing to institutions in emerging and frontier markets	Global	Link
12	SimGas BIX Capital	BIX is an investment vehicle initiated by the Shell Foundation, Cardano Development, and FOUNT. SimGas designs, produces, and installs biogas systems for households in Africa and Asia. SimGas systems enable rural households with livestock to use the manure from their livestock to generate clean fuel for cooking and organic fertilizer.	✓	✓		✓	Debt financing to MSMEs through an innovative result-based finance structure	Kenya	Link
13	Sustainable Transition Bond Marfrig S.A.	Sustainable Transition Bond aims to support suppliers halt all deforestation (Amazon region).	✓	✓		✓	Green bond	Brazil	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
14	Bovaer® DSM	This is a private company active in nutrition, health, and sustainable living. It provides financing for R&D of a feed additive to reduce methane emissions from ruminants that can contribute to the CSR pledge of companies that may source from farms that utilize the product.	✓	✓		✓	Own finance in R&D	Global	Link
15	Yara International	This is an international fertilizer company, producing solution for grasslands to enhance animal health.	✓	✓		✓	Value chain finance and training for clients	Global	Link
16	Verified Sourcing Areas (VSAs), Pilot in Mato Grosso IDH	IDH, The Sustainable Trade Initiative, brings governments, companies, civil society organizations (CSOs), and financiers together in action-driven coalitions. IDH works on monitoring, convening public-private partnerships, and developing the Verified Sourcing Area (VSA) model.	✓	✓		✓	PPPs End buyers are connected to the compacts in various ways, including via pilot projects to support implementation of the compact targets or sourcing from the region.	Global, currently pilots in Brazil, Vietnam, and Indonesia	Link
17	Integrated Crop-Livestock-Forest Systems WWF Brazil, Rabobank, and UNEP	Rabobank is a cooperative bank with their international banking focusing on international business and rural activities, in general, and on the food and agricultural sector, in particular. It works on the integration of trees with pastures and/or crops, and on the reduction of indirect emissions through renewable energy.	✓	✓	✓	✓	Blended finance facility	Brazil and Indonesia	Link Link
18	Bill & Melinda Gates Foundation	Grants are disbursed to ILRI, FAO, and national governments to advance research.	✓	✓	✓	✓	Grants	Global	Link
19	Walmart	Walmart has a commitment to achieving zero net deforestation by 2020 for key commodities (beef, pulp, soy, palm oil, paper) It created the Brazilian Beef Monitoring System to track the origin of meat.	✓	✓	✓	✓	Private own finance Value chain finance	Brazil	Link
20	Carrefour	Carrefour aims to develop a zero-deforestation beef meat production system by 2030. It provides technical assistance and credit facilities to local ranchers.	✓	✓	✓	✓	Private own finance Value chain finance	Brazil	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
21	Cencosud	This supermarket chain is committed to source meat from processors who are not linked to deforestation	✓	✓			Private own finance	Brazil	Link
22	Cargill	Cargill has committed US$30 million to finance ideas to halt deforestation from beef cattle raising.	✓	✓	✓		Private own finance Finance for research and development	Brazil	Link
23	McDonald's	McDonald's partnerships with local companies to improve tracking of beef from local suppliers	✓	✓			Own finance Long-term project financing	Brazil	Link
Indirect Climate Finance: Investments within the Animal Protein Sector That Have an Observed Climate Outcome but Do Not Specifically Advocate It									
24–28	Bill & Melinda Gates Foundation	This private foundation works with partners worldwide and within the United States in: Global Health, Global Development, and Global Growth & Opportunity. Livestock-related grants are disbursed in connection with R&D concerning health as well as rural development. Examples of livestock-related projects supported through grants are: SAHEL Capital Agribusiness Managers Ltd. (Sahel region) and Heifer International. Examples of livestock-related projects within the Strategic Investment Fund Portfolio are ClinVet (Morocco) and Hester Biosciences Africa Ltd. (Tanzania).	✓	✓	✓	✓	Grants Strategic Investment Fund: Direct equity investments, volume guarantees, loans, and credit enhancements	Global	Link
29–30	Rabo Foundation	Rabobank is a cooperative bank with their international banking focusing on international business and rural activities, in general, and on the food and agricultural sector, in particular. Project: Mruazi Heifer Breeding Unit Fostering focuses on crossbreeding to enhance productivity and smart farming using a smartphone app (Tanzania). Project: Madhya Pradesh Women Poultry Producers Company Private Limited is a chicken feed factory run by women (India).	✓	✓	✓	✓	Long-term loan facility and advice Long-term grants, technical assistance, industry knowledge, loan	Tanzania and India	Link Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
31	Coopers-K Brands Kenya Africa Agriculture and Trade Investment Fund (AATIF)	AATIF is an innovative public-private partnership with the objective of leveraging African agriculture potential, helping reduce poverty and increasing food security. AATIF finances new plant for minerals and nutrition supplements for livestock in East Africa. AATIF contributes capacity building and funding of local financial institutions.	✓	✓	✓	✓	Depends on investees (intermediary investment companies, direct investment companies, or financial institutions) Instruments range from senior debt, mezzanine, guarantees, and risk sharing to co-financing and warehouse financing. Interest rate is market-based and average tenure is 5 to 8 years	Kenya	Link
32	Aqua-Spark	Aqua-Spark is an investment fund with a focus on sustainable aquaculture businesses around the world. The SMEs Aqua-Spark investments are working toward the production of safe, accessible aquatic life, such as fish, shellfish, and plants, in ways that do not harm the oceans. Investments lead to reducing the demand for emission-intensive protein sources, and result in sustainable feed production.	✓	✓	✓	✓	Private equity (minimum US$250,000)	Global	Link
33–34	UFF African Agri Investments	This blended finance institution specializes in African agriculture fund management and advice. Projects: Eastern Cape Boerbokke, Nigeria Pandagric Animal productivity and health (breeding), grazing management, on-farm production of fodder, use of feed additives	✓	✓	✓	✓	Private equity, loans Local project-level farms and communities	Eswatini, South Africa, Nigeria	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
35–36	SilverStreet Capital	This is an impact investment firm managing African agricultural funds. Projects: Poultry and Feed, and Cattle Ranching Projects focus on sustainable intensification of livestock, on-farm production of fodder, animal productivity & health (changing the composition of the herd, improved breeds), and (in the case of poultry) reducing the demand of emission intensive protein sources.	✓	✓		✓	Debt, equity Investment in infrastructure, e.g., processing plants, storage, logistics, the seed sector…	Tanzania and Zambia	Link
37–40	Acumen	Acumen is a nonprofit impact investment fund tackling poverty by investing in sustainable businesses. Of 91 projects, 23 are within agriculture and four fall within the animal protein sector: EthioChicken (Ethiopia), Juhudi Kilimo (Kenya), National Rural Support Program (Pakistan), and Sahayog (India). The projects focus on animal health and breeding, and (in the case of poultry) reducing the demand of emission-intensive protein sources.	✓	✓	✓	✓	Patient/philanthropic capital Seed and early stage investments	Ethiopia, Kenya, Pakistan	Link
41–42	Tanga Fresh and Countryside Dairy dob equity	Dob equity invests in businesses that create social and sustainable impact and deliver long-term profitability. Tanga Fresh has built and improved the cold chain of milk within Tanzania. Countryside Dairy is the first processer-owned and controlled retail network. They will set up and operate a network of branded, company-owned dispensers' shops. The focus is on avoided food loss, localization of value chains, and indirect emissions throughout the processing.	✓	✓		✓	Private Equity	Tanzania	Link Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
43	Green Dairy Kukula Capital	Kukula Capital is a leading venture finance and private equity firm in Zambia. Through Kukula Fund I and Kukula Seed Fund, Kukula Capital invests in Zambian growth companies with capital and expertise. Green Dairy is a commercial dairy farm, located outside Solwezi, which sells fresh milk products to the local market. The focus is on avoided food loss, localization of value chains, and indirect emissions throughout the processing.	✓	✓		✓	Debt and equity financing	Zambia	Link
44	Shreedhar Dairy IntelleGrow (Calvert Impact Capital)	IntelleGrow empowers emerging businesses of India with collateral-free/secured loans. With a loan from IntelleGrow, Shreedhar Dairy's processing plant was equipped with up-to-date technologies. Products need to survive India's long distribution chain and through innovative packaging, Shreedhar Dairy products are free of contaminants and bacteria.	✓	✓		✓	Debt financing for small and growing businesses Value chain finance	India	Link
45–56	OIKOcredit	Oikocredit is one of the leading global social investors in agriculture and supports small-scale farmers by providing access to finance and capacity building for agricultural cooperatives, producers, processors, and distributors. Impact: Rural employment, poverty alleviation and food security. Of 513 projects, 103 are related to agriculture and 12 are related to the animal protein sector (see Table A.3.2).	✓	✓	✓	✓	Loan and equity investment	Global	Link
57–58	African Agricultural Capital Fund Pear Capital Partners and Bill & Melinda Gates Foundation	Pear Capital Partners is a specialist agriculture investment firm that has been investing in small- and medium-sized agribusinesses. Of 23 projects managed by Pearl Capital Partners, two fall within the animal protein sector: Biyinzika Poultry International Ltd. (Uganda) and Eldoville Dairies Ltd. (Kenya).	✓	✓	✓	✓	Blended finance	Uganda, Kenya	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
59–60	Agriculture Africa 2019 Village Capital (ceniarth and smallfoundation)	Village Capital is the largest organization worldwide to support impact-driven seed-stage startups. Projects relevant for the animal protein sector are: Aywajieune (Senegal) and CAPTURE Solutions (Kenya; smart farming: LivestockMANAGER app and LactoCAPTURE app).	✓	✓	✓	✓	Seed capital	Africa	Link
61-68	Shuraako	Shuraako as part of One Earth Future (OEF) works in conflict-affected areas and underserved small and medium enterprise (SME) markets in Somalia to develop a more resilient and responsible private sector. Out of the 104 entrepreneurs fostered by the program, eight are within the livestock sector.	✓	✓	✓	✓	Blended finance, seed capital	Somalia	Link
69-70	Agricare Ltd. And Proveto SA Injaro Agricultural Capital Holdings	Injaro carries out investment activities for poverty alleviation. Agricare Ltd. (Ghana) produces and sells animal feed in its trading area. Proveto SA (Côte d'Ivoire) supplies inputs for broiler production: day-old chicks, starter feed, and veterinary products to local farmers.	✓			✓	Investments in debt, quasi-equity, and equity in SMEs	Ghana and Côte d'Ivoire	Link
71	Paniel Meat Processing and Livestock Bank Fledge	Fledge is a global network of company accelerators and seed funds that help entrepreneurs create impactful companies and co-ops at scale through short, intense programs filled with education, guidance, and a massive amount of mentorship. Paniel produces meat from farming livestock and aims to make its meats available and affordable to all income categories in Rwanda and neighboring countries, supplies to retailers.	✓			✓	Seed funding of US$15,000–US$20,000 Revenue-based equity investing: the investor buys equity in the company, but the company repurchases that equity using a small percentage of "top-line" revenues, returning only 2x–5x.	Rwanda and neighbors	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
72	Samunnati Financial Intermediation and Services Pvt Ltd. responsAbility and OIKOcredit	ResponsAbility Investments AG is an asset manager in the field of development investments and offers professionally managed investment solutions to private, institutional, and public investors. Samunnati is an Indian Non-Banking Financial Company that provides loans to smallholder farmers and small and medium-sized businesses across the agriculture value chain (dairy emphasis).	✓			✓	Private equity fund Investing growth capital in SMEs in developing countries across the agriculture and food value chain	India	Link
73	Lilongwe Dairy Eastern and Southern African Trade & Development Bank (TDB)	This is a multilateral, treaty-based development financial institution. Lilongwe Dairy is a Malawian family-owned company engaged in the processing of milk and milk products. The project provides employment, supports local cattle owners by assuring them of a ready market for their milk, and supports nontraditional suppliers of milk by purchasing raw milk in surplus months when other local processors were unable to consume all the milk produced.	✓			✓	Long-term project financing Corporate financing	Malawi	Link
74	Nestlé	Nestlé purchases from local rural producers. The Moga processing facility in India has increased production from 2,000 to 300,000 tons and introduced tree-planting programs.	✓	✓		✓	Value chain finance Own finance of training	China, India, Colombia, Indonesia, Pakistan	Link
75	New Hope Liuhe Co., Ltd.	CSR policy targets policy alleviation, production, and sales of animal feeds into rural households. The focus is on localization of value chains, animal productivity, and health.	✓	✓	✓	✓	Own finance, CSR Provision of microfinance	China	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
Potential Climate Finance: Investors within Agriculture, Forestry and Land Use That Include Animal Proteins That Could Be Climate-Mainstreamed									
76-79	Global Partnerships	Global Partnerships is an impact-first investor dedicated to creating and managing impact investment funds, using capital from those funds to make loans and early-stage investments in sustainable solutions that help impoverished people increase their incomes and improve their lives. Projects leverage finance for microfinance institutions. Microfinance Institutions that focus on livestock farming are: FUNDEA (Guatemala), FDL (Nicaragua, has a dairy-focused credit), Juhudi Kilimo (Kenya, animal financing for dairy cows), Musoni Kenya (Kenya), and BRAC (see below).	✓			✓	Impact First: Loan directed to regional microfinance institutions and project-level agribusinesses Microfinance: Providing tailored credit and training to producers	Latin America & the Caribbean and Sub-Saharan Africa	Link
80	BRAC	BRAC is an international development organization. Program: Creating Sustainable Value Chains for Farmers and Poultry Rearers. It aims to improve food security, income, and nutrition by developing highly productive, environmentally sustainable farming livelihoods. The focus is on developing value chains through capacity building, extension services, and market access.	✓			✓	Microfinance and training	Liberia, Sierra Leone, Uganda	Link
81	INOKS Capital	INOKS is an independent, alternative asset manager that supports commodity value chains throughout emerging markets worldwide, including the animal protein sector along the value chain. It has 10 objectives: Local availability, self-sufficiency, access to finance and to markets, optimal use of resources, consistent quality, stable pricing, competitive market, transparent operations, and value adding production.	✓			✓	Short-term: Commodity structured trade finance Mid-term: Debt-to-equity conversion option Long-Term: Early stage private equity	Global	Link

Case		Description	Animal Protein Sector	Mitigation Outcome	Adaptation Outcome	Livelihood Outcome	Funding Instrument	Geography	Link
82	Kiva	Kiva is an international nonprofit organization providing a platform for lenders and borrowers. Out of the 4,878 loans presented on their platform, 61 fall within the Livestock category that aims at animal financing to increase rural incomes.	✓			✓	Crowdfarming/ crowdfunding	Global	Link
83	Oxfam Unwrapped	Oxfam Unwrapped is a range of unique charity gift cards that help people beat poverty definitively through the finance of purchase of pigs, goats, or chickens.	✓			✓	Crowdfarming/ crowdfunding	Global	Link
84	SV Capital	This is the first South African crowd-investing fund manager. A pool of funds is used to purchase livestock managed by Beefcor, one of the largest feedlots in South Africa. The livestock is fed and maintained until it reaches the optimum weight to be sold to an abattoir. The value of investment is based on the weight gain of the cattle as well as the selling (market) price.	✓			✓	Crowdfunding directed toward animal financing	South Africa	Link
85	Livestock Wealth	Through crowdfarming, individuals can invest in pregnant cows or free-range calves.	✓			✓	Crowdfunding directed toward animal financing	South Africa	Link

Note: The checks indicate animal protein sector relevance and whether a case achieves single or multiple outcomes. Checks in lighter shades point to secondary outcomes—that is, the focus is on other outcomes. AATIF = Africa Agriculture and Trade Investment Fund; CSOs = civil society organizations; CSR = corporate social responsibility; FAO = Food and Agriculture Organization of the United Nations; GCF = Green Climate Fund; IDH = The Sustainable Trade Initiative; ILRI = International Livestock Research Institute; MSME = micro, small, and medium enterprise; NGO = nongovernmental organization; OEF = One Earth Future; PPP = public-private partnership; R&D = research and development; SME = small and medium enterprise; VSA = Verified Sourcing Area.

TABLE A.3.2 Projects within Oikiocredit's Portfolio Directly Related to Animal Protein Value Chains

Project	Company	Loan Size (ISO codes)	Value Chain and Country
A freezing tunnel to increase production and create jobs	Tradimer Suarl	XOF 163,989,250	Seafood and fish exporter, Senegal
Better processing machinery for alpaca wool	Cooperativa de Producción y Servicios Especiales de los Productores de Camélidos Andinos Ltda	USD 530,000	Alpaca and vicuña wool producer, Peru
Enhancing agricultural value chains	ProDev-Rwanda Ltd	USD 2,168,930	Aggregation, processing, and distribution of animal feeds, Rwanda
Funding for a dairy production unit	Agricultural producer Milka Staneva Vasileva	EUR 80,000	Small-scale dairy breeding and farming, processing, and local distribution, Bulgaria
Funding for the dairy value chain	CALCAR, Cooperativa Agraria de Responsabilidad Ltda Carmelo	USD 5,405,883	Dairy production, processing, and domestic and international distribution, Uruguay
Funding to combat rural poverty and support indigenous youths	CPF, Colonia Piraí Foundation	USD 540,000	Livestock production and capacity building, Bolivia
Promoting dairy consumption and local cereal varieties	Les Mamelles Jaboot SA	XOF 500,000,000	Dairy processing, Senegal
Storage, access to markets and agricultural supplies for local farmers	Sociedad Agropecuaria de Correa Cooperativa Ltda	ARS 5,686,800	Feed production, aggregation, Argentina
Supporting cattle farming and agriculture across Uruguay	COPAGRAN, Cooperativa Agraria Nacional	USD 5,741,000	Beef production, aggregation, Uruguay
Supporting smallholder farmers and market traders, developing local agricultural economies in India	Samunnati Agro Solutions Private Limited	INR 120,000,000	Aggregation, distribution of dairy, poultry, and fish, India
Wool processing and trading for farmers throughout Uruguay	CLU, Cetral Lanera Uruguaya	USD 6,000,000	Wool aggregation, processing, and distribution, Uruguay

Note: Further information about Oikiocredit's Portfolio can be found at https://www.oikocredit.coop/en/what-we-do/partners/our-partners/map?searchText=Cooperativa%20de%20Pro&zoom=9&lat=-23.973488289035668&lng=-57.086990000000014 and https://www.oikocredit.coop/en/what-we-do/partners/partner-detail/25928/tradimer-suarl,

Jurisdictional Approaches

TABLE A.3.1.1 Existing Jurisdictional Initiatives

Initiative	Description	Pilots/Jurisdictions
Commodities/ Jurisdiction Approach	Provides information for companies interested in responsible sourcing Independent experts assess subnational-scale programs against criteria established by committed buyers and two standards FCPF's Carbon Fund Methodological Framework VCS's Jurisdictional and nested REDD framework	Under preparation
Integrated Food Systems Leadership	The BioCarbon Fund's Initiative for Sustainable Forest Landscapes Multilateral fund supported by governments and managed by the World Bank	Colombia, Orinoquía Ethiopia, Oromia Indonesia, Jambi Mexico, Nuevo León Zambia, Eastern Province
LandScale	Initiated by the Climate, Community & Biodiversity Alliance, the Rainforest Alliance, and Verra Provides measurable social, economic, and environmental indicators of state and trajectory	Costa Rica, Greater San José (Ethiopia) Ghana, Juabeso Bia & Kakum Guatemala (Indonesia) (Kenya) (Peru) (Mexico)
Verified Sourcing Areas (VSA)	Initiated by IDH in 2018 Provides a platform for committed buyers to connect to coalitions of stakeholders in sourcing areas (facilitates information and communication) Coalitions consist of farmers, producers, government, and civil society who have jointly agreed on a compact Committed buyers can support compacts, monitor progress, and deliver on their sustainability commitments Next steps are the development of the VSA business case and guidance material and setting up an MRV system and VSA platform	Brazil, Mato Grosso (Colombia) (Gabon) (Ghana) (India) Vietnam, Lam Dong Indonesia, Aceh
Landscape Finance Lab	Initiated in 2016 by the WWF Incubator for sustainable landscapes programs Build learning, capacity, and impact measurement, via online platform Four-step incubation process: Discover (ideas for commercial potential, impact at scale, governance and support structure), structure (team, partners, technical resources and sourcing funds business case and concept note), Develop (full-fledged proposal), Fund (coaching for investor and donor cases)	Cameroon, TRIDOM Fiji, Great Sea Reef Georgia, Adjara mountains Malaysia, Kedah state Paraguay, Upper Parana Atlantic Forests Russia, Dvinsky Forest

Note: Geographies in bold involve animal protein–relevant commodities; geographies in brackets are possible/future pilots. FCPF = Forest Carbon Partnership Facility; IDH = The Sustainable Trade Initiative; MRV = measurement, reporting, and verification; VSA = Verified Sourcing Area; VCS = verified carbon standard; WWF = World Wildlife Fund.

Index-Based Livestock Insurance Schemes

Table A.3.2.1 lists Index-Based Livestock Insurance schemes along with the country in which they operate and some information about each scheme.

TABLE A.3.2.1 Index-Based Livestock Insurance Schemes and Companies

Country	Name	Information
	Schemes	
Kenya	Kenyan Livestock Insurance Program (KLIP)	• Government-sponsored program established in 2015 • Designed for very poor herders with few livestock units, this program has no financial sustainability despite private sector involvement • 18,000 pastoralists rearing 90,000 livestock units • In 2017 and 2018, 6,000 and 12,000 farmers were given payouts after a dry season of KSh 87 million (US$860,000) and KSh 202 million (US$2 million), respectively.
Ethiopia	Satellite Index Insurance for Pastoralists in Ethiopia (SIIPE)	• Operated through the World Food Programme Ethiopia Country Office alongside the Ethiopian Government and the International Livestock Research Institute (ILRI) • 5,001 households were insured through four insurance companies (2019) • Mandatory contribution to community work
Senegal, Malawi, Kenya, and Zimbabwe	R4 Resilience Initiative	• Run by the World Food Programme (WFP) • Reached over 87,000 farmers in 2018
Cameroon	Pilot project	• Engaging AXA and ACTIVA Insurance • The aim is to have 135,000 contracts by 2020
Zambia	Pilot project	• Originally aimed at 60,000 beneficiaries in 12 districts • 2018: The government made weather-based insurance compulsory for farmers that take part in the Farmer Input Support Program (FISP), leading to more than a million insured farmers
Mongolia	World Bank partnership with Government of Mongolia	• A World Bank–funded project initiated in 2005 • Designed to protect against ***dzuds*** or harsh weather • Involves five private insurance companies and is ongoing
Pakistan	Kashf Foundation	• Loan program for animal insurance against theft or death due to illness • Not IBLI, but could provide a platform to set it up
Brazil	Agricultural Activity Guarantee Program (PROAGRO)	• Insurance to protect against weather events or diseases • Promotes insurance market, mostly for crops but some also for livestock

Country	Name	Information
	Insurance Companies	
Kenya	Takaful Insurance of Africa (TIA)	• Operates under the Islamic Law of Sharia in order to cater to and attract Muslim clients
Ethiopia	Oromia Insurance Company (OIC)	• Active in the Borana region
Kenya, Uganda, Tanzania, Rwanda, Burundi, Democratic Republic of Congo, and Sudan	UAP Insurance	• Traditional insurance for livestock and crops, has potential to transition to index-based insurance • Partner of ILRI

Sources: Kilimo 2018; WFP 2018, 2019.

APPENDIX B

List of Interviewees

Name	Affiliation/Position and Summary of the Interview	Date
FRITZ SCHNEIDER	• Chair of the Guiding Group, Global Agenda for Sustainable Livestock (GASL). Interview consisted of: • Overview of the governance structure and project/activity pipeline • Discussion of funding sources from public and private sector, and relationship with private sector stakeholders • Regional overview of the state of main mitigation pathways, obstacles and opportunities, and efforts for mitigation along livestock value chains	November 22, 2019
RICHARD BOWMAN	• Ruminant Methane Specialist for RuMeth International. Interview consisted of: • Overview of Richard Bowman's trajectory and experience regarding ruminant methane feeding supplements • Overview of RuMeth International project pipeline, with special interest in Dairy Feed Improvement Uganda (DFIU) Project • Review of experiences and expertise on CDM market structure, pricing, and governance, as well as CDM methodology development and its associated opportunities and limitations • Exploration of Molasses Urea Product (MUP) feed additives as a mitigation pathway, and its environmental and economic viability	November 22, 2019
VIKAS CHOUDHARY	• AGP-II Task Team Leader and Senior Agricultural Specialist. Interview consisted of: • Introduction to AGP I and II projects and the components related to capacity building, institutional engagement and agricultural & livestock sectors • Contribution of the projects toward climate mitigation, challenges and opportunities • Experience of local stakeholder interaction within the sector, emphasis on improvements in mitigation along value chains and private sector engagement • Experience with blended finance institutions and mechanisms, and their ability to leverage private investment within the sector	November 25, 2019

Name	Affiliation/Position and Summary of the Interview	Date
MILENA GONZALEZ VASQUEZ	• GEF Climate Change Specialist, Latin America regional team, Climate change mitigation. Interview consisted of: • Overview of GEF secretariat role regarding climate mitigation within livestock, governance structure and project pipeline • Governance structure and relation between GEF, implementing agencies and project-level stakeholders • Introduction to Climate-smart Livestock Production and Land Restoration in the Uruguayan Rangelands project. State of the project, contribution to climate mitigation, stakeholder involvement, potential for replicability and scale-up, obstacles & opportunities • Expertise in regional approaches toward climate mitigation with special emphasis on main mitigation pathways per region, obstacles and opportunities for scale-up • Expertise in promotion of greater private sector involvement in sustainable livestock projects. Emphasis on public-private and blended finance mechanisms	November 26, 2019
RUARAIDH PETRE	• Executive Director, Global Roundtable on Sustainable Beef. Interview consisted of: • Introduction to GRSB and the governance structure, financing, and project pipeline • Expertise in smallholder farmers' obstacles to adapting sustainable livestock practices, with emphasis on climate mitigation pathways, and how to address these obstacles • Overview of the state of main mitigation pathways per region; challenges and opportunities for scaling up and leveraging investment • Expertise in the potential for climate mitigation along livestock value chains. Emphasis on demand-side mitigation pathways, state, and feasibility, and the potential new products to reduce emissions from enteric fermentation • Expertise on promotion of greater private sector investment in sustainable livestock projects. State of blended finance and impact investment in the sector • Key considerations for private investors in livestock	November 28, 2019
POLLY ERICKSEN	• Program Leader, Sustainable Livestock Systems at the International Livestock Research Institute (ILRI). Interview consisted of: • Introduction to Polly Ericksen's position within ILRI regarding climate finance in the livestock sector. Governance structure, funding, and project pipeline • Expertise in the state of main mitigation pathways by region, challenges, opportunities, and mitigation potential along value chains • Introduction to the Program for Climate-Smart Livestock Systems; review of funding, current state, impact potential • Opinions on the state of MRV frameworks to measure mitigation impact in the sector • Expertise in the promotion of greater private sector involvement in mitigation within the livestock sector, with special emphasis on the main gaps in finance and the role of innovative finance mechanisms in bridging those gaps	November 29, 2019

Name	Affiliation/Position and Summary of the Interview	Date
RAPHAEL PODSELVER	• Policy Coordinator at ProVeg. Interview focused on: • Demand-focused mitigation pathways and how ProVeg is assisting alternative protein start-ups with obtaining finance. • The role of policy to guide consumer pathways and activities that ProVeg supports, such as plant-based procurement strategies, capacity building, etc	December 4, 2019
MATTHEW REDDY	• Senior Private Sector Specialist of the GEF. The interview was focused on: • Various types of sector activities directed toward mitigation in the livestock sector • Is the primary motivation of companies to reach scientific targets or because the mitigation technology constitutes a promising business opportunity • Cross-value-chain partnerships, indicated valuable input for the pathway-instrument matrix	December 7, 2019
ROBERT SEATON	• Carbon Analyst at Brinkman Climate. Interview consisted of: • Introduction to Brinkman Climate and their approach toward carbon offsetting markets in developed countries as well as in the Global South • The role of carbon offsetting markets in targeting climate mitigation pathways such as forest and grassland management or silvopastoral systems • Experience of implementing projects under VCS, obstacles encountered in methodology development and implementation • Challenges and opportunities derived from scaling up carbon offsetting projects in different regions • Challenges and opportunities derived from accessing finance from public, private, and blended sources	December 9, 2019
HAYDEN MONTGOMERY	• Special Representative of New Zealand to the Global Research Alliance (GRA). Interview focused on: • An elaboration of what mitigation pathways are already best practice and what role technological development will play. • The major obstacle that the animal protein sector faces with regard to climate finance is that institutions would rather direct funds to sectors other than livestock because of the sector's poor reputation and notoriety as a main emission source	December 10, 2019
ZOE KNIGHT	• Managing Director, HSBC Centre of Sustainable Finance. Interview consisted of: • An overview of the activities and investments carried out by the Centre of Sustainable Finance • The lack of private finance in the livestock sector and the obstacles associated with it, focusing on the financial capacity necessary to reach a certain threshold that makes livestock-related projects attractive to private investors	December 17, 2019

Name	Affiliation/Position and Summary of the Interview	Date
MARK VAN NIEUWLAND AND CARLOS SAVIANI	• Mark van Nieuwland, Vice President/Program Director Clean Cow, DSM, and Carlos Saviani, Director for Sustainability and Animal Nutrition, DSM, about Bovaer® and the Clean Cow project. The interview focused on: • Bovaer® and the Clean Cow project (expected market launch early 2021), the importance of sustainable development especially in the dairy industry • The demand of retailers for lower footprint products, and missing equity participation • The importance of the government, its role in enabling innovation to market, and how developed countries lack behind a fair subsidy model for farmers • The animal protein sector is at the early stages of developing and implementing sustainability solutions and DSM, as a forerunner, understands and works to solve those needs	January 7, 2020
MUHAMMAD IBRAHIM	• Director General at CATIE. The interview focused on: • Climate-smart practices and the role of dry-forest corridor silvopastoral systems • The importance of the policy environment and collaborative relationships and how important it is to use the right incentives for farmers to adopt climate-smart practices • Understanding the high importance to the economy of having a livestock sector that is very sustainable and low carbon • The job of creating awareness and looking at the different dimensions of livestock systems • The advantages of shared risk in climate funding • Indexed based livestock insurance • Productivity issues in developing countries • The general trend to put more emphasis on quantification of the emission factors	January 7, 2020
BERNHARD STORMYR AND KEVIN CUNNINGHAM	• Head of Sustainability Management and Lead Agronomist at YARA. The interview consisted of: • what is needed to become a crop nutrition company for the future and why this is connected to impacts on climate change. The organization focuses on profitability and economics (as a starting point) through feed efficiency, which is directly linked to yield and quality of forage. • With the right dosage of nitrates, the microbial balance inside a biogas reactor is manipulated, so that the process becomes more efficient and produces a five percent increase in biogas yield • Using a holistic approach and the Cool Farm Tool GHG calculator, the objective is also to reduce the carbon footprint per ton of dry matter produced and to revive degraded lands,	January 16, 2020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