REPORT

Shifting finance towards sustainable land use:

Aligning public incentives with the goals of the Paris Agreement

CLIMATE FOCUS

ODI

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS

NICFI Norway's International Climate and Forest Initiative

giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

On behalf of:

Federal Ministry for the Environment, Nature Conservation and Nuclear Safety

of the Federal Republic of Germany

Shifting finance towards sustainable land use: Aligning public incentives with the goals of the Paris Agreement

For Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ)

July 2021

The research and writing under this project were concluded in March 2021. This report does not capture developments since then.

Authors: Hilda Galt, Thiago Chagas, Danick Trouwloon, Barbara Hermann, Felipe Bravo, and Charlotte Streck

Climate Focus B.V.
Van Diemenstraat 170
1013 CP Amsterdam
The Netherlands

This publication was funded by Norway's International Climate and Forests Initiative (NICFI) in cooperation with the international forest-related climate finance project implemented by the Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH, on behalf of the German Federal Ministry for the Environment, Nature Conservation and Nuclear Safety (BMU). This project is part of the BMU-supported International Climate Initiative (IKI) on the basis of a decision adopted by the German Bundestag.

FSC www.fsc.org FSC® N001695

Design, layout and production by Phoenix Design Aid A/S, a CO2 neutral company accredited in the fields of quality (ISO 9001), environment (ISO 14001) and CSR (DS 49001) and approved provider of FSC™ certified products. Printed on environmentally friendly paper without chlorine and with vegetable-based inks. The printed matter is recyclable.

Acknowledgements

We sincerely thank the experts and colleagues who took the time to share their practical insights, knowledge and expertise through review of this report, including our project partners: Anna Locke and Charlene Watson (ODI); Cecil Haverkamp, Marion Ferrat and Micheline Khan (Sustainable Development Solutions Network); Christophe Bellmann (International Centre for Trade and Sustainable Development); Isabella Alloisio (Florence School of Regulation) and Nicklas Forsell (International Institute for Applied Systems Analysis).

We are grateful for the support from Norway's International Climate and Forest Initiative (NICFI) in cooperation with the Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH (GIZ) that enabled us to carry out the work. The views and assumptions expressed in this report represent the views of the authors and not necessarily those of the client and funders.

About the project

This report was developed in the context of a broader project on the practical policy challenges for 'Shifting finance towards sustainable land use' with five parallel workstreams. All project outputs are available on the web platform of the Food, Environment, Land and Development (FELD) Action Tracker, at www.feldactiontracker.org. The website also includes a dedicated section on "Shifting Finance" with a direct link through www.greytogreenfinance.org and an opportunity for individual download of the following five project reports:

A: Shifting finance towards sustainable land use: Aligning public incentives with the goals of the Paris Agreement

B: Climate-consistent finance flows in the agriculture, forest and other land use sector: A framework for reporting on Article 2.1(c) of the Paris Agreement

C: Shifting finance towards sustainable land use: Repurposing public support to agriculture

The focused analysis undertaken under this project and towards a proposed reporting framework were supported and complemented by two case studies for a closer look at the policy instruments employed in the land sector. These also include specific examples to illustrate the opportunities for policymakers to redirect existing finance flows to become more consistent and supportive of the Paris Goals.

D: Shifting finance towards sustainable land use: A case study from Colombia

E: Shifting finance towards sustainable land use: A case study on the European Union

Project partners

Climate Focus is a pioneering international advisory company and think tank that provides advice to governments and multilateral organizations, non-governmental and philanthropic organizations, and to companies across the globe. We support our clients in shaping and navigating through international and domestic climate policies, accessing climate finance and evaluating climate policy and investments.

ODI is an independent, global think tank working to inspire people to act on injustice and inequality. Through research, convening and influencing, ODI generates ideas that matter for people and planet.

The United Nations Sustainable Development Solutions Network (SDSN) mobilizes global scientific and technological expertise to promote practical solutions for sustainable development, including the implementation of the Sustainable Development Goals (SDGs) and the Paris Climate Agreement, working closely with United Nations agencies, multilateral financing institutions, the private sector and civil society.

The Food, Environment, Land and Development (FELD) Action Tracker is a strategic initiative under the Food and Land Use Coalition (FOLU), led by SDSN in cooperation with other partners, to support countries in their transformation toward sustainable food systems and land use.

Shifting finance towards sustainable land use:

Aligning public incentives with the goals of the Paris Agreement

Contents

1 **EXECUTIVE SUMMARY**

6 CHAPTER 1 **The case for change**
- 1.1 Shifting land-use finance to achieve climate goals
- 1.2 Land use as a climate problem and solution

14 CHAPTER 2 **Approach**
- 2.1 Scope
- 2.2 Overview of instruments
- 2.3 Terminology
- 2.4 Constraints

20 CHAPTER 3 **Facilitating action**
- 3.1 Establish long-term regulatory predictability
- 3.2 Promote policy coherence and complementarity
- 3.3 Build strong land sector coalitions
- 3.4 Establish robust land use governance and land tenure regimes
- 3.5 Strengthen the rights of and engagement with indigenous communities
- 3.6 Address gender inequality in land use

26 CHAPTER 4 **Redirecting public support to agriculture**
- 4.1 Types of agricultural subsidies
- 4.2 Where does the money go?
- 4.3 How does public support to agriculture influence GHG emissions?
- 4.4 Green redesign recommendations

52 CHAPTER 5 **Redirecting financial markets**
- 5.1 Types of financial regulations
- 5.2 Where does the money go, and how does it influence GHG emissions?
- 5.3 Green redesign recommendations to shift private sector capital

77 CHAPTER 6 **Conclusions and recommendations**

List of tables

Table 1. Summary of green redesign recommendations for public support to agriculture 3
Table 2. Summary of green redesign recommendations for redirecting financial markets 4
Table 3. Common rationales for public support to agriculture 30
Table 4. Estimates of tax expenditures due to fossil fuel tax concessions 49
Table 5. Physical and transition risks 56
Table 6. Percentage of TCFD-aligned disclosures by firms assessed in the agriculture, food and forestry industries 69
Table 7. Selected categories from China's Green Bond Endorsed Project Catalogue (2020 Edition) 76
Table 8. Summary of green redesign recommendations for public support to agriculture 79
Table 9. Summary of green redesign recommendations for redirecting financial markets 80

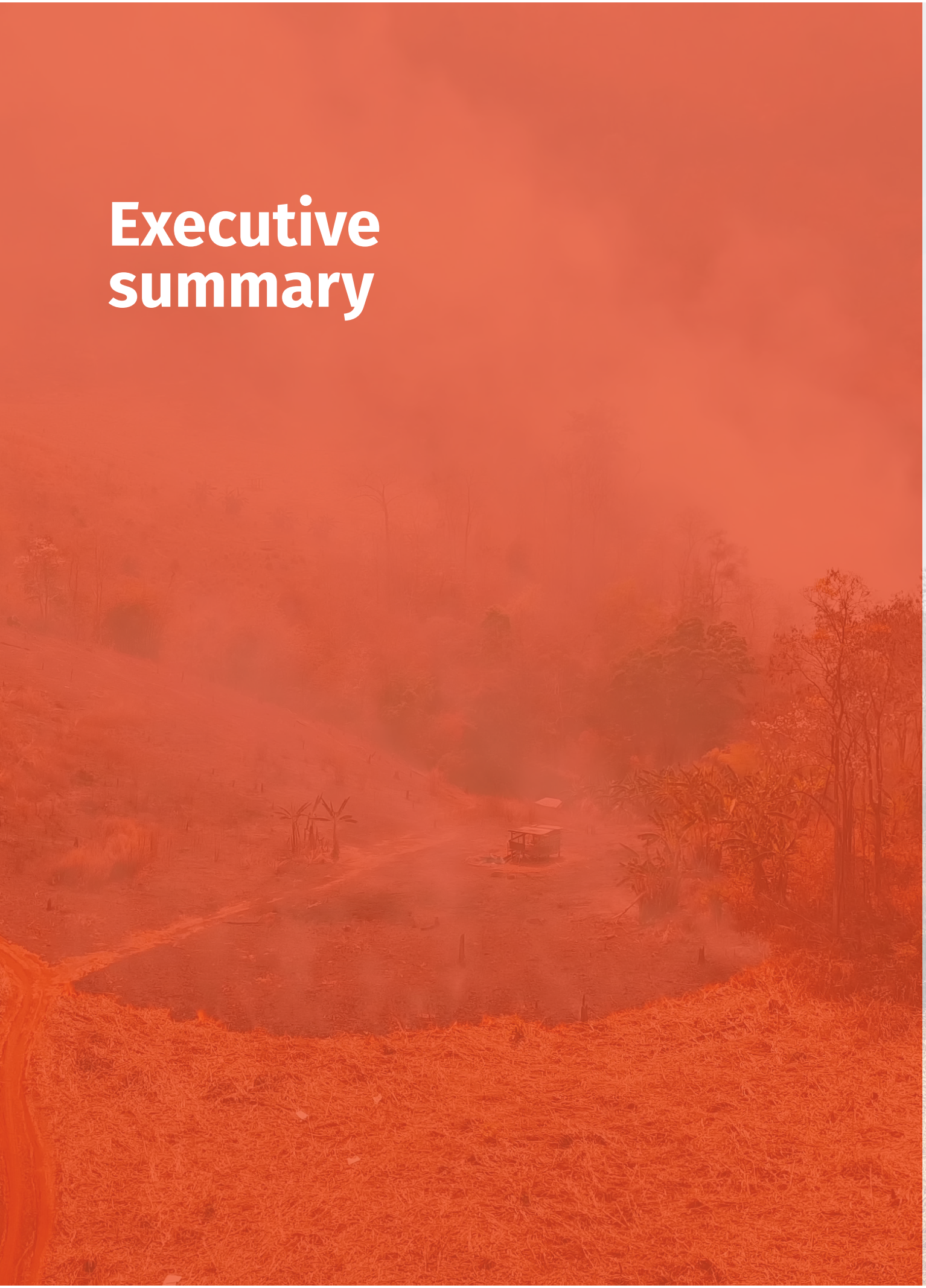
List of figures

Figure 1. Aims of the study 10
Figure 2. Agricultural production and LULUCF account for ~23 percent of global GHG emissions 11
Figure 3. Expected emission increase per type of agricultural emissions source (2010-2050) 12
Figure 4. Greenhouse gas emissions by 2050, under baseline and target scenarios 12
Figure 5. Mitigation potential of land use measures to keep global warming below 1.5˚C by 2050, in $GtCO_2e$/year 13
Figure 6. Classification of government policy instruments for redirecting finance to land use 17
Figure 7. Key governance enablers for realigning land sector finance with climate goals 21
Figure 8. Types of agricultural subsidies classified by financing mechanism 28
Figure 9. Total public support for agriculture compared to climate finance for land use 30
Figure 10. Total public support to agriculture relative to the size of the agricultural sector 32
Figure 11. Single transfers to the five commodities receiving the most support (annual average 2015 – 2019) 32
Figure 12. Examples of climate and environmental impacts of public support to agriculture 33
Figure 13. Total forest area replaced by seven commodities (2001-15) 34
Figure 14. Overarching recommendations for the green redesign of public support to agriculture 38
Figure 15. Conditions for cross-compliance to drive behavioural changes and emission reductions 39
Figure 16. Land use and GHG impacts per commodity and per million calories consumed (2010) 45
Figure 17. Average protein consumption compared to average daily protein requirements 46
Figure 18. Types of financial regulations 54
Figure 19. Overview of financial system actors and role of supervisory institutions 57
Figure 20. Amount of finance delivered through the financial system between 2016-20 per commodity and financial instrument 58
Figure 21. Double materiality in financial disclosure 66
Figure 22. Biodiversity indicators for financial market participants and financial advisers under the EU's Sustainable Finance Disclosure Regulation 68
Figure 23. A timeline of China's green taxonomy 75

List of boxes

Box 1. Definition of grey and green finance 19
Box 2. Coupled and decoupled subsidies – what is their impact and who benefits? 29
Box 3. Conservation agriculture and production retirement 31
Box 4. Conditionality of agricultural support in Brazil 41
Box 5. Agricultural innovation support in The Netherlands 44
Box 6. Meatless school lunches in Brazil 47
Box 7. Evaluation of EU agricultural promotion policy 48
Box 8. Agricultural input subsidy reform in China 50
Box 9. Examples of international forums addressing climate-related risks in finance 55
Box 10. Double materiality in financial regulations 60
Box 11. Voluntary disclosure initiatives and lack of standardization 63
Box 12. Examples of country regulations and guidelines adopting the TCFD framework 65
Box 13. The EU FLEGT and the Renewable Energy Directive 71

Executive summary



Parties to the Paris Agreement are committed to work towards aligning public and private finance with the goals of the Paris Agreement. Article 2.1(c) of the Paris Agreement formulates the long-term goal of making 'finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development'.[1] Making finance flows compliant with the Paris Agreement demands not only new climate finance but, more importantly, the redirecting of existing grey financial flows, that is, money with no stated objective to reduce GHG emissions, towards climate-aligned action. If we are to address the climate crisis and stay well below the warming threshold of 2° C, failure to redirect national budgets and align policy frameworks with this commitment is not an option.

The financial incentives that governments put in place in the land sector have the capacity to greatly influence greenhouse gas (GHG) emissions. The land sector is driving about one-quarter of GHG emissions each year. At the same time, the sector is an indispensable part of the climate solution and can provide up to 15 $GtCO_2e$ in annual emission reductions or removals by 2050.[2] To tap into this mitigation potential, public policy needs to ensure that finance is directed to activities that avoid or sequester GHG emissions while improving resilience of rural livelihoods. Agriculture is the most relevant land-based sector as both a direct source of emissions and the most important driver of deforestation.

Governments steer agricultural activities by providing public financial support, the delivery of which rarely takes climate objectives into account.[3] Almost all countries provide some form of preferential treatment for their agricultural sector. Between 2017-19, public support for agriculture provided by member countries of the Organisation for Economic Co-operation and Development (OECD) and 11 major developing economies amounted to approximately USD 619 billion per year. That is almost double the value received by the sector a decade ago, and 56 times the USD 11 billion in climate finance support aimed at land use.[4] Nearly one-third of this support is tied to the production of specific commodities. Around 75 percent of these commodity transfers go to rice, pork, beef and veal, maize and milk - many of which are top GHG emitters.[5] Only approximately 5 percent of the USD 619 billion delivered annually was explicitly linked to environmental goals.[6]

However, reforming public finance alone will not be enough to enable a shift to sustainable land use and revert ecosystem losses already incurred.[7] Private finance flowing to the land sector far outweighs that of public finance, and most of this private money supports activities that deplete natural assets. Business-as-usual private finance for agriculture, forestry and fishing totaled USD 191.6 trillion between 2010–16, or USD 27 trillion per year on average.[i] And global investments in meat and dairy activities– the top GHG emitters in agriculture along with rice production – topped USD 478 billion between 2015–20.[8]

This study seeks to support governments in their efforts to achieve Art. 2.1(c) by recommending how countries can reorient finance flowing to the land sector. As long as grey finance flowing to the land sector dwarfs climate-aligned green finance, efforts to lower the land-sector's emissions trajectory will not succeed. Governments must therefore (i) create a conducive environment for sustainable land use and prosperous rural economies; and (ii) create incentives for climate-aligned private investments. To do so, we explore opportunities for redirecting public support to agriculture and financial markets.

Facilitating a sustainable and just land-use transition

The land sector lies at the intersection of many policy priorities; achieving these diverse and potentially competing policy objectives demands effective leadership. The various policy objectives - ranging from food and nutritional security, to economic development and poverty alleviation, to sustainability and climate change – are complex. Addressing them requires coordinated and well-informed policy-making that integrates various policy objectives. Good policy-making includes establishing clear policy goals and long-term regulatory predictability to give private investors the securities needed for investment; promoting policy coherence and complementarity to minimise trade-offs and maximise synergies; building strong public-private coalitions; establishing robust land governance and land tenure regimes to enable and encourage investment; strengthening the rights of and engagement with indigenous peoples and local communities; and addressing gender inequalities in the allocation of land and access to finance and resources.

i The value refers to gross fixed capital formation as a proxy for investment in activities in the land sector. Data from FAOSTAT *Country Investment Statistics Profile*.

Any transition to using land resources more sustainably must be done in an equitable manner that protects and enhances the resilience of rural livelihoods. The land sector is of vital importance to many millions of farmers and rural and indigenous communities who depend on it for their livelihoods. Achieving a just rural transition involves supporting farmers and rural communities to adopt sustainable practices and adapt to the impacts of climate change. It involves creating employment in the rural economy that benefits the natural environment and ensures that all – especially the poor – have access to affordable, healthy and sustainable food.[9]

Policymakers who are serious about tackling the climate crisis need to ensure that existing policy frameworks do not harm the future of the people they represent. Governments and markets continue to offer farmers and corporations more incentives to exploit natural assets than they do to use them sustainably. This jeopardizes the ability of land to continue to provide the food, water and resources we need to sustain a growing global population.

Opportunities for redirecting public support to agriculture

Public support to the agricultural sector influences agricultural decision-making through providing incentives to bring land into production, determining which commodities to produce and influencing farming practices. Examples of these decisions include whether to deforest or drain peatland for agriculture; choose to farm produce that generates high or low GHG emissions; and adopt farming practices that deplete or regenerate soils.

Agricultural production accounts for 14 percent of global emissions. Of this, by far the greatest source of emissions is livestock farming. The digestive processes of livestock – ruminants in particular – and the practices used to manage animal manure generate significant methane and nitrous oxide emissions. In addition, approximately 83 percent of all farmland (equivalent to the combined area of the entire North and South American continents) is used to grow and feed animals.[10] Agricultural energy

TABLE 1. Summary of green redesign recommendations for public support to agriculture

RECOMMENDATION	REDESIGN CONSIDERATIONS
Make support conditional upon achieving environmental objectives	• Make compliance with all relevant legislation a condition to qualify for support, and/or require farmers to adhere to standards and regulations in order to qualify for support. • Offer graduated payments awarded for emission reductions or removals with increasingly ambitious performance targets, which are either practice- or performance-based. • Build environmental considerations into land and property tax valuations.
Rechannel production support to public goods and services	• Provide funding to drive agricultural innovation and improve productivity. • Provide agricultural training and extension services to farmers. • Invest in collective infrastructure for storage, processing and transportation to reduce food loss. • Provide environmental information services.
Avoid using public support to promote the consumption of ruminant meat	• Adjust value-added tax rates applied to ruminant meat. • Eliminate or reduce ruminant meat provided through public catering and encourage healthier diets. • Implement conditionality for public funds used for marketing, including restricting the use of public funds for meat marketing and allocating funds to promote low-carbon protein alternatives.
Remove or redirect government support provided for agricultural inputs	• Remove fertiliser subsidies, redirect support to income support or channel support to goods and services in high-income countries. • Provide extension services alongside fertiliser subsides in middle- and low-income countries or redirect support to income support. • Remove fossil fuel subsidies. • Remove or redirect subsides for animal feed.

consumption is the next-most important source of GHG emissions, followed by rice cultivation and soil fertilisation. Less than half of the nitrogen applied to soils is absorbed by crops, with the remainder leaching from fields to create local nitrogen pollution and being released into the atmosphere as nitrous oxide.

There are a number of opportunities for redirecting public support to agriculture or to the design of the instruments through which support is delivered (Table 1).

Three overarching recommendations can help to overcome the barriers policymakers face in reorienting finance. First, policymakers need to have a good understanding of the impact of current and planned support on climate, land-use decisions and rural incomes in order to make a strong case for change. Second, repurposing support must aim to reduce emissions without jeopardizing other important development goals; that is, reducing emissions must be part of policies that maximise synergies and minimise trade-offs with other environmental, economic and social goals in order to achieve a just rural transition.[11] Third, policymakers should be prepared for opposition from specific interest groups and other members of government. Ensuring that any repurposing of support goes hand-in-hand with a carefully constructed communications strategy can help to develop clear, targeted and appropriate messaging.[12]

Opportunities for redirecting private financial flows

Investors are channelling large volumes of finance to the land sector, much of which is driving GHG emissions through financing industrial agriculture and incentivizing tropical forest loss.[13] Financial actors, such as banks, asset managers and publicly listed corporations finance rural activities through a variety of forms, including investment funds, bank loans, trade finance, revolving credit facilities, stock markets and project finance.[14]

Financial regulations can ensure that investors and traders consider climate and ecosystem impacts when investing, offering credit or providing other financial services. Notably, governments and supervisory authorities can induce a structural shift in private capital allocation by adapting existing financial regulations. A combination of climate-related prudential requirements and active promotion of sustainable finance can foster new and more climate-friendly agricultural practices and ensure that financial system actors involved in agricultural supply chains have an interest (and duty) to mitigate the adverse impacts of their businesses and redirect financial flows at scale. There are a number of opportunities for redirecting financial markets (Table 2).

TABLE 2. Summary of green redesign recommendations for redirecting financial markets

RECOMMENDATION	REDESIGN CONSIDERATIONS
Move from voluntary to mandatory disclosure	• Increase overall transparency, comparability and quality of disclosures. • Harmonize disclosure obligations by aligning domestic requirements with a common disclosure framework. • Directly adopt (or gradually integrate) a double materiality approach to disclosure. • Provide detailed metrics for reporting on forests, soil and biodiversity impacts.
Enhance risk management frameworks for the land sector	• Adopt (through legislation or supervisory guidance) more comprehensive risk management controls for financial system actors. • Integrate scenario analysis and climate-related stress tests into supervisory approaches (that also covers the agricultural sector). • Impose a legal duty of care and mandatory due diligence for financial system actors that addresses the risk of deforestation within global commodity supply chains.
Active promotion of climate-aligned finance to the land sector	• Introduce (through legislation or supervisory guidance) taxonomies that clearly define the different categories of green and sustainable finance, including for the land sector. • Develop green lending guidance that covers the agricultural sector. • Increase lending limits for farmers and companies that provide evidence of being climate-aligned.

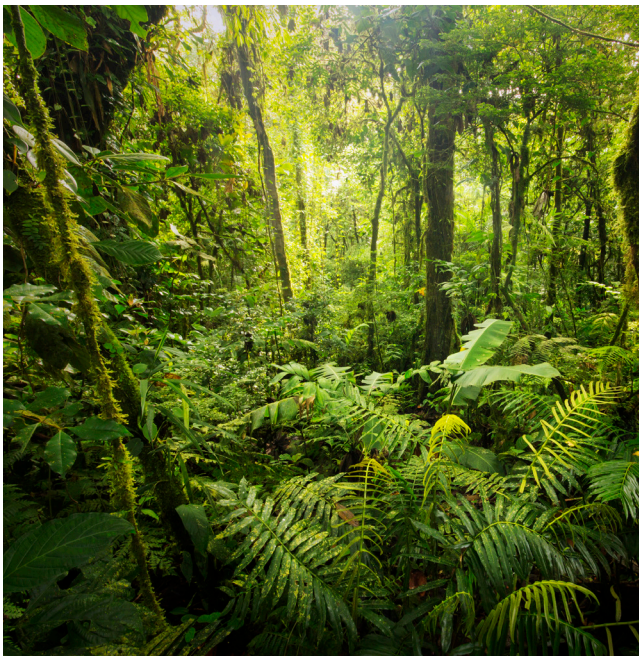
The first two redesign approaches foster climate-aligned finance by addressing issues such as lack of transparency, mispricing of financial assets and misallocation of capital. The third approach moves towards regulatory measures that can be taken by countries and supervisory authorities to more actively promote sustainable (climate-aligned) finance. While certain aspects of these strategies can be implemented simultaneously, binding disclosure requirements along with a common taxonomy that clearly specifies green and climate-consistent enterprises are usually deemed a necessary first step for more informed investment decision-making and the promotion of sustainable investments.

Taking first steps towards a just landuse transition

To move towards aligning financial flows with Article 2.1(c) of the Paris Agreement, policymakers need to pursue a better understanding of the impact of the policies they have in place and identify opportunities for redesign in a manner that facilitates a just land-use transition. To do so, policymakers should:

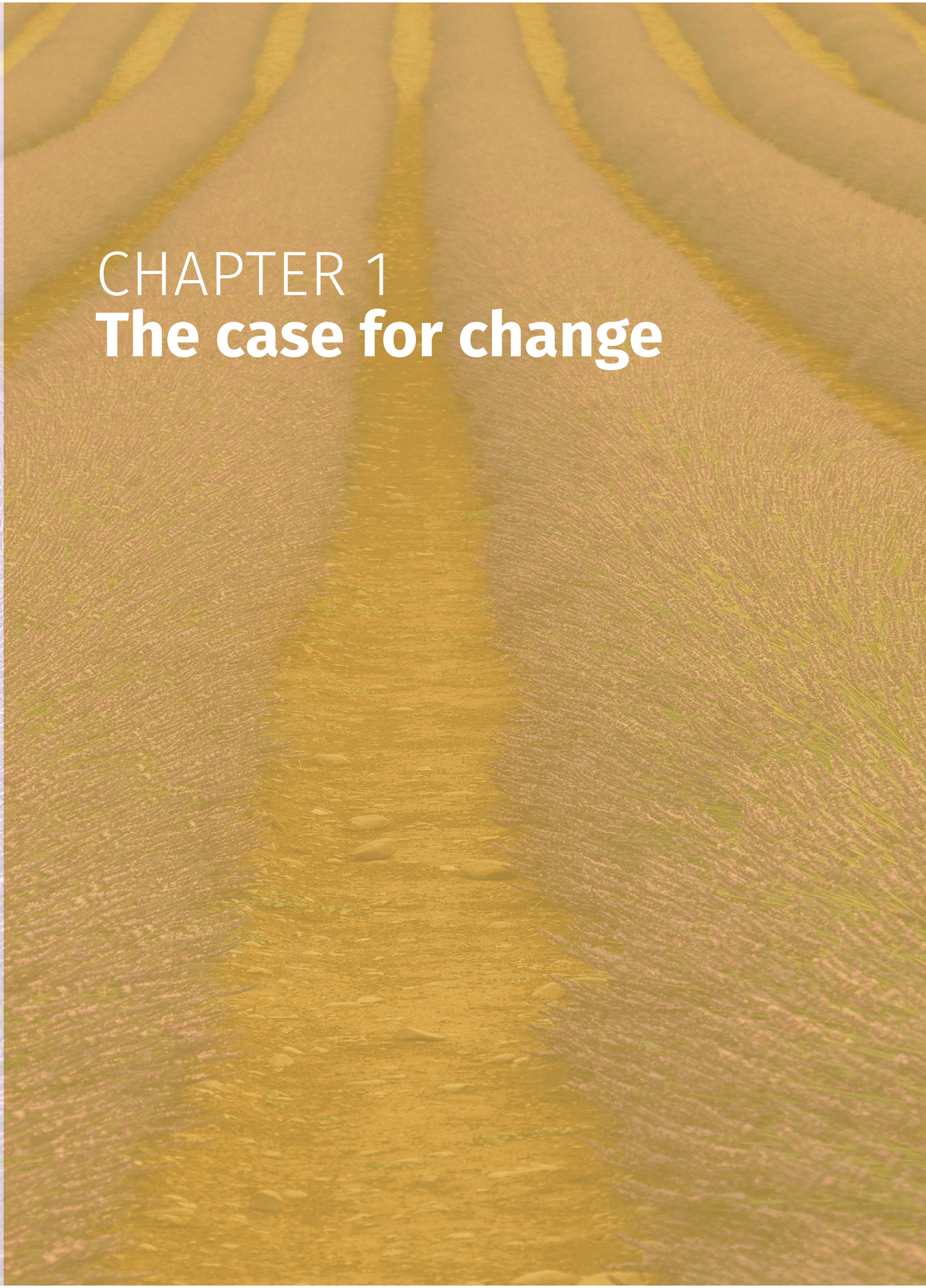
Map out the policy framework influencing how finance is flowing to the land sector. The policies impacting the land sector go beyond those simply developed for agriculture and forestry. They also include the financial regulations that determine the economic environment through which private finance flows to the land sector and the many other legal, regulatory and other financial incentives that influence investment decisions and the ability of land users to access finance. Few policymakers have a comprehensive overview of the policies they have in place influencing when, how and where finance flows to the land sector. This is an essential first step to facilitating a transition to more sustainable practices.

Evaluate the impact and effectiveness of the policies in place. Many of the incentives that remain in place today either have already achieved their intended policy objective or have objectives that are no longer relevant.[15] In other cases, the policy objectives themselves may be obscure, or the method through which support is provided fails to bring the country closer to achieving the stated objective of the support.[16] There is thus a clear need to re-examine the support provided to the land sector to determine who benefits from the support, whether it is effective in achieving its intended objectives, and what the environmental and social impacts of the support are.



Identify opportunities for redirecting finance by redesigning the policy incentives in place. This includes evaluating how best to reorient policy incentives to achieve contemporary policy goals and align with low-carbon development. It also includes identifying who will benefit from the redesign, when these benefits will be delivered, and what are the associated costs if any; it also addresses trade-offs between socio-economic and environmental goals. This report identifies where such opportunities lie within public support to agriculture and financial markets. The suitability of these measures will depend on individual country contexts and capacities, and some may be more attractive and have greater potential for shifting finance than others depending on the national policy context, including where and how public support is awarded today.

Take action to reduce or remove emissions from the land sector by reorienting the policy incentives in place. Making green policy changes can be a long and politically challenging process. With only 10 years to bend the trend on our GHG emissions trajectory, there is no time for further delay. Governments – especially those most responsible for the emissions in our atmosphere today – must make climate-change mitigation a priority and embed mitigation strategies in every facet of their policy frameworks. There are significant opportunities in pursuing a green economy.[17] Between 2009-18 the global green economy demonstrated an annual growth rate of 8 percent, and in 2020 it was materially larger than the oil and gas sector.[18] Many governments, jurisdictions and businesses are waking up to the need to mitigate climate change and the economic opportunities that arise from doing so.



CHAPTER 1
The case for change

The financial incentives that governments put in place in the land sector influence deforestation and forest restoration, farming practices, and demand for agricultural products and their prices. So far, concerns about productivity and economic growth have dominated agricultural and land finance decision-making. These policies miss opportunities to direct money to much-needed investments that reduce or remove emissions while maintaining productivity and economic growth. However, until recently, climate considerations largely have been left outside of the design and regular review of public support mechanisms for land use. This needs to change if the goals of the Paris Agreement are to be met.

In 2015, Parties signed the Paris Agreement, including a long-term goal to make finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development (Article 2.1(c)). This demands not only new and additional finance, but, more importantly, an overhaul of existing financial flows. While investments in sustainable land use have increased in recent years, much more is needed to align public support for the land sector with the achievement of climate goals.

The land sector is driving almost one-quarter of GHG emissions. About 40 percent of those are driven by land use, land-use change and forestry, and the remaining 60 percent of emissions are driven by agricultural production. But the land sector also holds huge potential to be part of the climate solution. The mitigation potential of emissions reduction and carbon removal measures from the land sector is estimated at 15 $GtCO_2e$ per year by 2050. This is equivalent to the annual emissions of the United States, the European Union, Russia and India combined.[19] To tap into this mitigation potential, public policy needs to ensure that finance is directed to activities that mitigate climate change and improve the resilience of rural livelihoods.

In this report we, therefore, aim to:

- Illustrate how public finance is influencing land-use practices and the sector's associated GHG emissions;
- Showcase how policy instruments for directing finance can be redesigned to consider climate goals;
- Provide examples from countries that have already repurposed elements of public policy to support sustainable land use;
- Recommend redesign opportunities for policymakers.

1.1 Shifting land-use finance to achieve climate goals

Policy decisions have a significant impact on our landscape, and as such, governments hold the key to ensuring land use is aligned with global and national climate-change goals. The financial incentives that governments put in place in the land sector influence deforestation and forest restoration, farming practices, the cost of production, demand for agricultural products and their prices. Land also provides the biophysical basis for food, freshwater, fuel, fibre, minerals and shelter, along with many other ecosystem services. The paramount importance of land for socio-economic development has led governments to devote substantial volumes of public support to land use in the last decades.

Land and land use lie at the intersection of many policy priorities, from food and nutritional security, to economic development and poverty alleviation, to sustainability and climate change. Achieving these diverse, and potentially competing, policy objectives is contingent upon the efficient use of land and demands strong and effective land-use policies. However, until recently, climate considerations have been, by and large, left outside the design and regular review of public support mechanisms for land use.[20]

This needs to change if the goals of the Paris Agreement are to be met. Agriculture, Forestry and Other Land Use (AFOLU) is driving about one-quarter of global greenhouse gas (GHG) emissions, at 12 ± 2.9 $GtCO_2e$ each year.[21] At the same time, the agricultural sector has a mitigation potential of 2.3 – 9.6 $GtCO_2e$ per year by 2050; reducing deforestation and degradation could achieve up to a further 5.8 $GtCO_2e$ in lowered GHG emissions.[22] If dietary changes are considered, the technical mitigation potential from land use rises by a further 0.7 - 8 $GtCO_2e$ per year by 2050. The sector is, thus, also an indispensable part of the climate solution. To tap into the mitigation potential of the land sector, public policy needs to ensure that finance is directed to activities that mitigate climate change and improve the resilience of rural livelihoods.

So far, concerns about productivity and economic growth still dominate agricultural and land finance decision-making. Public support for agriculture totaled USD 619 billion annually between 2017–19,[23] the vast majority of which did not consider any climate objectives. Approximately half of this finance was disbursed via market-distorting instruments that are detrimental to environmental health and resilience.[24] This includes subsidies that are either directly linked to agricultural output or that support the unconstrained use of farm

inputs, with little attention paid to the generation of wider public goods.[25] Other forms of public support to agriculture – such as market price supports – concentrate on subsidising only a few carbon-intensive commodities. These policies hamper sectoral competition and divert money from much-needed investments that reduce or remove emissions while maintaining productivity and economic growth.[26]

However, reforming public finance alone will not be enough to enable a shift to sustainable land use or to promote reversal of the losses already incurred. The amount of private finance flowing to the land sector far outweighs that of public finance, and most of this private money supports activities that deplete natural assets.[27] Agricultural growth has helped to satisfy the needs of growing populations and reduce poverty, yet it has also triggered an unsustainable rate of natural ecosystem loss.[28]

The current policy framework in the land sector is not designed to limit emissions from agriculture, nor is it working to protect forests. Over the past 50 years, unprecedented population growth has generated dramatic increases in demand for food, resources and energy. According to the Intergovernmental Panel on Climate Change (IPCC), agricultural growth – including expansion of agricultural land into previously forested areas – has led to significant increases in GHGs, loss of ecosystems and dramatic declines in biodiversity.[29] Human-induced environmental changes are threatening agricultural productivity itself, with farmers around the world struggling to adapt to changes in temperature, extreme weather events and pest outbreaks. These changes are threatening the ability of future generations to meet their agricultural needs.[30]

The human-induced impacts on climate could be minimised if financing decisions were to adequately consider their impact on the climate. The signing of the Paris Agreement in 2015 marked a significant step in international efforts to tackle climate change. Signatories agreed to three long-term goals in Article 2. This includes limiting the increase in global warming to well below 2°C and pursuing efforts to limit this warming to 1.5°C above pre-industrial levels (Article 2.1(a)); fostering climate resilience and low greenhouse gas emissions development (Article 2.1(b)); and – most importantly for this study – making finance flows consistent with a pathway towards low greenhouse gas emissions and climate-resilient development (Article 2.1(c)).[31]

But to stay within 1.5°C of warming, by 2050 agricultural emissions would need to decrease by 75 percent from projected business-as-usual levels and extensive reforestation efforts would be required to offset other emissions. Meeting the more lenient 2°C goal similarly would require reducing agricultural emissions by 75 percent while achieving net-zero emissions from land-use change between 2010 and 2050.[32] Considering the current emissions trajectory, both scenarios will require a strong commitment from policymakers.

While investments in sustainable land use have increased in recent years,[33] they are not occurring fast enough; the rate of investment must be accelerated to align public support for the land sector with the achievement of climate goals.[34] The acknowledged and imminent effects of climate change must be central to policymaking, especially in a sector that will broadly shape the health, social and economic outcomes of future generations.

In committing to the goals of the Paris Agreement – in particular Article 2.1(c) – governments have pledged to align finance flows with climate action. This demands not only new and additional finance but, more importantly, an overhaul of existing financial flows. Failure to redirect national budgets and align policy frameworks with this commitment is no longer optional if we are to address the climate crisis. Governments must translate their words into actions, and redirect finance flows into facilitating the sustainable land use transition that is needed to remain within safe levels of global warming.

This study seeks to support governments in their efforts to achieve the long-term goal of Article 2.1(c) of the Paris Agreement. The aims of the study are outlined in Figure 1.

We discuss public instruments that are commonly applied by governments, channel large amounts of finance, and have a clear potential to impact GHG emissions. These public policy instruments influence how, where and when financial support flows to the land sector.

This study is organized as follows:

The remainder of **Chapter 1** summarizes the share the land sector has in global GHG emissions as well as its ability to contribute to achieving the climate goals of the Paris Agreement.

Chapter 2 outlines our approach, including the rationale for focusing the analysis on the selected policy instruments, and the elements we explore for each. It also summarizes key data sources, terminology and the constraints of our research.

FIGURE 1. Aims of the study

Chapter 3 presents the conditions that need to be in place to facilitate private sector action and propel financiers to realign land sector finance with the Paris goals.

Chapters 4 and 5 analyze selected policy instruments in detail and present recommendations for green reform.

Chapter 4 considers options for redirecting public financial support to agriculture. These influence whether to bring land into agricultural production, how to farm and what to produce. We consider options to move away from using public funds to promote demand for ruminant meat, including environmental conditionality in support, removing support coupled to inputs, and redirecting production support to the provision of public goods and services.

Chapter 5 examines other instruments to shift private finance including prudential requirements in the form of disclosure, reporting standards and capital adequacy requirements, and risk management controls. It also considers standards that facilitate market development and actively promote sustainable finance. Those standards along with prudential requirements are essential to ensure that private investments are also aligned with climate mitigation objectives.

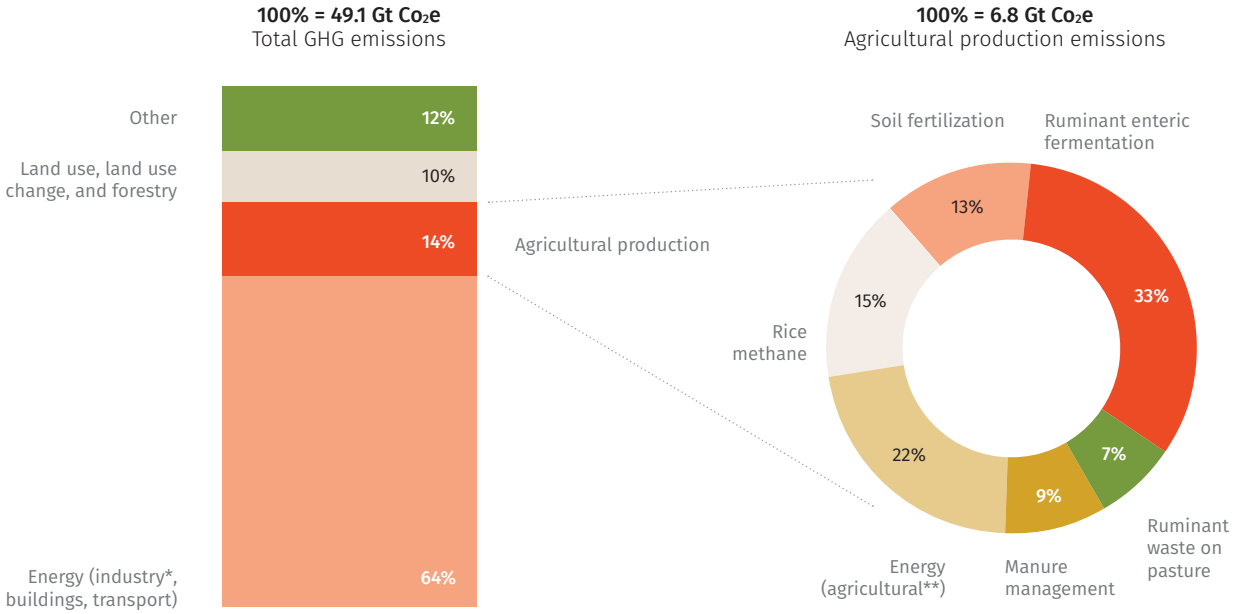
Chapter 6 presents our conclusions and recommendations.

1.2 Land use as a climate problem and solution

The land sector refers to land used for agriculture, forests and other non-aquatic ecosystems. The sector as a whole emits GHGs through land conversion, ecosystem degradation and agricultural activities, but also acts as a sink that stores carbon away from the atmosphere in soils and biomass. Globally, 9-14 percent of GHG emissions come from crop and livestock activities and 5-14 percent from deforestation and peatland degradation, much of which is driven by agriculture.[35] The most significant emitted gases are carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O); the latter two of which have a global warming potential that is, respectively, 28 and 298 times more powerful than an equivalent amount of CO_2 over 100 years. Unsustainable land use can disrupt terrestrial carbon stocks to become enormous emitters of carbon dioxide. Land-use changes comprise the bulk of CO_2 emissions - whereas agricultural production is responsible for the majority of the non-CO_2 emissions – and together they account for almost one-quarter of global GHG emissions (Figure 2).[36]

Between 2010–20, 7.8 million hectares of natural forests were lost each year through forest fires and logging. This is equivalent to losing an area the size of the Czech Republic each year, and deforestation shows no sign of slowing.[37] Concurrently, emissions from deforestation have risen by 0.43 – 1.4 Gt CO_2 per year in the period from 2013-19.[38] Much of the forest clearing – around 40 percent – is carried out to make way for commercial commodity production.[39] This includes cattle, palm oil, soy, cocoa, rubber, coffee and wood fibre.

FIGURE 2. Agricultural production and LULUCF account for ~23 percent of global GHG emissions



Source: Reproduced from WRI (2019) Creating a Sustainable Food Future.
** Excludes emissions from agricultural energy sources.*
*** Includes emissions from on-farm energy consumption, as well as from manufacturing of farm tractors, irrigation pumps, other machinery, and key inputs such as fertilizer. It excludes emissions from the transport of food.*

Within agricultural production, the single greatest source of emissions by far is livestock farming (Figure 2). The digestive processes of livestock – ruminants in particular – and the practices used to manage their manure generate significant methane and nitrous oxide emissions. In addition, approximately 83 percent of all farmland (equivalent to the combined area of the entire North and South American continents) is used to grow and feed livestock. The livestock segment contributes close to 60 percent of the food system's GHG emissions but provides only 18 percent of calories consumed globally.[40] This is followed by agricultural energy consumption[ii] and rice cultivation, which generate methane through the anaerobic decay of materials. The next major source of emissions is fertiliser application to soils. Crops absorb less than half of the nitrogen applied to soils; the remainder leaches from fields to cause localized areas of nitrogen pollution and also is released into the atmosphere as nitrous oxide.

With the global population projected to reach nearly 10 billion people by 2050 (requiring an increase in food production of 25 –70 percent)[iii], total emissions from agricultural production are projected to grow significantly (Figure 3).[41] The greatest rise in emissions is expected to come from the livestock sector, with enteric fermentation, waste and manure management seeing significant growth.

By 2050, demand for animal-based food is expected to rise by 68 percent.[42] Demand for meat from ruminants (cattle, sheep and goats) is expected to grow even more, by 88 percent by 2050. Meeting this demand while maintaining current production practices would require clearing most of the world's remaining forests and putting the world on track to far exceed a 1.5° C – 2°C temperature rise.[43]

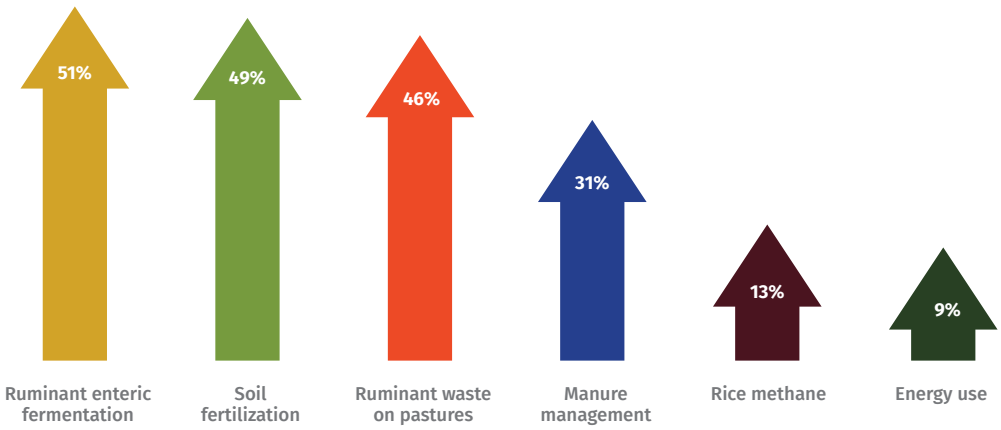
GHG emissions from soil fertilisation are also expected to see significant growth by 2050, mainly due to increased food production. Fertilisation of crops with nitrogen, phosphorous and potassium is important to achieving high yields, but more than half of the nitrogen now applied to crops is lost as run-off. [44]

ii This includes emissions from on-farm energy consumption, as well as from manufacturing of farm machinery and key inputs such as fertiliser. It excludes energy emissions from the transport of food.

iii Projected emissions growth represents the average over the sector.

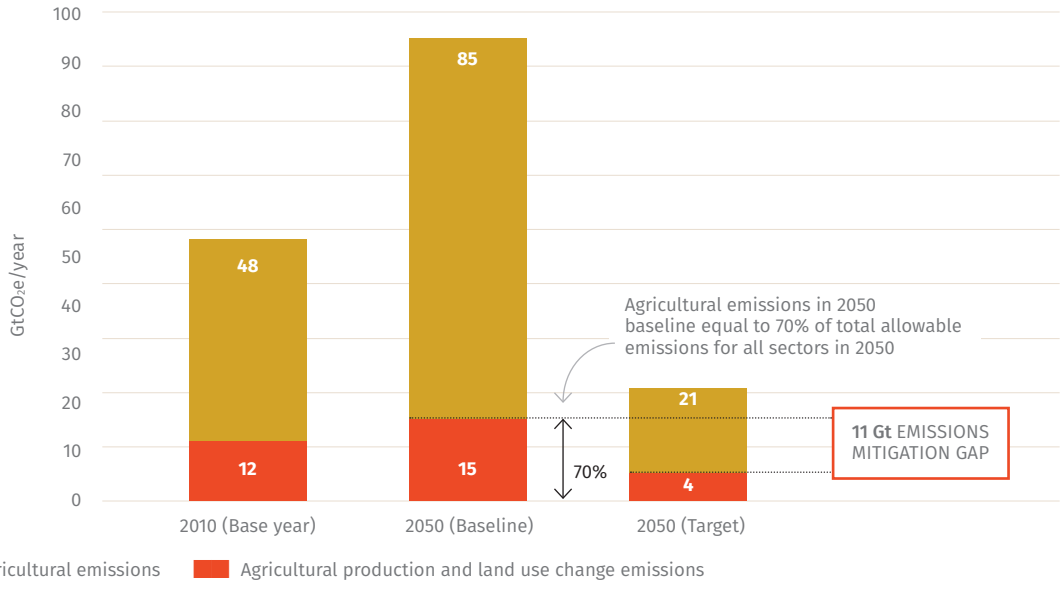
On our current trajectory, agricultural and land-use change emissions will likely equal 15 Gt CO_2e per year by 2050, while emissions from other sectors are expected to be 70 Gt CO_2e (Figure 4).[iv] Yet, to stay within 2°C of warming, a recent analysis suggest an annual global GHG emissions budget of around 21 Gt CO_2e by 2050 as a 'most plausible target'.[45] On a business-as-usual trajectory, emissions from agriculture and land use alone would generate 70 percent of allowable emissions. This scenario leaves far too little room for GHG emissions arising from all other sectors – and would prevent humanity from meeting the long-term goals of the Paris Agreement. The alternative, which accounts for predicted emissions growth across all other sectors – requires a 75 percent emissions reduction in business-as-usual activity. In other words, it requires emissions from agriculture and land-use change to drop to 4 Gt CO_2e by 2050, leaving a GHG gap of 11 Gt CO_2e to be mitigated between 2010-50.

FIGURE 3. Expected emission increase in percentage per type of agricultural emissions source (2010-2050)



Source: Searchinger et al. (2018), Creating a Sustainable Food Future.

FIGURE 4. Greenhouse gas emissions by 2050, under baseline and target scenarios

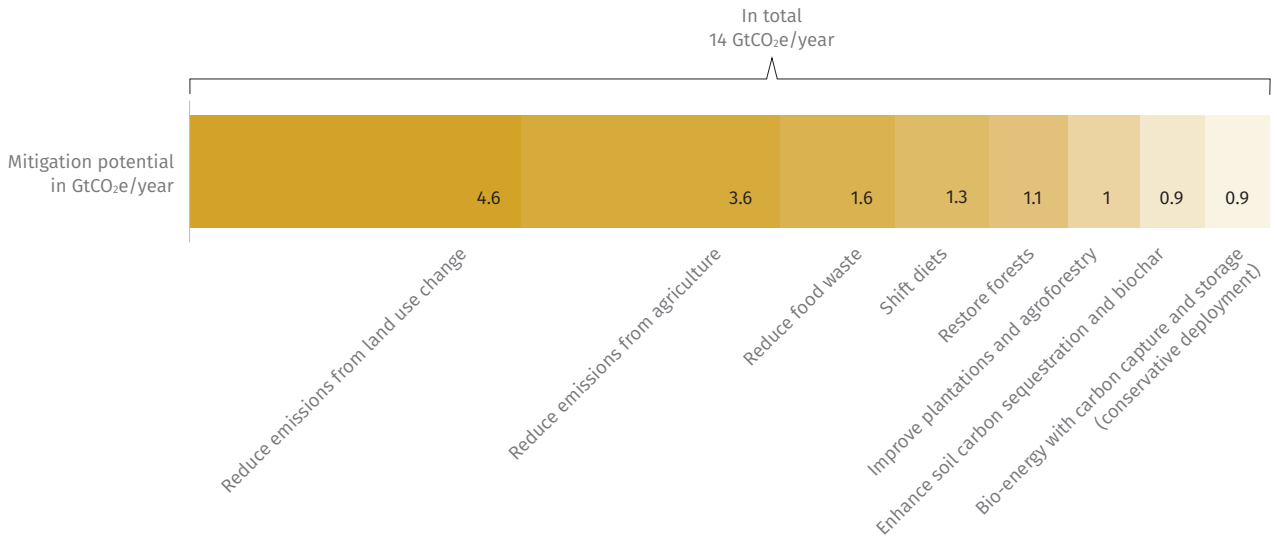


Source: reproduced from Searchinger et al. (2018) Creating a Sustainable Food Future; GlobAgri-WRR model, WRI analysis based on IEA (2012); EIA (2012); Houghton (2008); OECD (2012); and UNEP (2013).

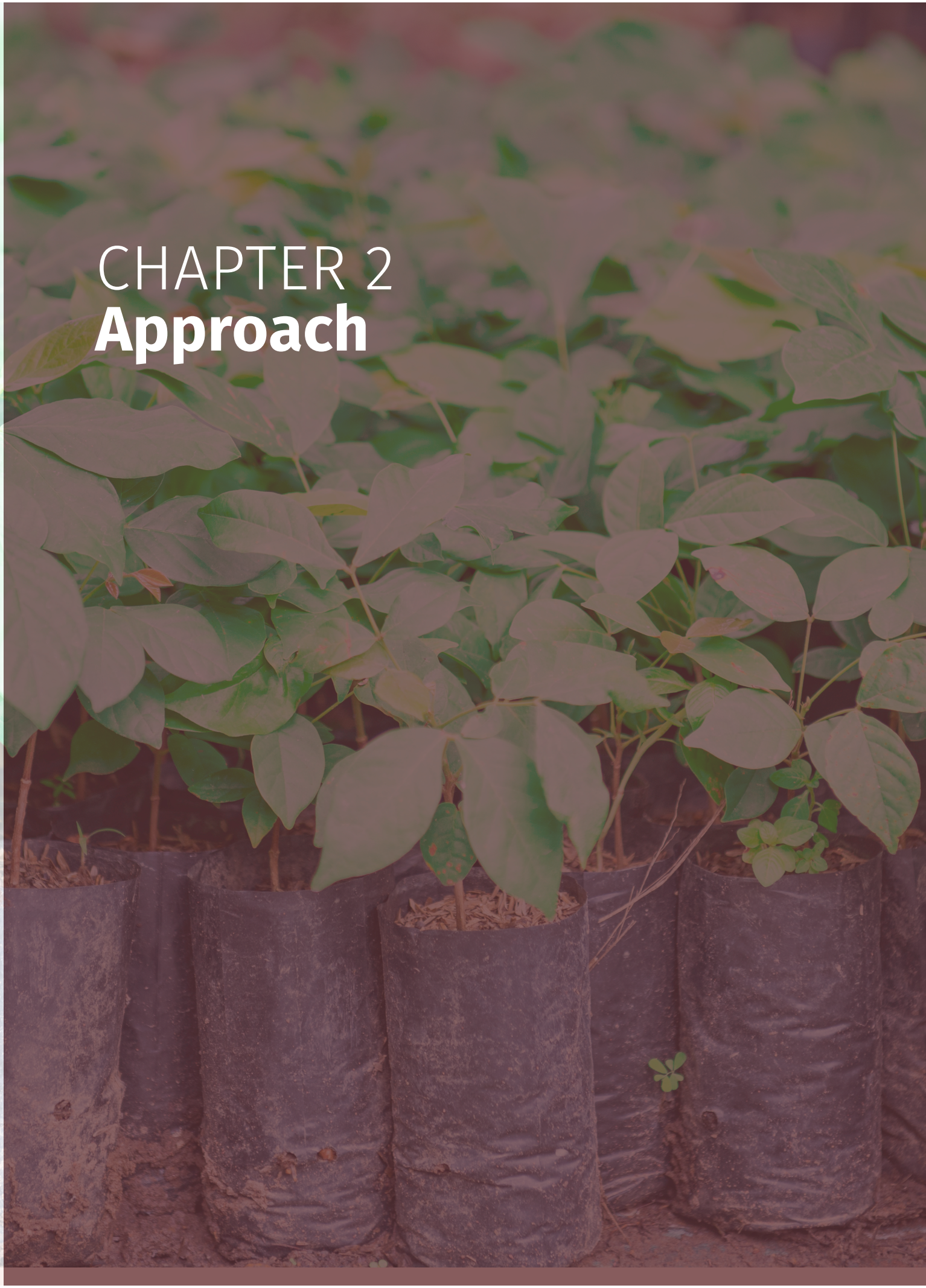
iv The baseline projection for 2050 is based on the assumptions that increased food demand will be met while yields and productivity do not increase. The 2050 GHG emissions target provides an estimate of permissible emissions that are compatible with the 2°C long-term temperature goal and assumes a limited role of negative emissions. Setting a single-year target is a complicated process, as it must consider many emissions pathways that are plausible and compatible with a 2°C warming scenario, but which require different emissions in a specific year. The 2050 GHG emissions target presented here is, therefore, only a useful benchmark and should not be interpreted as a definite carbon budget.

While agricultural production and land-use change are today significant sources of GHG emissions, they also hold huge potential to support global climate-change mitigation efforts. Mitigation activities involve the reduction or avoidance of GHG emissions through improved agricultural or forest management practices and the direct removal of GHGs from the atmosphere through sequestering carbon in soils and biomass. By 2030, the land sector is estimated to have a mitigation potential similar to that of the energy sector. Overall, the sector could deliver almost one-third of mitigation needs required to keep global warming below 1.5˚C The global mitigation potential of emissions reduction and carbon removal measures from the land sector is estimated at 15 $GtCO_2e$ per year by 2050 (Figure 5).[46] In tropical countries, the biggest potential will come from avoiding deforestation, peatland fires and mangrove conversion. In middle- and high-income countries, mitigation opportunities include ecosystem restoration, forest and agricultural soil management, and lifestyle choices such as reducing food waste and shifting to a low-carbon diet.

FIGURE 5. Mitigation potential of land use measures to keep global warming below 1.5˚C by 2050, in $GtCO_2e$/year



Source: Roe et al. (2019).[47]



CHAPTER 2
Approach

In this report, we examine opportunities for redirecting finance away from activities that are leading to the destruction of natural ecosystems and into activities that will result in more sustainable land uses. We focus on several policy instruments that direct a significant portion of public and private finance, are commonly applied by governments and have the potential for redesign to enhance climate mitigation.

This includes public support to agriculture, due to this representing the bulk of government spending in the land sector; and financial regulations, due to the policies and regulations that govern the financial system having vast potential to redirect private finance for land use.

In order to guide our analysis of the selected policy instruments, we explore:

- Which social, economic and environmental motivations typically drive employment of the instrument in the land sector;
- How much finance is mobilized through the policy instruments and where it is directed;
- To what extent the policy instruments support activities that lead to GHG emissions;
- What options exist for repurposing the instruments to ensure that financial decisions account for climate change.

Our attention is directed primarily to agriculture as a land use. Globally, agriculture is estimated to be the driver of around 80 percent of deforestation and uses almost half of the world's habitable land. Over 75 percent of this land is used for livestock (including grazing land and area used to produce crops for animal feed), and the remaining area is used to produce crops for human consumption. Most finance flowing to forests can already be categorized as 'green' i.e., it is delivered with the objective of conservation, protection or the sustainable use of land.

The recommendations presented in this report are not without constraints. Country-specific analyses will need to be carried out to determine how best to reshape policies within a national context, taking into account national circumstances and (sometimes competing) national priorities in the land sector. Our discussions exploring where public finance is currently flowing do not aim to be comprehensive or to precisely capture all types and volumes of flows. Quantifying exactly how much finance is flowing through which instruments and in support of which activities on a global level is complicated by data gaps, overlaps and differences in how countries quantify and report their financial data. There is also an absence of commonly agreed-upon international definitions and uncertainties around the manner in which different public policy instruments are deployed and how to determine their impact on GHG emissions. We, therefore, do not seek to quantify the GHG impact of financial flows at a global level, instead relying on country-specific estimates to illustrate the magnitude of GHG impact relative to national emissions.

2.1 Scope

We refer to the 'land sector' throughout the report, including land used for agricultural production, forests and other non-aquatic ecosystems.[v] Of these, our analysis focuses primarily on agriculture as a land use for a number of reasons:

Firstly, agricultural subsidies and spending represent the biggest chunk of government support for the land sector. Governments provide annually around USD 619 billion to the agricultural sector.[48] In 2010, by contrast, the last year for which global public expenditure data is available for forests, governments disbursed only USD 38 billion to forest-related activities.[49]

Secondly, agriculture is estimated to be the direct driver for around 80 percent of deforestation, or 2.6 $GtCO_2e$ in emissions annually (from tropical deforestation).[50] In Latin America, two-thirds of forest loss is driven by commercial agriculture; in Africa and tropical Asia, both commercial and subsistence farming account for one-third of deforestation.[51] Over the last 100 years alone, the continued expansion of land for agriculture has been the primary driver resulting in the loss of enough forests to cover an area the size of the United States.[52]

Finally, 46 percent of the world's habitable land is used for agriculture.[53] Over three-quarters of that is used for livestock – including grazing land and area used to produce crops for animal feed.[54] The remaining habitable land is comprised of 38 percent forest, 14 percent wild grassland and shrubs and 1 percent urban and built-up areas. Over the last century alone, over one-third of the world's forests have been lost, primarily to agriculture.

v A detailed analysis of opportunities for fiscal reform to reduce deforestation and forest degradation and enhance sustainable forest management is provided in a publication from the World Bank (2021) *'Designing Fiscal Instruments for Sustainable Forests'.*

In this report, we are concerned with moving finance away from activities that are leading to the destruction of these natural ecosystems and into more sustainable land uses. Most finance flowing to forests – which as demonstrated above is relatively little – can already be categorized as 'green,' i.e., it is delivered with the objective of conservation, protection or the sustainable use of land. Our attention is, therefore, directed at land uses that are driving the loss of forests and other non-aquatic ecosystems.

We also focus predominantly on the potential for shifting finance to achieve climate-change mitigation. The Paris Agreement's Article 2.1(c) aims to make finance flows consistent with a pathway towards low GHG emissions and climate-resilient development.[55] Resilience and adaptation are essential qualities, especially in the land sector where livelihoods are vulnerable to the impacts of droughts, floods, seasonal variations and changes in the types of pests and their ranges. But due to limitations of scope, we focus our discussion largely on mitigation aspects and the urgent policy changes required for achieving a large-scale transition to a low-carbon land sector.

2.2 Overview of instruments

Governments have an array of policy instruments at their disposal to influence how, when and whether land is used (Figure 6).

FIGURE 6. Classification of government policy instruments for redirecting finance to land use

Government spending and revenues		Financial regulation		Soft law
Fiscal policy instruments	Public finance instruments			
Direct government expenditures and revenue collection used to steer a country's economy	Indirect government spending through majority state-owned financial institutions and agencies	Policy and regulations for the financial system and financial institutions within it, including those that affect monetary supply and achieve macroeconomic stability goals		Non-binding policy and information instruments
↓	↓	↓	↓	↓
e.g. direct budget spending on credit lines and subsidies, and revenue raising through taxes, fees and levies	e.g. channelling public finance and financial instrument application (inc. grants, debt, equity, guarantees and insurance) domestically and internationally	e.g. disclosure requirements, stress testing and due diligence requirements	e.g. green taxonomies, credit allocation by central banks, capital and lending requirements	e.g. certification, labelling, transparency initiatives, statistical services, voluntary standards
Instruments considered in report				
Agricultural subsidies	Not evaluated	Disclosure requirements, Risk management frameworks, Standards that promote sustainable invesment		Not evaluated

Source: adapted from Whitely et al. (2018).

Fiscal policy instruments involve government spending and tax revenue collection employed to steer a country's economy. These instruments influence the cost of production and commodity pricing, and directly influence land use decisions by channeling significant portions of public finance, especially to agriculture. To shift risk in farm-level decision making, policymakers can also choose to provide loans and credits lines in support of certain activities, and/or offer grants, equity, guarantees or insurance products. The interest rates that are attached to these financial products, repayment terms and lending requirements all influence the choices that landowners will make when investing in their businesses.

Public finance instruments focus on expenditure from majority-owned public financial institutions. This includes finance that flows through, for example, development co-operation agencies or export credit agencies. Many experts also classify these instruments within the broader category of fiscal policy instruments.

Financial regulations refer to regulations put in place to ensure safety of the financial system and to limit the financial risks to which an institution or financial market may be exposed.[56] These include prudential requirements addressing financial risks posed by climate change, such as standards and rules related to disclosure of environmental, social and governance (ESG) risks in general, and climate-related risks in particular, as well as supervisory guidance on risk management frameworks to understand, manage and monitor these risks. Financial regulations also have a role to play in more actively supporting low-emission development pathways, e.g., through green taxonomies, green credit allocation, and expansion of lending limits to green enterprises.

And finally, **soft law instruments** can be employed by governments – typically by endorsing initiatives – as non-legally binding instruments that still hold potential for influencing land use behaviour. This can be through influencing demand for agricultural and forest products, such as by raising awareness of how commodities are produced through transparency initiatives or influencing buyer choices. Statistical services and product labelling also help to guide consumer decisions. Transparency initiatives that provide platforms for reporting on climate-related risks and investments allow improved accountability and monitoring of financial activities.

Our analysis focusses several policy instruments that direct a significant portion of finance, are commonly applied by governments and have potential for redesign to enhance climate mitigation. Within fiscal policy instruments, we focus our analysis on **public support to agriculture; within financial regulations we consider disclosure requirements, risk management frameworks, and standards that more actively promote sustainable investments** (Figure 6).

In order to guide our analysis of the selected policy instruments, we explore:

- Which social, economic and environmental motivations typically drive employment of the instrument in the land sector;
- How much finance is mobilized through the policy instruments, and where it is money directed;
- To what extent does the policy instruments support activities that lead to GHG emissions?
- What options exist for repurposing the instruments to ensure that financial decisions account for climate change.

We provide examples of successful reform to illustrate that the shift of finance flows can be – and has been – done. We also offer general recommendations that highlight opportunities for reform and inspire a national re-examination of the policy incentives in the land use sector.

We also provide a detailed analysis of selected policy instruments, presenting options for consideration by policymakers and opportunities for reflection on the potential impact that incentives in the land sector are having on greenhouse gas emissions. We describe how these reform options have been applied in different countries, aiming to demonstrate that changes can be made. Our recommendations provide a menu of options for redesigning policy instruments that impact land use. These can be adjusted and fine-tuned to meet the unique conditions of individual countries.

2.3 Terminology

The diversity in climate mitigation and adaptation activities makes it difficult to properly classify financial flows as either contributing to or undermining climate objectives. Classification is further hindered by the absence of an internationally agreed-upon measure that quantifies the minimum GHG reductions an investment must achieve to be considered 'climate finance', thus allowing moderately low-carbon activities the same recognition as those in strict alignment with the goals

of the Paris Agreement.[57] Nonetheless, in the context of this study we employ the definitions outlined in Box 1 in which distinctions are made between 'green', 'grey' and 'climate misaligned' finance.

Any reference made to GHG emission reductions also refers to emissions removals, unless otherwise stated.

2.4 Constraints

Shifting finance will require coordinated action and agreement across multiple government agencies, and the mobilization of a number of instruments to be effective. Analysing flows and redesign options for the selected instruments in this study provides an important first step in assessing opportunities for shifting finance flows. Country-specific analyses will need to be carried out to determine how best to reshape policies within a national context, taking into account national circumstances and (sometimes competing) national priorities in the land sector. This includes an analysis of the tradeoffs with other important land sector goals, such as poverty alleviation, biodiversity support, food security enhancement and economic development. The redesign options presented are, however, selected to minimise such trade-offs and capitalize on opportunities for win-win solutions.

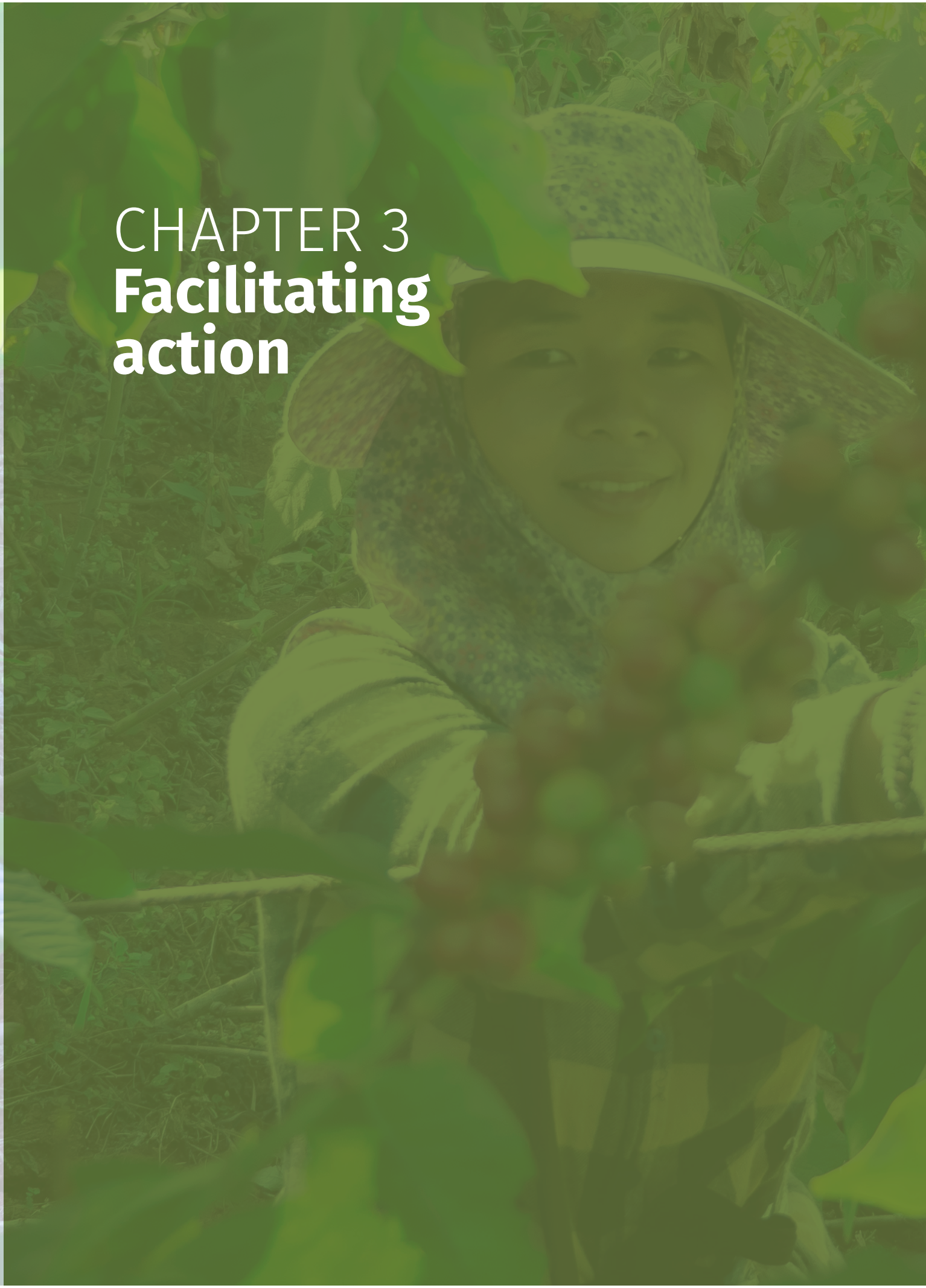
Providing a prescriptive set of guidelines is also complicated by the difficulties in quantifying exactly how much finance is flowing through which instruments and in support of which activities at the global level. This makes linking financial flows to GHG emissions a challenge. There is an absence of commonly agreed-upon international definitions and uncertainties around the manner in which different public policy instruments are deployed. Significant data gaps and differences in how countries quantify and report their financial data create additional complications. Our discussions exploring where public finance is flowing do not aim to be comprehensive or to precisely capture all types and the volume of flows. As we rely on data from a wide range of secondary sources, the figures mentioned are sensitive to double counting, for instance, where the same activity is counted towards different objectives or where public finance flows are recorded simultaneously as primary and secondary disbursements. We have, therefore, relied on case studies and regional research to provide illustrative estimates of how much finance is flowing through specific policy instruments, although some overlap in reported figures may still occur. We also do not seek to quantify the GHG impact of financial flows at the global level, instead relying on country-specific estimates to illustrate the magnitude of GHG impacts relative to national emissions.

BOX 1. DEFINITION OF GREY AND GREEN FINANCE

Green finance is defined as finance that is aligned with objectives for the conservation, protection or sustainable use of land. This includes finance provided with a clear and stated objective of climate mitigation and/or adaptation in the land sector.

Grey finance is defined as finance that has no stated objective to positively impact emissions from the AFOLU sector but has potential to impact it. The impact – whether positive or negative – depends on the context, as well as the design and implementation of these activities. In the context of this assessment, we consider primarily non-specific finance for agricultural activities as grey finance.

Climate mis-aligned finance refers to financial flows that support carbon-intensive activities, which have few if any safeguards against resulting climate impacts. In the context of this assessment, climate misaligned finance is used to refer to fossil fuel investments or finance that supports activities that are clearly detrimental to the climate (e.g., deforestation, peatland drainage).

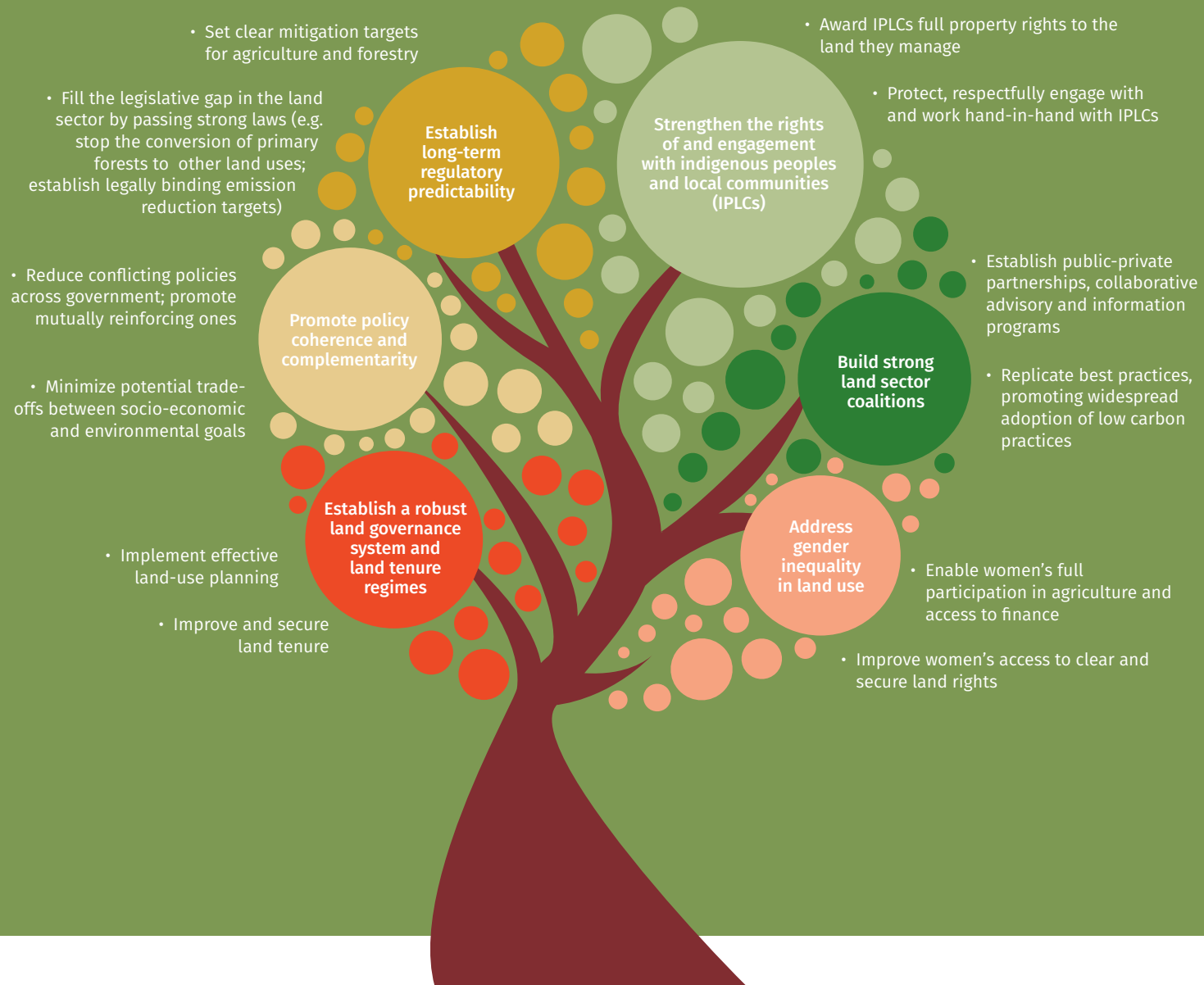


CHAPTER 3
Facilitating action

To achieve the long-term goals of the Paris Agreement, all finance – both public and private – flowing to the land use sector must be green. There are a number of enabling conditions that will facilitate this shift in finance. This includes establishing clear policy goals and long-term regulatory predictability to give private investors the securities needed for investment; promoting policy coherence and complementarity to minimise trade-offs and maximise synergies; building strong public-private coalitions; establishing robust land governance and land tenure regimes to enable and encourage investment; strengthening the rights of and engagement with indigenous peoples and local communities; and addressing gender inequalities in the allocation of land, access to finance and resources.

Figure 7 depicts the key governance factors that this chapter outlines as necessary to facilitate private sector action and enable financiers to realign land sector finance with the Paris goals.

FIGURE 7. Key governance enablers for realigning land sector finance with climate goals



3.1 Establish long-term regulatory predictability

Clear policy goals and long-term regulatory predictability are crucial for redirecting private sector investments in the land sector. Agricultural and forest-related investments often carry high up-front costs with long investment return horizons. Private investors, therefore, need long-term regulatory certainty on which to base their investment decisions, especially if finance is to flow towards more climate-friendly farming technologies and practices.

3.1.1 Set clear mitigation targets

To foster an enabling regulatory environment that provides certainty to investors, farmers and businesses, governments should develop specific short, medium and long-term land sector goals and build their land sector policies to clearly work towards achievement of these goals.

Nationally Determined Contributions (NDCs) detail countries' ambitions for achieving the Paris goals. They can be a powerful vehicle to showcase political commitment to achieve land use emission reductions and attract international finance and mobilize domestic funding. Almost all of the NDCs submitted feature the agriculture and/or Land Use, Land Use Change and Forestry (LULUCF) sector in their mitigation and/or adaptation contributions.[vi] However, very few provide specific quantitative goals, clear targets or a strategy for tracking and monitoring progress.[vii/viii] NDCs should be reviewed and updated to include ambitious emissions trajectories for the land sector and offer clarity on the measures planned, actions to be taken and their estimated costs.[58]

vi Out of the 194 NDCs submitted, 96 percent included agriculture and/or LULUCF in their mitigation and/or adaptation contributions. K. Crumpler, K., Meybeck, A., Federici, S., Salvatore, M., Damen, B., Dasgupta, S., Wolf J., and Bernoux, M. (2019) Assessing the role of agriculture and land use in Nationally Determined Contributions. Environment and Natural Resources Management, Working Paper no. 76. Rome, FAO.

vii Despite this high NDC coverage, by 2016 only nine countries had advanced specific quantitative goals for the agricultural sector. Richards, M. et al. (2016). How countries plan to address agricultural adaptation and mitigation – an analysis of intended nationally determined contributions. Climate Change, Agriculture and Food Security (CCAFS)

viii An analysis by Bakhtary et al. (2020) looked at updated NDCs to determine whether any had made improvements with respect to their forest targets and found that although only 12 countries had submitted an updated NDC, 10 of these had improved forest targets. This included 'more ambitious GHG and non-GHG targets, more clarity on the strategies and measures to achieve these targets, and more detail on costs, financing sources and co-benefits'. None include a clear strategy for tracking and monitoring implementation. Source: Bakhtary, H.; Haupt, F. and Manirajah, S. M. (2020) Enhancing forest targets and measures in Nationally Determined Contributions (NDCs).

3.1.2 Fill the legislative gap in the land sector

Climate goals and emissions trajectories should be embedded in legally binding domestic legislation along with positive and negative incentives to ensure that ambition is pursued and to prevent targets from becoming merely aspirational.[59] So far, the focus of national climate legislation has been centered on energy issues, and there are twice as many climate acts related to the energy sector as there are climate acts related to the agriculture sector.[60]

Filling this legislative gap is crucial for achieving climate mitigation targets in the land sector. South Korea, for example, has established an institutional framework aimed at facilitating action for agriculture. The Environment-friendly Agriculture Fosterage Act requires the Minister for Food, Agriculture, Forestry and Fisheries to develop 'fosterage plans' every five years. These plans should provide – at the very least – policy goals, basic directions and measures that foster an enabling climate for environment-friendly agriculture. Legislation has also been introduced to define what can be considered as climate-smart agricultural practices.

Similarly, facilitating climate action requires that forestry policies are supported by strong laws specifying appropriate rights, obligations and procedures.[61] Of particular concern is introducing legislation to stop the conversion of primary forests to other land uses. For example, Indonesia's Presidential Instruction No. 5/2019, on stopping new permits and improving primary natural forest and peatland governance, established a permanent moratorium on new land use licenses; this resulted in the protection of 66 million hectares of primary forest and peatland – an area roughly the size of France. To achieve environmental and social goals, laws should provide comprehensive protection to primary forests and other carbon- and biodiversity-rich ecosystems. In Brazil, Argentina and Paraguay, for example, roughly 105 million hectares of forests can legally be deforested, despite forest-protection laws in these countries.[62]

Governments need to set ambitious emission reduction targets and support these with both legally binding domestic legislation and positive and negative economic incentives.[63] Ireland provides an example of comprehensive legal action; in 2019, the country adopted a Climate Action Plan to reduce emissions in every sector and achieve net-zero emissions by 2050. Five-yearly carbon budgets and sectoral decarbonization targets will be enshrined into law. For agriculture, the 2019 Climate Action Plan sets an emissions reduction target of 10 – 15

percent for 2030.[64] As of 2021, fuels used during agriculture are covered by Ireland's carbon tax, and EUR 20 million has been allocated in the 2021 budget to pilot results-based financing schemes that incentivize farmers to adopt low carbon practices.[65]

3.2 Promote policy coherence and complementarity

When policies are designed in isolation, they risk having divergent – or even conflicting – policy outcomes. It is not uncommon for a country to have stated conservation goals while at the same time subsidizing commodity agriculture without any forest safeguards. Enhancing policy coherence involves reducing conflicting policies across government ministries and promoting mutually reinforcing ones.[66] Identifying complementarity among policies will also help to raise the political support needed to enact change. For example, a policy designed to promote plant-based diets to lower GHG emissions from beef consumption will also yield health benefits in communities that are over-consuming beef, and appeal to decision-makers advocating for improved animal welfare in farming. Politicians backing such a policy will generate greater political support if they capitalize on the complementarity of policies when advocating for change.

Hand-in-hand with identifying complementarity is the need to minimise potential trade-offs between socio-economic and environmental goals.

As land is central to human life and the fulfillment of most basic needs, land use lies at the intersection of many – potentially conflicting – policy priorities. This includes food and nutritional security, economic development, poverty alleviation, as well as environmental sustainability objectives such as mitigating and adapting to climate change. Achieving these diverse policy objectives requires coherent policy-frameworks that maximise synergies and minimise potential trade-offs between these policy priorities. For example, while poorly designed climate mitigation policies could put an additional 110 million people at risk of food insecurity by 2050, a globally inclusive approach to designing mitigation policies in combination with food support could avoid these adverse impacts.[67]

3.3 Build strong land sector coalitions

In order to help the transition from voluntary to mandatory approaches and minimise opposition, public-private partnerships can be formed in which different agendas are brought together, including government, industry, farmers' associations and research institutions. These partnerships can work as collaborative advisory and information programmes to replicate best practices and promote widespread adoption of low-carbon practices. Once established, these coalitions need to be actively sustained and engaged to avoid unravelling during reform processes.[68]

In some cases, governments are able to leverage their influence (and control) over industry and business associations to build coalitions and generate momentum for desired structural changes. In China a coalition of scientists, agricultural businesses, and technicians offers farmers detailed guidance on optimal fertiliser use depending on the soil, crop and nutrient needs. From 2005–15, fertiliser use dropped by 15 percent (from very high levels), while yields of maize, rice and wheat increased by 11 percent on average.[69]

Financial coalitions between public and private sector stakeholders can also reduce the financial risks involved in mitigating and adapting to climate change in the land use sector. In this context, Latin American governments – with the support of multi-lateral banks – are setting up so-called Financial Innovation Labs to disperse financial and non-financial de-risking instruments.[70] Colombia and Bolivia, for instance, are implementing climate risk insurance through blended finance. In Brazil, a multi-sectoral discussion forum has been set up to promote dialogue among stakeholders and encourage the creation of green financial solutions. A mechanism is currently being developed collaboratively through this discussion forum to issue green bonds on the London stock exchange in an effort to raise up to USD 1 billion to finance sustainable agriculture. The funds will support sustainable soy and corn production on degraded land, which is projected to encourage the restoration of 1.5 million hectares of degraded land and prevent the emissions of 250 $MtCO_2$.[71]

3.4 Establish robust land use governance and land tenure regimes

Balancing potentially competing land policy objectives such as food security, poverty alleviation and climate mitigation requires robust land use governance.[72] Robust land governance includes the presence of strong institutions, transparent and inclusive processes leading to land-use decisions, the enforcement of such decisions and the management of competing interests and conflicts.[73]

3.4.1 Implement effective land-use planning

Through land-use planning, a central authority assigns specific uses to land – often in zones – in order to achieve potentially competing policy objectives in a balanced manner.[74] Incorporating the policy objective of reducing emissions into land-use planning processes can promote a transition to low-carbon land use that is consistent with other policy objectives such as food security and rural development.

Effective land use planning takes place at national, regional and local levels. Land use planning should be the result of participatory process with negotiated outcomes. Different groups in society have divergent views on how to balance competing policy objectives – such as climate change mitigation and economic development – and what this should mean for land use planning.[75]

There are various ways in which stakeholder views can be effectively integrated. Participatory mapping methods, for example, can be used to determine the preferences of different stakeholders with respect to current or future land use plans.[76] In addition, policymakers can involve stakeholders directly in developing and analysing future land-use scenarios.[77] Scenario analysis enables stakeholders to conceive of potential futures that are both possible and desirable in the wake of a changing climate, and to identify policy actions that can lead to these futures.[78]

Measuring, reporting and verifying changes in land use and land cover is another key component of mainstreaming climate mitigation into land-use planning. Novel remote sensing and modelling techniques are capable of quantifying the current carbon stock and predicting the future sequestration potential of forests with enough resolution to support land-use planning.[79] Integrating these models into participatory multi-criteria decision-making enables policymakers to optimize land-use planning across competing objectives in a participatory, transparent and comprehensive manner.[80]

3.4.2 Improve and secure land tenure

Shifting greater volumes of private capital to the land sector also requires clear land tenure and defensible land rights. In the absence of clearly defined and enforced land rights, landowners have little incentive to invest in their land, and tend to make decisions that are motivated by short-term, rather than long-term, gains.[81] Insecure land tenure is also a barrier to accessing finance, as it is often required as collateral by lenders. Evidence strongly suggests that ensuring landowners have secure and robust land rights can lead to more productive and sustainable agricultural investments; empower women to make land-based decisions;[82] and improve forest stewardship and forest protection.[83]

Weak land titles, absent land registries and lack of enforceability of titles is a problem in many developing countries. Vulnerable smallholders and poor farmers – especially women– are particularly likely to operate on the basis of informal or non-recognised land title and resource management rights. Governments can strengthen land tenure by clarifying rights to land, either through a formal or community-driven process, and by building institutional capacity to enforce those rights. Raising individual awareness of rights through legal empowerment is also important.

3.5 Strengthen the rights of and engagement with indigenous communities

Indigenous peoples manage or have tenure rights over one-quarter of the world's land surface area, and more than one-third of the world's remaining intact forests are on indigenous land.[84] Indigenous peoples are an intrinsic part of natural ecosystems as stewards, landowners and land users; actively ensuring their participation, engagement and involvement in forest and land management is essential to the long-term sustainable use and preservation of these ecosystems. Indigenous peoples and local communities (IPLCs) have deep knowledge and understanding of the landscapes they manage; they do so in a manner that allows the landscape to continue to provide for future generations. A study exploring indigenous-managed land in Australia, Brazil and Canada found that land managed by IPLCs hosts as much or more biodiversity than land set aside for conservation by government.[85] Forests managed by indigenous peoples also demonstrate significantly less deforestation than those managed by non-IPLCs, although only when full property rights are granted.[86]

Considering their contribution to the protection of natural ecosystems, strengthening the rights of IPLCs is particularly important. IPLCs have secured rights to only half of the land that they manage, despite it being clear that they are strong stewards when awarded such rights.[87] IPLCs must have secure right to free, prior and informed consent to the land they manage. Awarding property rights to IPLCs in the Amazon has, for example, been crucial in

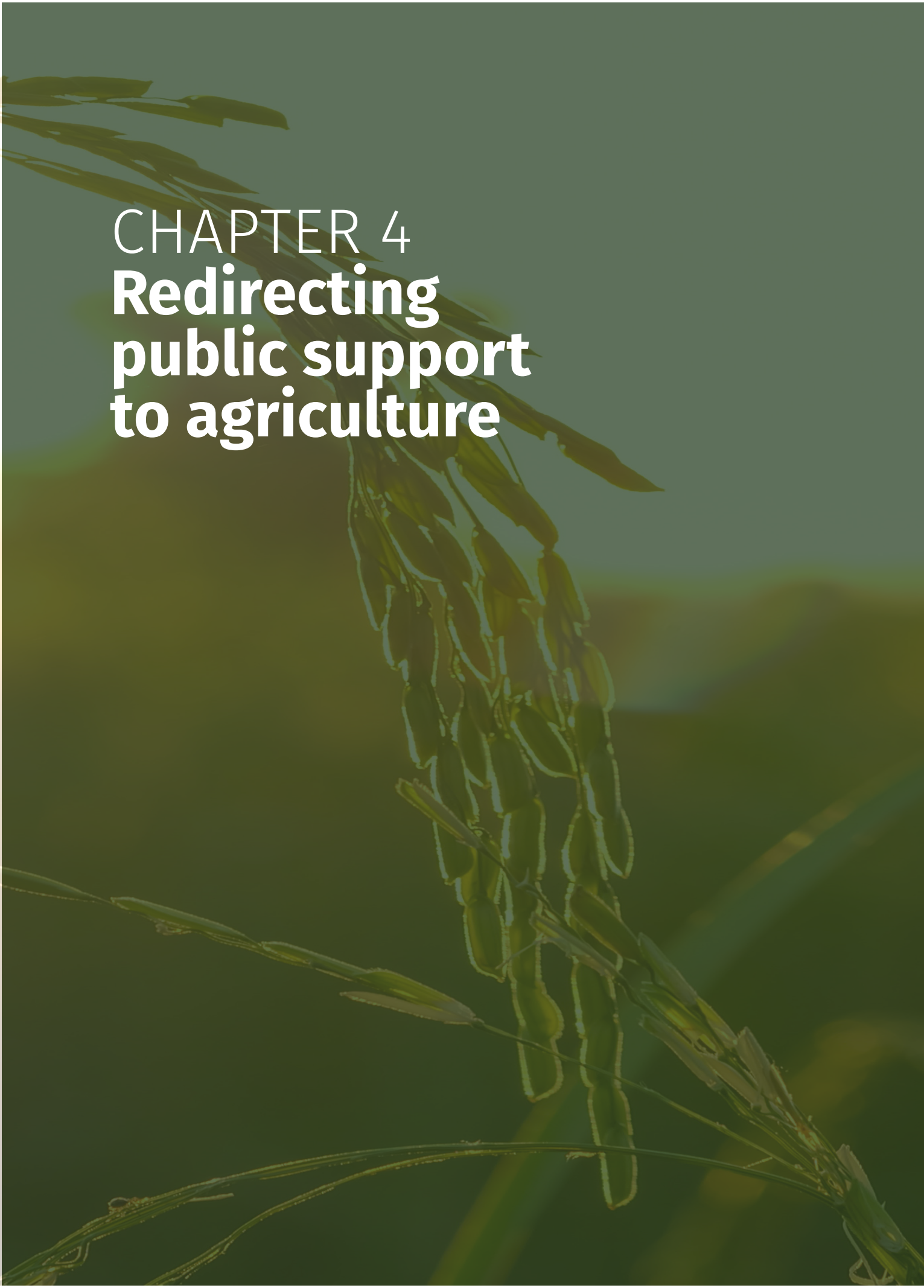
reducing illegal deforestation.[88] However, IPLCs continue to experience a lack of protection by governments and are at increased risk of violence from groups or individuals that wish to profit from their land.[89] IPLCs must, therefore, be awarded full property rights to the land they manage, and governments must protect, respectfully engage with and work hand-in-hand with IPLCs in managing land resources.

3.6 Address gender inequality in land use

Women face far more constraints than men in accessing the resources, markets and services needed to fully perform as farmers, workers and entrepreneurs. Women and girls make up almost 50 percent of the agricultural workforce in developing countries, yet they own less than 15 percent of land.[90] Their financial contributions to farm income are also often undervalued and underappreciated.[91]

Enabling women's full participation in agriculture has potential to yield huge gains to society. This includes increasing agricultural productivity, lowering poverty and hunger and promoting economic growth.[92] The Food and Agriculture Organization estimates that 'if women had access to the same productive resources as men, they could increase yields on their farm by 20 – 30 percent. This could raise total agricultural output in developing countries by 2.5 – 4 percent'.[93] In addition, securing land rights for women is proven to generate better economic outcomes for them and their families, including improved child nutrition.[94]

Improving women's access to clear and secure land rights may require adapting or introducing land legislation that recognises women's equal rights to own land. For example, in Swaziland, the Parliament is developing legislation to address a discrepancy between the Constitution of 2005 – which states that women are equal to men – and previous laws whereby only husbands can hold communal property in a marriage. Beyond legislation, improving land tenure security will require investment in education for local land administrators to overcome traditional and cultural biases that limit women's land rights.[95] Efforts to address gender inequality must also facilitate women's access to agricultural finance. This requires that rural finance providers – whether they be private or public institutions – understand the roles and contributions of women in farming households and develop appropriate financial mechanisms accordingly.



CHAPTER 4
Redirecting public support to agriculture

Almost all countries provide some form of preferential treatment for their agricultural sector. Public support is provided through policy measures that increase domestic agriculture product prices as compared to international reference prices; the transfer of public funds or liability; the provision of tax exemptions or rebates; and the provision or purchase of public goods and services to support agricultural development.

Worldwide, a total of USD 619 billion in public support is provided to the agriculture sector annually. Some of this support leads to GHG emissions, including subsidies directly linked to agricultural outputs and supporting unconstrained use of farm inputs. High GHG emissions are associated with the five commodities receiving the most support - beef, maize, milk, pork and rice. The EU and three countries – China, Japan and the US – provide almost 80 percent of public support to agriculture.

Agricultural subsidies can influence the behaviour of farmers by changing the economic conditions they face. Subsidies can influence:

- whether to bring land into agricultural production, including whether to convert forest or peatland into productive land;
- which commodities to produce, such as whether to farm cattle or grow crops;
- how to farm, including how to manage land, which inputs to use and in what quantities, and whether to employ sustainable production practices.

However, the design of public support to agriculture rarely considers climate impacts. Of the total support provided, only five percent is linked to specific environmental objectives. It also provides little incentive to farmers to switch from high to low emissions-intensive production or commodities. This perpetuates business-as-usual farming practices that generate GHG emissions and encourage overproduction of certain climate-intensive commodities.

We, therefore, propose a number of recommendations for redesigning how public support is used to assist the agricultural sector. This includes:

- Making support conditional upon achieving environmental objectives;
- Rechanneling production support to public goods and services;
- Avoiding using public support to promote the consumption of ruminant meat;
- Removing or redirecting support provided for agricultural inputs.

4.1 Types of agricultural subsidies

Almost all countries provide some form of preferential treatment for their agricultural sector, be it in the form of tax concessions or otherwise subsidizing production. The Organisation for Economic Co-operation and Development (OECD) defines agricultural support as 'gross transfers to agriculture from consumers and taxpayers arising from government policies that support agriculture, regardless of their objectives and economic impacts'.[96]

We focus our analysis on market price support, direct transfers to farmers, forgone tax revenues, and the government provision of public goods and services (Figure 8). These instruments have the potential to directly influence agricultural decision making through providing incentives to bring land into production, adjust production levels and output mixes, and change agricultural practices.

Market price support (MPS) increases a country's domestic prices for an agricultural product compared to international reference prices. Policy measures facilitate gross transfers from consumers and taxpayers to agricultural producers, creating a gap between domestic market prices and the international prices of a specific commodity.[ix] MPS can be delivered in the form of tariffs and quotas - or as minimum price guarantees for agricultural producers. Governments purchase goods at administered prices to foster food security – also known as public stockholding – or to maintain minimum prices. These policies require significant and direct government expenditure, in contrast to trade protection policies that are financed by consumers paying higher prices.[97]

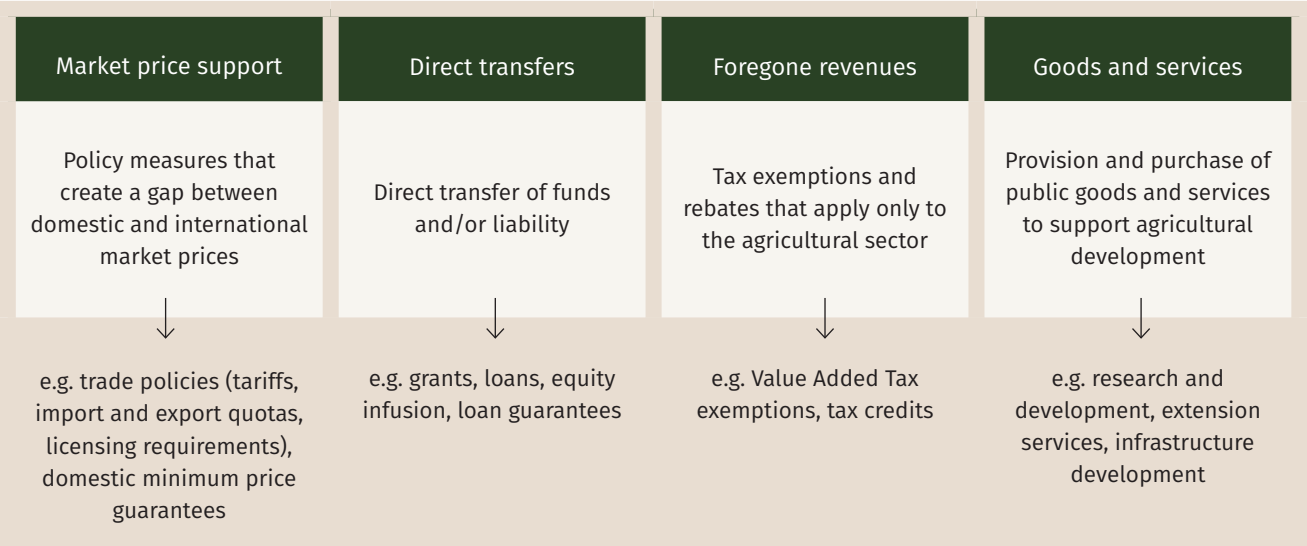
Direct transfers involve budgetary payments from governments to agricultural producers. These include payments for the public procurement of agricultural outputs, preferential interest rates on agricultural credit, government-sponsored agricultural insurance schemes, and subsidies for agricultural inputs such as seeds, fertilisers, pesticides, water, electricity and fossil fuels.[98] Direct transfers (Box 2) also include payments that are not related to commodity production, such as income support, as well as payments related to conservation and production retirement.

Governments **forgo tax revenue** by offering tax concessions (also tax breaks or exemptions). Agricultural tax concessions are measures that exempt the agricultural sector from certain tax obligations that apply to other sectors or activities.[99]

Governments also provide and purchase public goods and services that support agricultural development. This includes all measures that create an enabling environment for the agricultural sector but do not flow directly to agricultural producers such as investments in research and development, agricultural training, collective infrastructure, marketing and inspection services.

ix There are two quite different approaches to calculating market price support. The OECD calculates MPS as the net difference between current international prices and government-fixed prices. In turn, the WTO compares 1986-1988 reference prices to government-fixed prices without accounting for inflation in reference prices. The MPS estimates provided in this report are based on OECD methodology and data.

FIGURE 8. Types of agricultural subsidies classified by financing mechanism



BOX 2. COUPLED AND DECOUPLED SUBSIDIES – WHAT IS THEIR IMPACT AND WHO BENEFITS?

The literature often categorizes public support channelled directly to farmers as either coupled or decoupled subsidies.[100]

Subsidies are considered coupled when they are conditional upon one or more aspects of production. Coupled subsidies aim to increase profitability either by reducing unit costs of production or increasing the price received by farmers for specific outputs.[101] The World Trade Organization (WTO) defines decoupled subsidies as those that are not based on the type or volume of production undertaken currently or in the future, on the factors of production employed currently or in the future, or on domestic or international prices. In addition, decoupled subsidies should not require current production, but should rather be based on clearly defined eligibility criteria such as income, status as a producer or landowner, factor use or production at a past reference point.

Regardless of whether a payment is coupled or decoupled to production, farmers remain the direct beneficiaries. This is not the case for finance channelled to support goods and services in which an intermediary is often the direct beneficiary of financial support, such as a research institution or an NGO offering extension services.

4.2 Where does the money go?

In economic terms, agriculture, forestry and fishing provided a value-added contribution – that is, the net value generated by producing agricultural goods and services – to the global economy of just over 3 percent of gross domestic product (GDP) in 2019.[102] However in sub-Saharan Africa and South Asia the average value-added contribution of agriculture, forestry and fishing is much higher – at 14 percent and 16 percent of GDP in 2019 respectively.[103]

The vast majority of land sector public support goes to agriculture, usually driven by one or more of the goals outlined in Table 3. All offer strong cases for public support to agriculture, but many of the subsidies that remain in place today either have already achieved their intended policy objective, or have objectives that are no longer relevant.[104] In other cases, the policy objectives themselves may be obscure, or the method through which support is provided fails to bring the country closer to achieving the stated objective of the support.[105] Most of the public support also finds its way to large-scale farmers that own more land and produce more than the smaller and poorer farmers who are more likely to need public support.[106]

Between 2017-19, public support for agriculture provided by the OECD countries and 11 major developing economies amounted to approximately USD 619 billion per year, almost double the value received by the sector a decade ago, and 56 times the USD 11 billion in climate finance aimed at land use (Figure 9).[107] These countries together comprise approximately two-thirds of global agricultural production. The level of public support provided amounts to nearly 30 percent of the value-added contribution of agriculture in these countries' economies.[108]

TABLE 3. Common rationales for public support to agriculture

RATIONALE	EXPLANATION
Achieve food security and avoid exposure to price spikes in staple foods	Maintaining a stable agricultural supply remains a primary reason for introducing subsidies. Trade policies aimed at restricting exports and increasing the availability of staple foods have been implemented in several countries. For instance, India and Vietnam introduced such restrictions to wheat and rice, respectively, during the period between 2007-09, when international prices for staple food commodities spiked.
Address rural poverty and income disparity	When compared to other sectors, economic growth in the agricultural sector is two to four times more effective in raising incomes among the poorest.[109] Some countries also subsidize agriculture as a means of reducing income disparities between rural and urban areas, or between smallholders and large commercial farmers.[110]
Support rural livelihoods	Globally, nearly 26 percent of the workforce is employed in the agricultural sector.[111] The number is much higher in South Asia and the sub-Saharan Africa, where agriculture provides over 40 percent of all employment.[112] In turn, approximately 0.4 percent of the global workforce is employed in the formal forest sector, although actual employment rates are likely to be significantly higher as much of the sector exists in the informal economy.[113]
Provide public goods	Agriculture generates environmental services that are of value to wider society, such as the preservation of landscapes or provision of biodiversity. These public goods have no market value but nonetheless have value to society. The argument is that without government support, the provision of these public goods would be reduced.
Support foreign currency income from exports	Many low- and middle- income countries are most competitive in the agricultural sector. Cocoa, coffee, palm oil and sugar, to name but a few, are all-important export commodities that generate significant national income and facilitate a country's ability to access foreign currency.
Achieve climate and environmental goals	The last decade has seen a growing recognition of the need to leverage land use policies towards achieving climate goals in a manner that is synergistic with other land policy objectives.[114] As much as 96 percent of the NDCs to the Paris Agreement make reference to the land sector in their mitigation and/or adaption contributions.[115]

FIGURE 9. Total public support for agriculture compared to climate finance for land use

Source: Agricultural support estimates - Edition 2020, OECD (2020),[116] *and Global Landscape of Climate Finance 2019 (2019).*[117]

Only a small volume of agricultural support – approximately 5 percent, or USD 28 billion a year – is explicitly linked to environmental goals.[118] This includes expenditures targeting conservation as well as those retiring land from agricultural production. While this type of expenditure is generally consistent with climate objectives, it can be difficult to ascertain the exact extent to which it is actually contributing to GHG mitigation (Box 3).

According to the OECD database, as little as 17 percent of agricultural support is conditional on either environmental, social or animal welfare criteria. The majority of this support is based on regulations for which there is an existing legal basis, and the remaining 4 percent is subject to only voluntary environmental conditions on input use.[119] Another independent review found that approximately 18 percent of agricultural support is subject to broader environmental conditions that are not recorded in the OECD database.[120]

BOX 3. CONSERVATION AGRICULTURE AND PRODUCTION RETIREMENT

In their analysis, Searchinger et al. (2020) re-categorize and quantify the agricultural support tracked in the OECD database linked to 'conservation' (3.6 percent) and 'production retirement' (0.9 percent).[121]

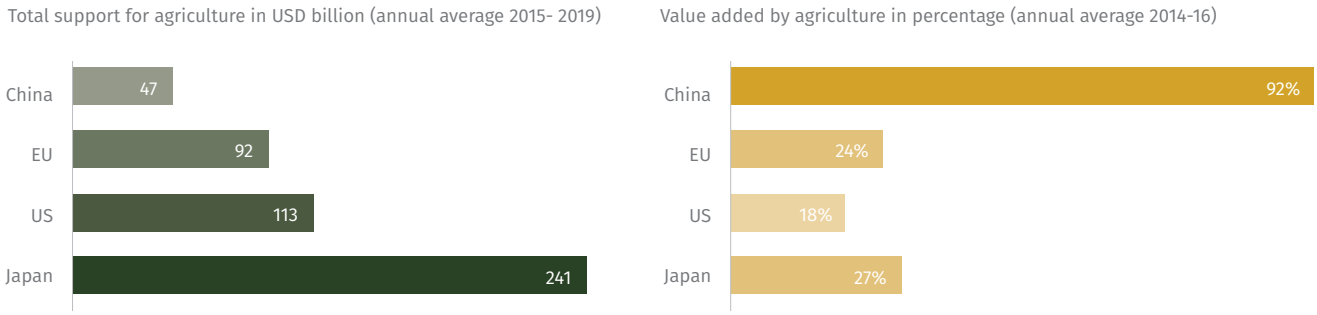
Within agriculture, conservation focuses on preserving the long-term sustainability of the agricultural sector. Specifically, conservation agriculture 'strives to achieve acceptable profits together with high and sustained production levels while concurrently conserving the environment'.[122] While conservation finance is generally deemed to be a crucial component of the wider global efforts to address climate change and sustainable development, the precise extent to which conservation support leads to climate mitigation can vary and depends on local contexts.[123]

In turn, land retirement involves taking agricultural land or livestock out of production. This can be permanent or temporary, and often targets less productive land. The extent to which resource retirement results in global climate mitigation is difficult to ascertain, as it may result in domestic production being moved abroad, a form of carbon leakage.[124]

Agricultural support is strongly concentrated in just a few countries and regions. Between 2015-19, China provided 38 percent of total global support for agriculture, followed by the EU (18 percent), the US (15 percent), and Japan (7 percent) (Figure 10).[125] China has increased its agricultural support tenfold between 2000-19, a development that can also be seen in other emerging economies such as the economy of Turkey.[126]

Accounting for the size of each country's agricultural sector, Japanese producers received the most public support (92 percent of value added by the agricultural sector between 2014-16), followed by producers in the EU (48 percent).[127] In turn, the Chinese government provided 27 percent of value added in support; this was significantly lower than Japan and the EU despite being both the largest agricultural producer and the largest provider of support.

FIGURE 10. **Total public support to agriculture relative to the size of the agricultural sector**

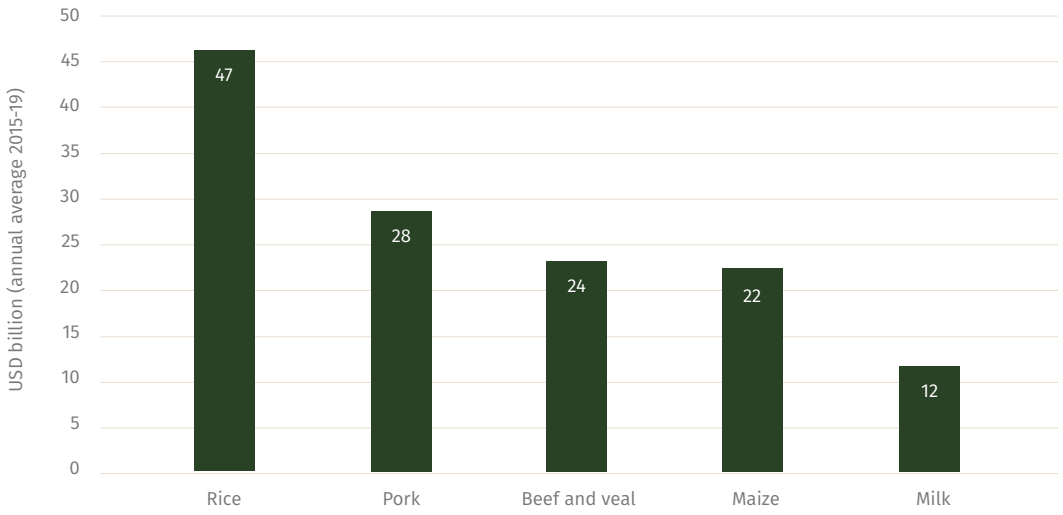


Source: Agricultural support estimates - Edition 2020, OECD (2020),[128] *and Searchinger et al. (2020).*[129]

Agricultural support is similarly strongly concentrated around a handful of commodities. Close to USD 200 billion worth of agricultural subsidies are tied to specific commodities, such that farmers must produce the designated commodity to qualify for support. Figure 11 shows the distribution of average annual support among the commodities which together receive around 75 percent of commodity transfers.[130] This strong concentration of subsidies tends to steer production towards these specific commodities, which are responsible for large portions of GHG emissions in the agricultural sector.[131]

Asian countries concentrate almost all of the support for rice and pork production, with China, Indonesia, Japan, South Korea and the Philippines providing over 90 percent of the total commodity support. In the case of producer support for milk, the US is the single largest contributor with 28 percent of the total producer support, followed by China with 24 percent. Despite the US being the top supporter, overall, the support for milk is largely concentrated in Asia, with China, Japan and South Korea combined providing 41 percent of the global support. In the case of beef and veal, the largest provider of producer support is the EU with 36 percent, followed by China and Turkey with 25 and 15 percent, respectively.

FIGURE 11. **Single transfers to the five commodities receiving the most support (annual average 2015 – 2019)**



Countries included: Argentina, Australia, Brazil, Canada, Chile, China, Colombia, EU, Iceland, India, Indonesia, Israel, Japan, Kazakhstan, Korea, Mexico, New Zealand, Norway, Philippines, Russia, South Africa, Switzerland, Turkey, Ukraine, United States, Viet Nam.
Source: Agricultural support estimates - Edition 2020, OECD (2020).[132]

4.3 How does public support to agriculture influence GHG emissions?

Public support to agriculture impacts the land transfer, land management and production behaviour of agricultural actors that, in turn, influence the GHG emissions generated.133 The design of agricultural financial support rarely considers climate impacts and provides farmers little incentive to switch from high to low emissions-intensive production or commodities.134 This perpetuates business-as-usual farming practices that generate GHG emissions and encourage overproduction of certain climate-intensive commodities.

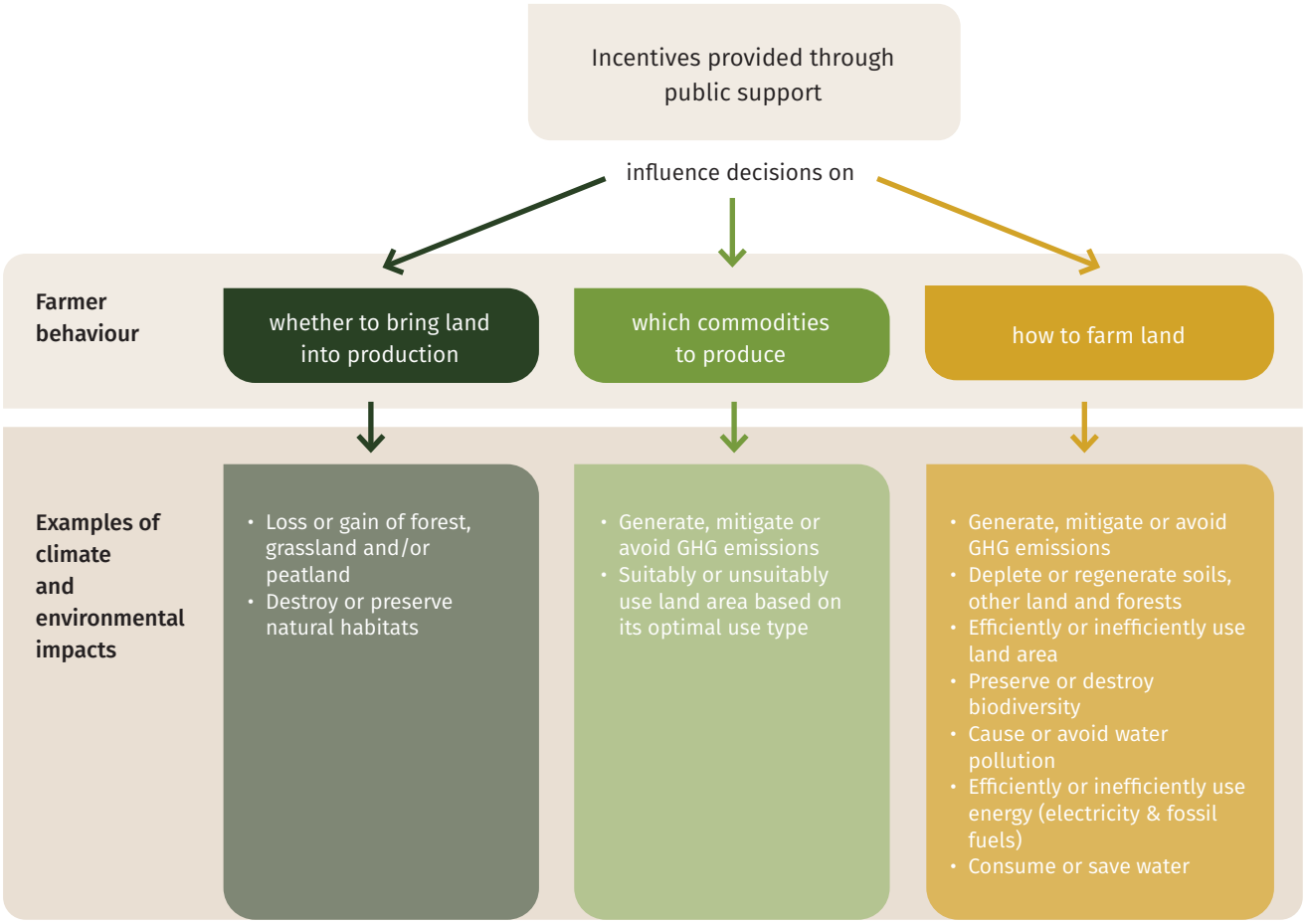
Only a handful of studies, however, seek to link agricultural subsidies to GHG emissions.135 In the case of tax concessions, for example, a 2020 study by the OECD found that the climate impacts are 'almost totally uninvestigated.'136 Only if this knowledge gap is closed will policymakers be able to grasp the climate impact of the financial instruments they employ in support of the agricultural sector.

Importantly, public support to agriculture can influence the behaviour of farmers by changing the economic conditions they face. Farmers seeking to maximise their profits will align their land management practices and production behaviour so as to benefit as much as possible from the financial support offered. As summarized in Figure 12, public support to agriculture can, therefore, influence:

- whether to bring land into agricultural production, including whether to convert forest or peatland into agricultural land;
- which commodities (cattle, maize, etc.) to produce;
- how to farm, including how to manage land, which inputs to use and in what quantities, and whether to employ more sustainable production practices.

The impact of public support to agriculture on each of the above is discussed in the following sections.

FIGURE 12. Examples of climate and environmental impacts of public support to agriculture



4.3.1 Influencing whether to bring land into production

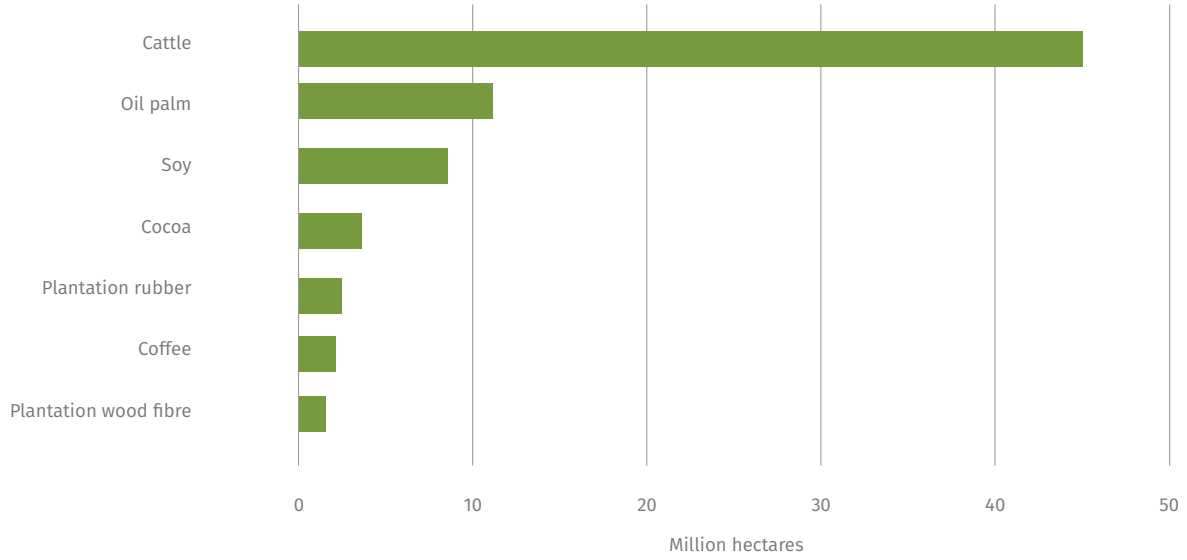
Support for production tends to intensify negative environmental effects associated with certain kinds of agricultural practices, for instance, by bringing marginal land into production, destroying wildlife habitats and accelerating land degradation.[137] The impact is particularly climate-relevant where public financial support incentivizes the production of forest-risk commodities at the forest frontier. Cattle, oil palm, soy, cocoa, coffee, wood fiber and rubber account for over half of all agriculture-linked deforestation (Figure 13).[138]

Public support that lacks environmental conditionality while encouraging agricultural production can indirectly drive land use change. For example, both in the US and in Canada, crop insurance programmes have created tangible incentives to drain wetlands that would have otherwise been too risky to cultivate. Canada's AgriStability and crop insurance programmes offer financial protection to producers that experience income losses over their average level of return and are not tied to any conservation or wetland preservation requirements. A simulated model found that these subsidies have the potential to increase the total area of wetland drained by 9 percent.[139] In turn, 20 percent of wetland loss in the US between 1992 and 1997 can be linked to an increased in crop insurance subsidies offered at the time. Increased crop insurance schemes motivated farmers to expand their cropland under cultivation, resulting in previously uncultivated wetland areas being brought into production.[140]

4.3.2 Influencing which commodities to produce

When public support is linked to specific commodities, it can influence which products farmers choose to produce. Beef, dairy and rice account for 80 percent of emissions from cultivation practices, and also feature as the commodities receiving the highest levels of support.[141] Most of this is delivered through market price support, although commodity-specific input/output subsidies are also important. The guaranteed higher prices for produce shield farmers from market signals that would otherwise encourage a shift to more profitable – and less GHG intensive – produce.[xi]

FIGURE 13. **Total forest area replaced by seven commodities (2001-15)***



Source: Goldman et al. (2020).

* All agriculture-related deforestation accounts for 123 million hectares of forest loss, as calculated by Curtis et al. (2018). Cattle, oil palm, soy, cocoa, coffee, wood fiber and rubber alone account for 58 percent of this, at 71.9 million hectares.

xi In other words, by increasing the price of agricultural outputs, MPS influences supply by sending a price signal to farmers to produce more. At the same time, MPS can also influence demand. Specifically, when MPS increases prices for consumers – such as the case in border adjustments – this sends a price signal to consumers to consume less, which counteracts the increase in supply. In this case, the net impact of MPS on production will depend on the relative strength of the impact on demand and supply. In turn, when MPS does not increase prices for consumers – such as the case with public stockholding – MPS does not alter demand. In this case, the net impact of MPS is likely an increase in production.

When input subsidies are provided for certain seeds or crop varieties that are highly input-intense – such as those requiring high levels of fertiliser or use of heavy agricultural machinery for harvesting and processing – they can influence farmers to produce more GHG-intense commodities. For example, after Zambia introduced a maize-fertiliser subsidy programme in 2002 farmers did grow more corn but much less sustainably, as they had abandoned sustainable practices such as natural fallowing, intercropping and crop rotations.[142]

Similarly, when output subsidies are provided based on the number of animals owned, but similar subsidies are not provided for less GHG-intense commodities, they can encourage livestock production by making it more profitable. For example, until 2014, Switzerland provided subsidies that were based on the number of cattle owned, which lead to the intensification of livestock farming and increased emissions without increasing profitability.[143]

Subsidies provided on agricultural outputs can also influence production decisions through influencing the purchasing behaviour of consumers. The EU, for example, provided EUR 60 million between 2018–20 for marketing campaigns that promote the consumption of pork, beef, poultry and lamb products.[144] Consumers' purchasing decisions can also be influenced by product pricing. This effect is especially pronounced when tax concessions – or other forms of subsidy – are applied only to certain

agricultural outputs and not to others.[145] The absence/reduced rate of taxes on agricultural outputs decreases the price of goods, leading to rising consumer demand for these products.[146] This increased demand is often matched by an increase in production.[xii]

This is problematic in the case of agricultural products that have a large GHG footprint. For example, meat and dairy products are typically exempt from value added tax (VAT), much like fruits and vegetables.[147] Yet, the environmental footprint of plant-based proteins is significantly lower than that of animal-based ones across the board, using metrics based on weight, caloric content or protein content.

The impacts on producer and consumer behaviour, however, depends on the price elasticity of supply and demand (i.e., how much supply/demand is likely to change as a result of changes in the price of the output). While these vary between countries, consumer types and types of agricultural outputs, research indicates that the price elasticity of various meat products tends to be rather high.[148] In other words, demand for and supply of meat products tends to be sensitive to changes in the price of these products.

4.3.3 Influencing how to farm

Public support can impact the way in which farmers manage their land and how they produce their commodities.

When producer support is applied to agricultural inputs, they have the potential to be highly damaging.[149] For example, subsidies applied to agricultural inputs – such as electricity, fossil fuels or fertilisers – may incentivize farmers to use these resources less efficiently, thus generating higher GHG emissions than if these inputs were priced at their true cost. They may also fail to be incentivized to use less-GHG intense alternatives, such as more environmentally friendly fertilisers.[150] Soil fertilisation and energy use in agriculture are significant sources of GHG emissions. In 2010, they together accounted for almost 35 percent of emissions from agricultural production (Figure 2) Under a business-as-usual scenario, emissions from these two sources are expected to grow by almost 50 and 10 percent respectively.[151]

Subsidization can also influence how farmers manage livestock manure – a key GHG source responsible for 10 percent of emissions from agricultural production. In the Netherlands, for example, a mixture of policy instruments including command-and-control, market-based and educational instruments successfully incentivized farmers to make more valuable use of manure, for example by processing it into fertilisers.[152]

There are also a number of examples of payments having potential to influence the uptake of more environmentally friendly farming practices. Payments made for the delivery of environmental services – such as the preservation of biodiversity – are one example. The government provision of goods and services to foster knowledge sharing and innovation can help to encourage farmers to adopt more sustainable agricultural practices, such as by providing farmer training on how to optimally apply fertilisers to minimise run-off and ensure optimal plant uptake. Providing farmer extension and training services is another example of public support being put to good use through helping farmers to learn and adopt more environmentally friendly and efficient farming practices. Support for inspection and control programmes can also be beneficial in encouraging the adoption of sustainable agricultural practices if the standards against which farmers are held are environmentally sound.

4.4 Green redesign recommendations

There is a clear case for re-examining the support provided to the agricultural sector and evaluating how best to repurpose it to achieve contemporary policy goals and align with low-carbon development. The support provided often encourages emission-intensive practices or misses valuable opportunities for cost-effective emission reductions. In addition, many of the intended benefits of public support to agriculture are not ever realised, making the expenditures highly inefficient and poorly spent.[153] However, repurposing support for agriculture is not an easy task, and will likely be met with resistance. Three overarching recommendations to redesigning support can help to overcome the barriers that policymakers face in shifting finance.

Firstly, policymakers need to have a good understanding of the scale and impact of current and planned support. This involves gathering information on the size of support, costs in terms of government spending and tax expenditures, and the social, environmental and economic impacts. The alternative policy options should be carefully

xii By reducing the price of agricultural outputs for consumers, VAT concessions send a price signal to consumers to consume more, thereby influencing demand. As VAT concessions on agricultural outputs do not reduce the price that farmers receive, it does not send a price signal to farmers to produce less. In this way, VAT concessions encourage increased production to meet increased consumer demand.

examined to determine the relative costs and challenges in their implementation, as well as the ability to monitor their effectiveness. In middle- and low-income countries, where governments may deal with challenges related to poor governance, inefficient law enforcement, limited resources, lack of training and monitoring equipment, governments may opt for gradual reform while building government capacities.

Secondly, repurposing support must aim to reduce emissions without jeopardizing other important development goals. This requires a focus on reducing emissions that must proceed hand-in-hand with the analysis of policy options that maximise synergies and minimises trade-offs with other environmental, economic and social goals.[154] Minimising potential trade-offs applies to both the way in which support is provided and the nature of the support programmes themselves. For example, subsidizing fertilisers could increase yields – therefore improving farm income – but also result in environmental damage by increasing GHG emissions and causing eutrophication in water systems. At the same time, appropriate use of fertiliser can drive sustainable intensification, reducing the demand for agricultural land and associated deforestation.[155] Rather than choosing not to subsidize fertilisers altogether, support could be coupled with extension services to ensure farmers know how to optimally apply fertilisers to maximise uptake by crops, thereby reducing environmental damage.

When compared to other sectors, economic growth in the agricultural sector is two to four times more effective in raising incomes among the poorest.[156] Any repurposing of support must ensure that finance goes to those who need it most. For example, a common argument for subsidizing agriculture is that the support is needed to bolster constrained rural livelihoods. Yet, research shows that most financial support goes to farmers with large holdings that already have the collateral needed to access finance and protect them from shocks.[157]

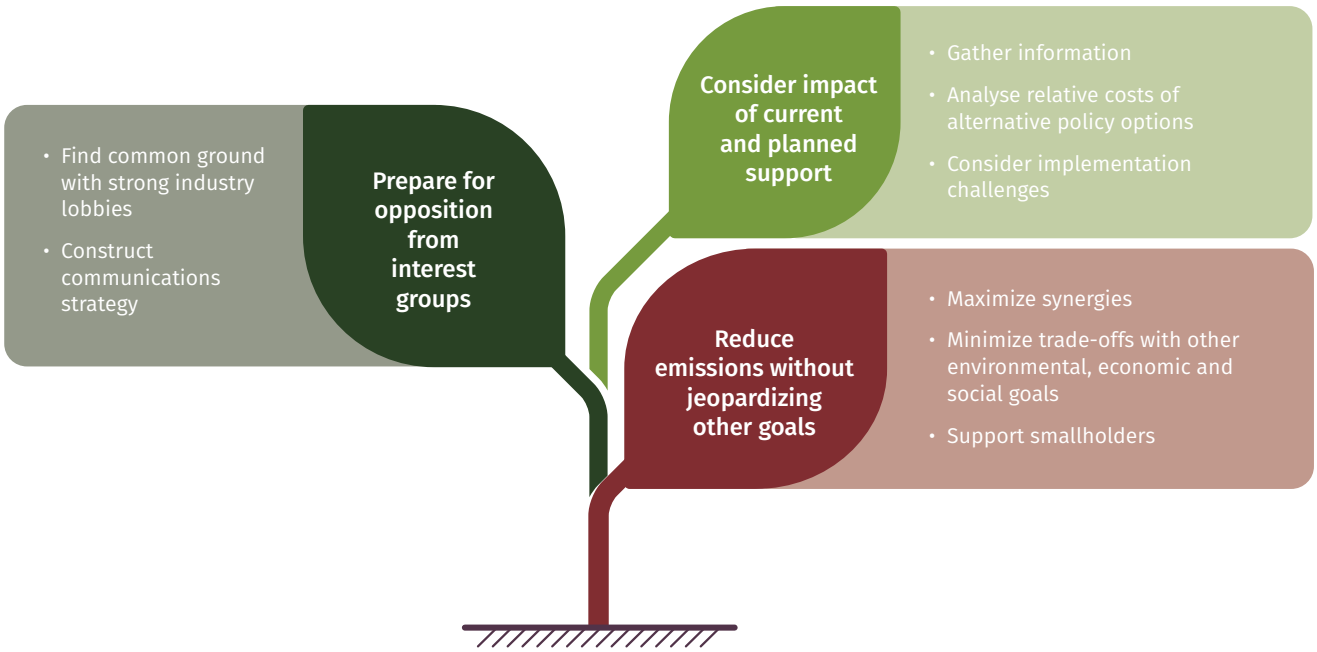
In addition, resource-poor farmers will be unable to change agricultural practices if the up-front fixed costs of adoption are high. Approximately 500 smallholders worldwide currently produce 80 percent of the food consumed in Asia and sub-Saharan Africa.[158] Supporting these farmers with the adoption of sustainable farming practices is critical to making agriculture climate-resilient while disentangling it from environmental degradation, and will require offering tailored financial services and technical assistance to smallholders.[159] Farmers given training and assistance in building capacity may more readily transition to sustainable food systems and appropriate land use, helping to achieve a just rural transition.

Thirdly, policymakers should be prepared for opposition from powerful interest groups and other members of government. Redirecting public support for agriculture is often politically sensitive. High public regard for the agricultural sector, the rights of rural farmers and – above all – a strong farm lobby can lead politicians to be cautious about approaching change of any sort.[160] Policymakers need, therefore, to consider how to find common ground with industry lobbies in order to steer away from business-as-usual practices. Governments can also regulate lobbying to ensure there is transparency as to the impact of lobbying on decision-making, allowing the public to access information on the nature of lobbying and its outcomes. Effective regulation should 'aim to ensure a level playing field for all actors to participate in the decision-making process on equal footing',[161] and make clear who is spending how much on lobbying, including for what purpose.

Another challenge is that enacting change may have to take place without vocal backing from those who stand to gain from the repurposing of support. A study in the United Kingdom exploring barriers to tax reform found that groups that stand to lose out from reforms tend to be vocal in opposition, whereas those that stand to gain are often silent.[162] Many input subsidies remain in place today as a result of effective lobbying from vocal groups that do not necessarily represent the majority of individuals that this support is intended to reach. For example, well-organized and capitalized farmers with large landholdings are better able to influence policymaking than the many thousands of unorganized, dispersed and resource-constrained smallholder farmers.[163]

Ensuring that any repurposing of support goes hand-in-hand with a carefully constructed communications strategy can also help to develop clear, targeted and appropriate messaging.[164] Such a communications strategy can be used to increase transparency around the manner in which public support is awarded and should rely on a scientific evidence base to credibly address doubts and opposition.

FIGURE 14. Overarching recommendations for the green redesign of public support to agriculture



4.4.1 Make support conditional upon achieving environmental objectives

The case for change

Most public support awarded to agriculture fails to consider how farmland is used and whether land is used in a manner that will allow it to continue to provide agricultural produce for future generations. As much as 82 percent of agricultural support does not impose any environmental conditions on the recipients of support.[165] This spending, therefore, forgoes a valuable opportunity to influence farmers' land-use decisions and the GHG emissions arising from the practices employed. As a result, economists and advocacy groups alike are arguing for the removal of public support that does not provide incentives for sustainable behaviour.[166]

However, making payments conditional upon environmental performance is likely to be easier than removing or rechannelling support altogether. This is because once support has been granted, removing it can be very difficult - even in those cases in which the support is clearly no longer contributing to its stated objectives.[167]

In addition, completely removing this public support can have undesirable socio-economic impacts, and in many cases preferential treatment for the agricultural sector may be warranted due to its importance in providing food security and livelihoods. At the same time, care must be taken to ensure that preferential treatment does not foster negative environmental externalities or fail to maximise positive ones. Making support for the agricultural sector conditional upon positive environmental performance could shift agricultural practices without jeopardizing other policy objectives.

In fact, most money targeting producers currently ends up with farmers with large holdings.[168] While this means that support may also need to be recalibrated to better align with poverty alleviation and food security objectives (particularly in low- and middle-income countries), there is significant scope to leverage the current provision of public support to shift the behaviour of the large-scale agricultural producers who own most land and whose practices significantly impact GHG emissions.

How it can be done

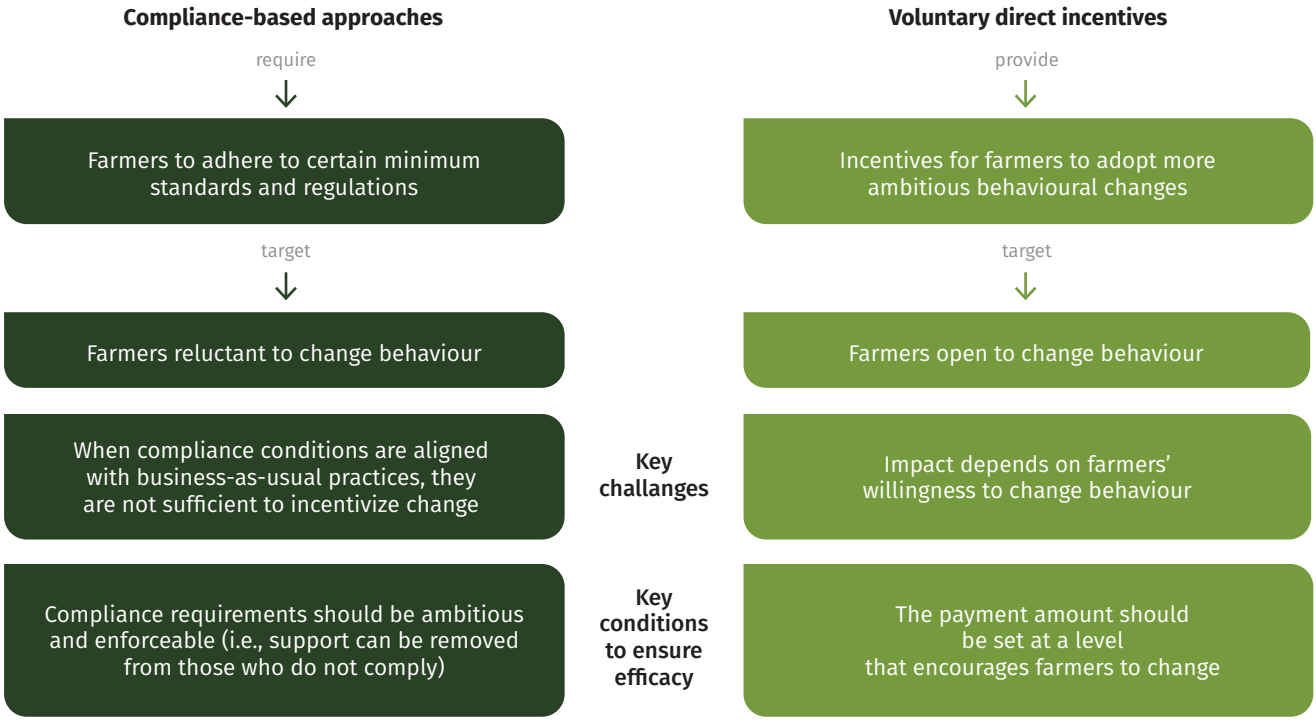
There are various ways in which climate conditions can be tied to the provision of public support for agriculture. In general, we can distinguish between compliance regimes – which require farmers to adhere to certain minimum standards and regulations in order to qualify for public support – and direct incentives for farmers to adopt more ambitious behavioural changes. Compliance-based approaches hold potential to influence the behaviour of farmers who are otherwise reluctant to change their practices, while incentive-based approaches target farmers who are more open to change.[169]

A number of countries have made **support conditional upon meeting legislative requirements, standards or regulations** over recent decades. In the US, for example, in order to qualify for most types of support – including crop insurance and agricultural loans – farmers must comply with two conditions established in the 1985 Farm Bill. Firstly, farmers are not permitted to produce on wetlands that were drained after 1985. In addition, farmers producing on highly erodible land must agree to install conservation systems in line with soil erosion plans developed with farmers as part of the Farm Bill. While the behaviour prescribed in both provisions directly contributes to climate mitigation, it has been challenging legally to remove support from non-complying farmers.[169] Despite these enforcement challenges, evidence suggests that both provisions have had some success in reducing erosion and preventing the conversion of wetlands.[171]

Similarly, cross-compliance – in which farmers must comply with certain conditions in order to receive support – has been part of the EU's Common Agricultural Policy (CAP) since 2003. A proposed reform to the CAP will remove all current exemptions, including those for payments under the Small Farmer Scheme and for farmers whose arable land area is below a certain size threshold. It will thereby require all beneficiaries to adhere to ten Good Agricultural and Environmental Conditions (GAECs), including conserving permanent pastures and preserving carbon-rich soils such as peatlands and wetlands.[172] However, some studies have shown that these compliance requirements – labelled as 'enhanced conditionality' – are unlikely to significantly reduce agricultural emissions, as the GAECs generally align with behaviour already displayed by farmers.[173]

These two examples – which represent the largest agricultural cross-compliance schemes in the world[174] – highlight important challenges with compliance-based conditionality: if compliance conditions are aligned with existing business-as-usual practices, they are not sufficient to incentivize change. And if support cannot be withdrawn from those who do not comply, little incentive exists for compliance. Thus, while cross-compliance is an important first step in ensuring that public finance does not support environmentally harmful activities, it alone is not enough to incentivize ambitious emission reductions unless the compliance requirements are sufficiently ambitious and enforceable (i.e., support can be removed from those who do not comply) (Figure 15). Farmers may also need additional support to enable them to make this transition. Brazil's Low-Carbon Agriculture Program provides an example of how governments can implement ambitious climate mitigation criteria and support farmers to transition to more sustainable practices (Box 4).

FIGURE 15. Conditions for cross-compliance to drive behavioural changes and emission reductions



Offering graduated payments are a form of a payment-for-ecosystem services. Farmers are rewarded for voluntarily adhering to increasingly ambitious conditions. This is a way to incentivize continuous emission reductions and removals while minimising the risk of resistance from farmers who find the new conditions too constraining.[175] Graduated payments offer a number of advantages:

1. They allow policymakers to provide economic incentives for desirable behaviour without setting a single standard that becomes meaningless when it has been reached.
2. They employ positive economic incentives and consequently are more likely to change farmer behaviour than forms of conditionality that involve negative incentives, such as penalties for non-compliance.[176]
3. They provide flexibility to farmers and enable them to align their decisions around environmental behaviour with the economic objectives of minimising costs and maximising profit.

In large jurisdictions – where regional differences in agricultural profitability are especially large – local authorities can also be given the mandate and discretion to tailor national targets to local conditions. In Japan, for example, local authorities in mountainous regions are empowered to combine income support to farmers with locally specific habitat and landscape management measures.[177]

The proposed EU CAP reform will also involve incentive-based conditionality in the form of graduated payments. In addition to requiring compliance with the GAEC, it will introduce eco-schemes that provide flexibility to both farmers and Member States.[178] Under eco-schemes, farmers can choose whether to adopt a number of agricultural practices that local authorities designate as beneficial to the climate and environment, and upon which additional support is conditional. In January 2021, the European Commission published a list of potential eligible practices, including organic farming, integrated pest management, agroecology, agroforestry, carbon farming and precision farming.[179] Agricultural scientists agree that eco-schemes hold significant potential to reduce emissions and advocate for strong environmental conditions and a minimum share of the CAP budget to be allocated to eco-schemes for them to deliver on this potential.[180]

As with all positive incentives, it is important to determine the appropriate payment level that would encourage farmers to adopt environmental behaviour without generating dead-weight social losses.[181] Studies suggest that for farmers to change their behaviour, positive incentives must be sufficient to cover farmers' compliance costs, including opportunity and transaction costs.[182] Yet, the costs and benefits of changing behaviour depend greatly on the farming practice and agro-ecological conditions in question. Some practices may be relatively inexpensive to adopt; whereas others may require farmers to invest in new equipment and learn new skills.

BOX 4. CONDITIONALITY OF AGRICULTURAL SUPPORT IN BRAZIL

Brazil began making its agricultural support conditional on environmental criteria in 2008. By 2016, approximately one-third of all support was conditional upon compliance with environmental laws.[186] Brazil's conditions go beyond ensuring that farmers comply with existing laws, however, and also incentivize farmers to adopt more ambitious practices. Under the Low-Carbon Agriculture Program (*Agricultura de Baixa Emissão de Carbono*; ABC), farmers gain preferential access to government-subsidized credit when they adopt agricultural practices that either increase productivity or reduce emissions. Eligible practices include recovering degraded pastures; intensifying livestock management; integrating crop, livestock, and forestry systems; and no-till planting.[187]

The Brazilian government provided over USD 1.5 billion in loans under the ABC Program between 2010–20. Despite some early implementation challenges, the Program has been successful in both reducing deforestation and accelerating the adoption of sustainable farming practices.[188] Its success has been attributed to the complementarity between its climate-related conditions – which called for ambitious behaviour change from farmers – and the capacity building and credit provided under the ABC Program – which supported farmers in adapting their farming practices.[189] In providing both financial incentives and technical support to farmers, the ABC Program illustrates how governments can implement conditionality in a way that supports farmers in their transition to low-carbon agricultural practices.

One way of addressing these highly differentiated (perceived) costs and benefits of sustainable farming practices is to focus on rewarding performance rather than behaviour. Performance-based graduated schemes provide farmers with flexibility as to how to minimise perceived costs and maximise perceived benefits, as they do not prescribe which behaviours farmers should adopt. To reward results rather than behaviour, governments could establish specific climate objectives, such as a reduction in GHG emissions or emission intensity, supported by verifiable and quantifiable indicators on which payments can be made conditional. Performance-based graduated schemes have the added advantage of encouraging innovation. For example, if farmers are paid for meeting increasingly ambitious emission reduction targets (as opposed to only being compensated for implementing emission-reducing technologies), they may invest more in innovative solutions to achieve higher emission reductions.

However, performance-based approaches are only appropriate where farmers are able to demonstrate that they have achieved the required performance benchmark, which requires well-developed MRV frameworks that can account for local conditions. In turn, when the focus is on behaviour, farmers must demonstrate that they have adopted the desired behaviour, which tends to be more straightforward. Thus, in countries with well-developed MRV frameworks – or where these can be developed quickly – performance-based approaches are more appropriate. In contrast, when farmers and institutions alike have limited MRV capacities, it may be more appropriate to introduce conditions that are focused on behaviour while strengthening MRV capacities.

Property and land tax rates also influence how farmers manage their lands. The agricultural sector enjoys preferential treatment for land taxation in many countries, although this rarely considers how land is used. One way to incentivize farmers to adopt sustainable management practices is to **build environmental considerations into annual land tax rates** – for example, by valuing land managed sustainably more favorably than land that is not. The taxable assessed value of farmland can be based on a number of factors that, depending on the country, include biophysical features (such as the size of the land and its hydrology); management features (such as the purpose of management and the management practices employed); exogenous features (in the case of a hypothetical 'best use' value); as well as access to roads and other basic services.[183] In Costa Rica, for example, farmland valuation considers land use and production – such that annual property taxes can be 40 percent lower for farms that employ soil management and conservation practices – with the explicit aim of conserving farmland.[184] In another example, Japan offers a lower registration tax rate on transfers of land managed for conservation purposes at 0.4 percent, compared to a registration tax rate of 2 percent for other land use types.[185]

4.4.2 Rechannel production support to public goods and services

The case for change

Approximately half of all public support for agriculture is provided in the form of payments based on current production – including market price support, payments based on output, and payments based on the unconstrained use of inputs. This is equivalent to an average annual total of USD 312 billion spent between 2017-19. Payments that are coupled to production risk exacerbating the negative environmental impacts of agriculture through incentivizing increased production without constraining producer behaviour (Box 2).[190] They also incentivize farmers to produce more in order to receive higher payments.[191]

As payments that are linked to production directly influence farmers' decision-making around what to grow and how to grow it, they are trade distorting. Production subsidies have also been criticized for being ineffective at achieving stated policy goals, including rural development and improving farmer's livelihoods.[192] This is partly because by design large producers capture the most support when it is coupled to production. For public support to truly contribute to rural development, it should reach smaller farmers. In Southeast Asia, for example, an estimated 100 million smallholder farmers account for around 40 percent of the region's workforce and play a leading role in the production of commodities such as palm oil, rubber, cocoa and coffee.[193]

To address these environmental and socio-economic concerns, the OECD suggests that public support should be channelled to the provision of goods and services that allow 'agricultural and food production to be responsive, sustainable and resilient to external shocks'.[194] This includes investments in agricultural research and development, agricultural training and education, inspection services to control quality and safety, off-farm collective infrastructures, as well as marketing and promotion.[195] Investments in research and development, in particular, have been found to be 'one of the most cost-effective policies to mitigate agriculturally driven deforestation'.[196]

How it can be done

Support for goods and services does not flow directly to farmers, but rather to services that create an enabling environment for agricultural production. As a result, channelling support away from production payments and towards goods and services will be felt by farmers, who will likely experience a short-term reduction in profitability even if they benefit from these goods and services over the long-term. This negative impact can be mitigated by implementing the shift in support gradually – a trend that is already visible in some OECD countries – and by developing strong and effective communications around newly introduced goods and services.

To avoid carbon leakage – in which production simply moves to another location – any reform to MPS should be combined with domestic strategies that address consumer demand for imported, high-emission commodities (see redesign option in Section 4.4.3). A recent study modelling the global impacts of removing coupled subsidies and market price support demonstrated that removing coupled subsidies has a global emission reduction potential of 34.4 $MtCO_2e$, predominantly from countries that provide large volumes of coupled support such as China, Mexico and the EU. In contrast, removing MPS without replacing it with more targeted climate mitigation policies would increase global emissions, partly by increasing consumer demand through lower prices and partly by shifting commodity production to regions with higher emission intensities.

Reducing GHG emissions while meeting the nutritional needs of a growing population will require sufficient and consistent investments in well-designed services.

Firstly, investments in **agricultural research and development** are needed to drive innovation in agricultural technologies, practices and processes.[197] Innovation is especially needed in the face of a changing climate where farmers will need to adapt to changes in the length of growing seasons, availability of water and temperature extremes that will put pressure on their ability to produce.[198] Returns on agricultural research investment can be high.[199] In China, for example, investments in research and development have a 6.75 percent return on investment and contribute significantly to poverty reduction.[200]

To ensure that agricultural innovation achieves emission reductions, governments must provide strategic direction and sufficient finance – for instance through research grants – and invest in research infrastructure such as databases and laboratories. Fostering collaboration between public and private institutions – as well as universities with strong agricultural specializations – will be crucial to ensure that new technologies are efficient and scalable. While private spending on agricultural research has grown faster than public research investments – rising from 21 percent of total investments in 1990 to 26 percent in 2014 – it focuses

on only a handful of commodities such as maize and soybeans.[201] Government involvement is thus needed to provide incentives for private actors to fund research on understudied produce and practices with high emission-reduction potentials. The Netherlands, for example, has a comprehensive agricultural research and development network that has driven agricultural innovation and increased productivity (Box 5).

Secondly, for innovation to be effective at reducing emissions, it must translate into improved practices. Thus, support should also be provided for **agricultural training and extension services** that equip farmers with the knowledge and skills needed to change production behaviour.[202] This includes enhancing the capacity of farmers to manage risks, adopt new technologies and access financing instruments. Access to regular information on how to best apply innovative practices also reduces the perceived risks associated with changing behaviour.[203] For example, Chinese wheat farmers reduced their fertiliser use intensity by 17 percent after receiving regular, in-field guidance on fertiliser application.[204]

Thirdly, governments should also **invest in collective infrastructure** – most notably storage and transportation infrastructure – which can reduce emissions by preventing avoidable food loss.[205] Food loss takes place throughout the value chain as a result of inefficiencies during the harvesting, processing, storing or transporting of food.[xiii] While farmers can be incentivized to invest in on-farm infrastructure to reduce food loss at the harvesting and processing stages, governments should invest in public, off-farm infrastructures to reduce food loss during storage and transportation.[206] This is a particularly relevant opportunity for low-income countries, where farmers often lack the basic infrastructure needed to avoid food losses occurring from farm to market.[207] More than two-thirds of food loss and waste occurring in South and Southeast Asia and sub-Saharan Africa occur during production and storage.[208] And losses in distribution are also significant; in Nigeria, for instance, 41 percent of tomatoes spoil during transportation alone due to inadequate transportation infrastructure and procedures.[209]

Various types of collective infrastructure can reduce food loss during storage and transportation. For example, governments can invest in strategically located collection centers, where farmers can bring their produce for

xiii In turn, food waste takes place at the moment of consumption, especially in high income countries.

collection by retailers.[210] In addition, governments can construct roads to facilitate access to these collection centers, thereby reducing transportation times and food loss caused by bumpy rides. In turn, collective cold and dry storage facilities can be placed at collection centers so farmers can benefit from longer storage times between harvests and markets, which is especially important during periods where supply exceeds demand.[211]

Finally, governments should invest in **robust environmental information services**. They can, for example, contribute to emission reductions by detecting pests and diseases early, which prevents avoidable food loss.[212] This is especially relevant considering the increasingly globalized nature of trade and projected climate impacts on the likelihood and severity of pest events. In the US, the early detection and distribution mapping system – which features maps and databases that enable farmers to monitor pests and invasive species – is an example of how governments can provide information infrastructure to foster an enabling environment for pest control.

BOX 5. AGRICULTURAL INNOVATION SUPPORT IN THE NETHERLANDS

The Netherlands provides significant public support for agricultural research.[213] Firstly, the Dutch implementation of the wider EU CAP policy encourages productive investments in the agricultural sector.[214] In addition, the Netherlands provides numerous tax concessions to stimulate agricultural innovation, including a concession on environmentally friendly investments and energy-saving investments.[215] Research grants are provided to stimulate sustainability in agricultural production and Wageningen University has a number of research and innovation programmes working alongside Dutch farmers. Finally, the Netherlands also has a long tradition of agricultural public-private partnerships for research and innovation, which have stimulated knowledge development and sharing as well as network building.[216] As a result of these efforts, agricultural productivity rates have grown by 33 percent in the Netherlands between 2005-16, and the Dutch agricultural sector is now the most efficient and productive agricultural sector in the EU per unit of land. [217]

4.4.3 Avoid using public support to promote the consumption of ruminant meat

The case for change

By 2050, global consumption of meat is projected to rise by 76 percent as a result of population growth and rising prosperity. To satisfy this demand, production levels will also need to rise.[218] While some improvements in production efficiency (i.e., the amount of meat output relative to agricultural inputs) can be expected by 2050, this is likely to be insufficient to limit the climate impacts of meat production.[219]

Ruminant meat (beef, sheep and goat) production is responsible for more than 5 percent of global GHG emissions and emits almost 20 times more GHG emissions per unit of protein than plant-based protein sources such as beans, peas and lentils, and requires considerably more land (Figure 16). Meat production – especially beef – is also highly resource-intensive; it requires more land, feed and water than any other protein. In particular, meat production requires not only the land on which animals are reared but also the land needed to produce animal feed. For instance, 100 calories of feed are needed to produce a single calorie of beef.[220] In addition, the area of forest cleared for beef production is more than twice the area cleared for palm oil, soy and wood products, combined.[221]

Shifting towards more sustainable and climate-friendly diets is, therefore, an important component in the global effort to mitigate the climate impacts of the agricultural sector.[222] According to the World Resources Institute, reducing ruminant meat consumption is the most promising strategy for reducing GHG emissions in the agricultural sector.[223] A 30 percent decline in ruminant meat consumption worldwide would cut GHG emissions from the agricultural sector by half until 2050. A 50 percent decline (relative to 2010 levels) would also translate into more than 300 million hectares of agricultural land available for other purposes.

Reducing red meat consumption also brings benefits to human health. The excessive consumption of red and processed meat – as is the case in countries such as the US and Brazil where the average person consumes 27 kilograms of meat per year – can increase the risk of obesity, cardiovascular diseases, cancers and type 2 diabetes.[224]

Despite growing awareness that the overconsumption of meat negatively impacts human health, diets continue to shift toward animal-based proteins; while the global

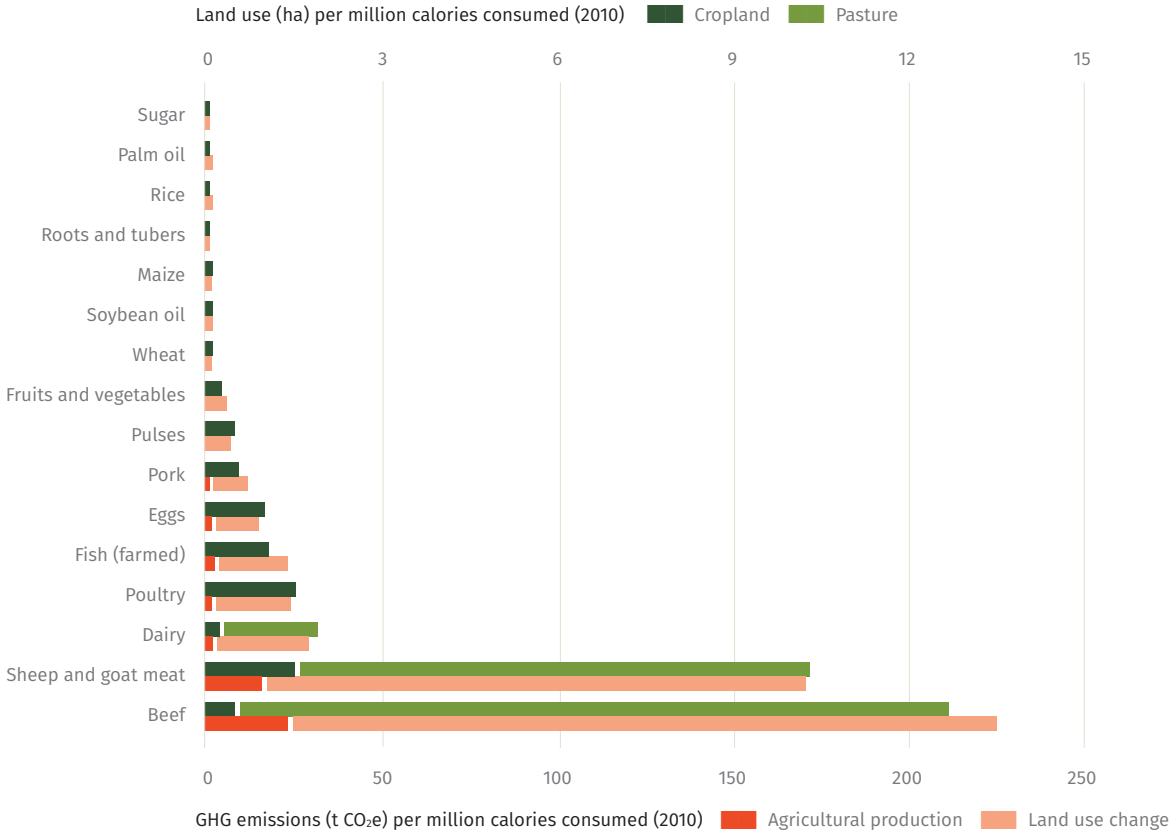
average availability of animal-based protein has risen by 59 percent per person between 1961 and 2009, that of plant-based protein has only grown by 14 percent. Moreover, the average protein consumption per person exceeds the estimated daily requirements in several countries as seen in Figure 17.[225]

Achieving global reduction aligned with the Paris Agreement will require the countries that consume the most meat to shoulder most of the burden while the countries that show low per-capita meat consumption are expected to moderately grow or stabilize that consumption at sustainable levels. For instance, a 30 percent decline in meat consumption worldwide would require a 40-60 percent reduction in meat consumption in the United States and Brazil, as well as a 22 percent reduction in the EU.[226] Contrary to the belief that this will negatively impact livestock farmers, reducing global consumption by these levels still allows considerable growth in the livestock business as regions with low consumption of meat are still expected to see a growth in consumption. Reducing consumption of ruminant meat by 30 percent by 2050 compared to business-as-usual projections still allows demand for meat to rise by 32 percent from now until then.[227]

Very few countries have public spending initiatives in place to promote dietary shifts towards healthy plant-based diets. One study finds that few if any countries implement policy instruments that aim to lower animal-base foods consumption.[229] In fact, most countries continue to subsidize the production and consumption of meat at a significantly higher rate than plant-based proteins and crops for human consumption. Livestock subsidies in OECD countries were estimated at USD 53 billion in 2013.[230] A recent analysis by Greenpeace finds that between 69 and 79 percent (i.e., up to EUR 32.6 billion) of direct payments under the EU Common Agricultural Policy are directed to livestock or animal feed producers. It is, therefore, unsurprising that much of EU agricultural land is dedicated to producing and feeding livestock; over 63 percent of arable land in the EU is currently used to produce animal feed instead of food for people.[231]

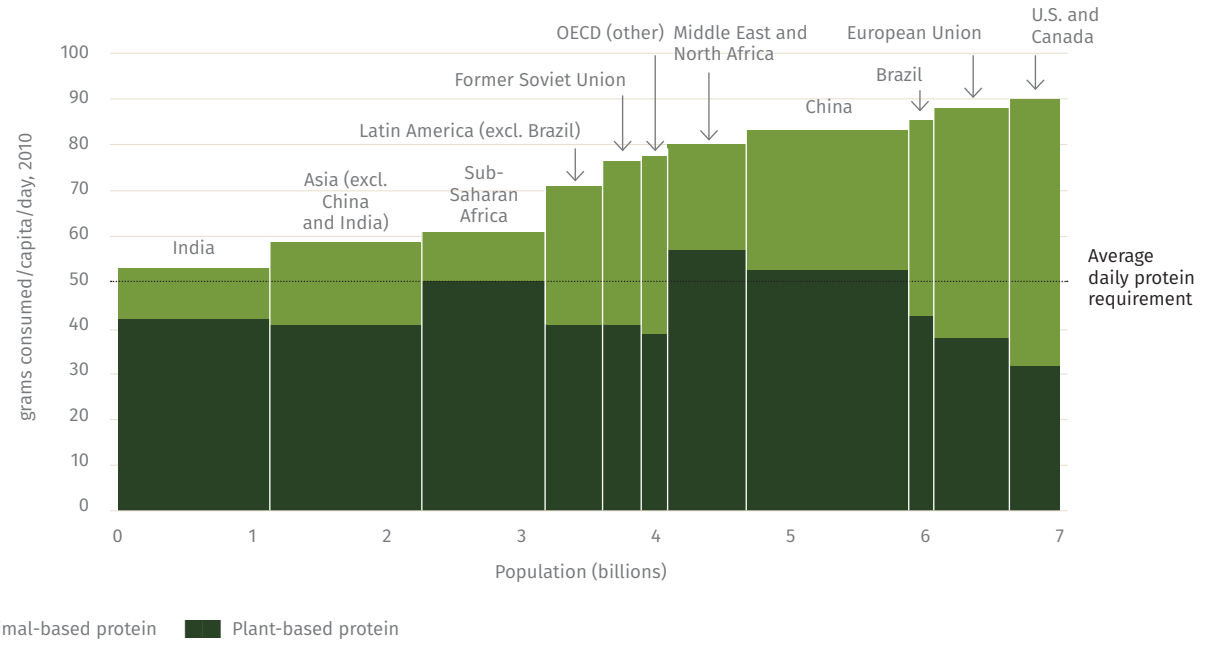
In the US between 1995-2010, roughly two-thirds of subsidies (with a value of USD 200 billion) went to the production of animal-feed crops, tobacco and cotton. None were allocated to the production of fruits, vegetables and nuts (except peanuts).[232] Another study found that the US spends up to USD 38 billion annually to subsidize the

FIGURE 16. **Land use and GHG impacts per commodity and per million calories consumed (2010)**[228]



Source: Reproduced from Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., Dumas, P., & Matthews, E. (2018). Creating a sustainable food future.

FIGURE 17. **Average protein consumption compared to average daily protein requirements**



Note: Width of bars is proportional to each region's population. Average daily protin requirement of 50 g per day is based on an average adult body weight of 62 kg (Walpole et al. 2012) and recommended protein intake of 0.8 g per kg body weight/day (Paul 1985). Individuals' energy requirements on age, sex, height, weight, pregnancy, location, and level of physical activity.
Source: Reproduced from Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., Dumas, P., & Matthews, E. (2018). Creating a sustainable food future.

meat and dairy industries, with less than 1 percent of that sum allocated to subsidizing the production of fruits and vegetables.[233] These schemes contribute to artificially low consumer prices on meat products that do not reflect real cost of production, and relatively high costs for protein- and plant-based alternatives that do not benefit from the same level of support. This, in turn, risks incentivizing meat consumption over plant-based alternatives.

Because these subsidies bring down the final cost to consumers, they also influence consumption decisions. Multiple studies show that increasing the price of meat can reduce its consumption, especially when such increases are coupled with a reduced price for protein alternatives. Lowering the prices of fruits and vegetables by 10 percent could encourage their consumption by an additional 14 percent in the US, as well as preventing or postponing the death of 150,000 people from heart disease by 2030.[234] In the Netherlands, a 30 percent increase in meat prices could bring net environmental and health benefits of EUR 4.1-12.3 billion over 30 years.[235]

Moreover, some countries encourage the consumption of meat through public support earmarked for marketing campaigns and advertising.[236] For instance, the EU provided EUR 60 million between 2018–20 for marketing campaigns that promoted the consumption of pork, beef, poultry and lamb products.[237] This funding is part of a larger subsidy of EUR 200 million the EU provides every year for the promotion of agricultural products (Box 7). The US government provided USD 562 million toward programmes that promoted the marketing and research of dairy, beef, pork and lamb consumption in 2016.[238]

How it can be done

Raising the price of meat by redirecting public support towards sustainable diets can reduce red meat demand in countries that are over-consuming it. Governments can influence diets through information campaigns, public procurement and making alternatives more attractive and cost-effective.[239] Reducing demand for red meat will require governments to employ a combination of all of these instruments in addition to collaborating with the food industry – such as restaurants, retailers and caterers – along with educators and the media to shift cultural norms and dietary habits.

Raising the price of meat for consumers could be achieved by **adjusting VAT rates applied to ruminant meat products**. Multiple studies show that increasing the price of meat can reduce its consumption. For example, a 15 - 30 percent increase on meat prices in the Netherlands is estimated to reduce meat consumption by 8 – 16 percent.[240] In the US, beef consumption declined by 12 percent as retail prices increased

by 51 percent from 2007-15.[241] And in Canada, higher prices for beef have been shown to reduce beef consumption.[242] The EU Commission – as part of its Farm to Fork Strategy - has already put forward a proposal to adjust VAT rates on foods to 'reflect their real costs in terms of use of finite natural resources, pollution, GHG emissions and other environmental externalities'.[243] This means that resource-intense and high GHG-emitting products such as beef would have an adjusted VAT rate relative to other products.

Another alternative is to **eliminate – or more likely reduce – the purchase of meat in direct assistance and public procurement**. Governments provide consumer subsidies through feeding programmes, food stamps and public procurement. This includes food purchases for public institutions such as canteens at universities, schools and kindergartens, as well as for healthcare facilities, social and welfare services, the military and prisons. In the EU, half the daily energy requirements of children are met by food they eat at school. Overall, EUR 82 billion are spent in public food services in the EU every year.[244] Redesigning consumer subsidies has the advantage of avoiding trade distortions, as both domestically produced and imported food can be sought. It also puts governments at all levels (national, state, municipal) directly in the driving seat to choose which types of food to cover and/or promote. Steering public purchases away from meat and towards healthy and sustainable diets can also increase the consumption of healthy foods and, therefore, overall health.[245] It also helps to culturally 'normalize' meals in which meat is not featured as the centrepiece (Box 6).

Public procurement policies can be adjusted to consider how their GHG impact or procurement criteria can cap the purchase of meat, as well as encourage healthier diets. A case study assessing the GHG impact of public food procurement found that by simply adding a vegetarian menu as an alternative option for children in schools, the GHG impact of each meal drops by 32 percent.[246] The EU, for instance, has introduced several voluntary guidelines for public procurement. The Green Public Procurement (GPP) criteria for food, catering services and vending machines aims to reduce GHG emissions resulting from food purchases. Several criteria are included, such as increasing the option of plant-based menus and providing more environmentally responsible marine and aquaculture products. However, as a non-binding instrument, the GPP has not been implemented by many Member States. The Commission disclosed in 2017 that more than half of Member States' procurement (not only in food) continue to use the lowest prices as the only award criteria.[247]

BOX 6. MEATLESS SCHOOL LUNCHES IN BRAZIL

In Brazil, beef consumption in schools in the city of Sao Paulo has been gradually going down as a result of municipal efforts to offer protein alternatives in school meals. By adopting Meatless Mondays every two weeks, the city was able to reduce their meat purchases by 1,056 tons per year.[248] Since December 2018, a Sustainable Vegetarian Menu has been introduced in schools once a week. It aims to increase the consumption of plant-based proteins, such as chickpeas, black peans, green peas and lentils. The success of this initiative can in part be attributed to the participatory approach taken to its design and eventual roll-out: the programme has involved the Secretary of Education, an NGO that promotes vegetarian diets called Sociedade Vegetaria Brasileira, as well as a TV chef Bela Gil. The programme has also provided capacity building to school cooks and menu inspiration to food service providers seeking to ensure the provision of balanced diets.[249]

Food programmes that aim to make food more affordable for low-income households should also shift their public support towards more balanced and sustainable diets. In the US, the Supplemental Nutrition Assistance Program (SNAP) provides subsidies for the purchase of food items at authorized retail food stores. In 2019, 35.7 million people participated in the program each month (11 percent of the US population), which translated into USD 60.4 billion in public support.[250] Except for dietary supplements, alcoholic beverages and tobacco products, SNAP participants can buy anything, including meat, junk food and soft drinks. While eliminating support for these food items is regarded as politically unfeasible by some,[251] real options exist to steer consumers towards more balanced diets without imposing limitations. One study finds that providing additional subsidies for fruits and vegetables that decrease their price by 10 percent can increase their purchase by SNAP participants by 6-7 percent.[252]

Finally, **support that promotes consumption of meat in marketing campaigns should be redirected**. This could involve implementing conditionality for market spending, including (a) restricting the use of public funds for meat (especially beef) in promotional campaigns, as well as (b) allocating budget to the promotion of low-carbon protein

alternatives. Both options can be achieved by ensuring that the criteria for selecting marketing campaigns integrates existing environmental, climate and health policies (Box 7).

BOX 7. EVALUATION OF EU AGRICULTURAL PROMOTION POLICY

Between 2018 and 2020, the EU conducted an evaluation of its agricultural promotion policy. It aimed to assess the impact of its subsidy programme under the Common Agricultural Policy (CAP) in terms of 'increased sales', 'consumer awareness', as well as 'problems encountered regarding the implementation of the instruments'.[253] As part of the evaluation, a public consultation was carried out that, amongst other qualifiers, assessed the coherence of the subsidy programme with other EU policies. Less than half (40 percent) of respondents thought that the agricultural promotion policy was aligned with EU policies on environment, climate action and development. Around one-quarter of respondents considered the CAP's subsidy programme fundamentally incoherent with these policies.

This resulted in a recommendation that the CAP's subsidy programme be aligned with climate, environmental, health and development policy objectives, citing the European Green Deal and the Farm to Fork strategy.[xiv] As a result, the 2021 budget has dedicated 50 percent of its funds to topics supporting, amongst others, sustainable farming and the consumption of fruits and vegetables in the context of balanced diets.

Moreover, the award criteria for organizations that aim to get their marketing campaigns subsidized now includes a new sub-criterion for 'contribution of the promotion project in respect of the objectives of the climate and environmental ambition of the CAP, the Green Deal and Farm to Fork strategies'.[254] While these are positive developments, it is unclear to what extent support for meat has been eliminated or reduced. There is no reference in the work programme concerning this.

xiv The Farm to Fork Strategy is part of the European Green Deal and aims to make food systems fair, healthy and environmentally friendly. See more at https://ec.europa.eu/food/farm2fork_en

4.4.4 Remove or redirect support provided for agricultural inputs

The case for change

Subsidies applied to agricultural inputs – such as electricity, fossil fuels, fertilisers and animal feed – are a common yet harmful type of production support. Input subsidies are most commonly applied in low- and middle-income countries to increase agricultural production and safeguard food security, although many high-income countries provide input support as well.[255] By design, these subsidies incentivize farmers to use inputs less efficiently, thereby generating higher GHG emissions than if these inputs were priced at their true cost. Thus, some of the emissions and societal costs associated with producing carbon-intensive commodities could be avoided by removing or reforming subsidies that apply to agricultural inputs.

Fertiliser subsidies are frequently applied, including in Indonesia, India, South Korea and Turkey. Between 2014–16, fertiliser subsidies totaled USD 12.8 billion, with 85 percent of this provided by India alone.[256] While fertiliser use is responsible for 13 percent of the GHG emissions generated by the agricultural sector, much of what is applied is lost, rather than taken up by crops. In fact, a recent study found that government subsidies increase nitrogen pollution by as much as 35 percent but have almost no impact on improving yields.[257] This suggests that national governments have a significant opportunity to cut budgetary costs and reduce nitrogen pollution without sacrificing agricultural production.

In addition, subsidies and tax exemptions that bring down the cost of fossil fuel used by agricultural vehicles and machinery create incentives for farmers to use that fuel inefficiently. Agricultural energy use is responsible for approximately 22 percent of agricultural GHG emissions. Despite these substantial negative climate impacts, many governments provide large amounts – sometimes more than USD 1 billion annually – of public support for fossil fuel use through agricultural tax concessions (Table 4). In Italy and France, for example, concessions on agricultural fossil fuel use amount to 40 and 60 percent respectively of forgone tax revenue on agriculture.

Finally, animal feed subsidies can create incentives for farmers to emit more GHGs. The production, processing and transport of animal feed is responsible for approximately 45 percent of the GHGs emitted by the livestock sector.[259] This includes emissions from agricultural land expansion for the production of animal

TABLE 4. Estimates of tax expenditures due to fossil fuel tax concessions

COUNTRY	TAX EXPENDITURES
France	Provides fuel concessions, which represented 60 percent of tax expenditures in 2018, at USD 2.39 billion.
Germany	Offers a refund on diesel used in agriculture, which cost USD 532 million in 2018.
Italy	Offers a lower excise tax on fuel used by the agricultural sector, which in 2017 was estimated to cost the country USD 1.19 billion in foregone tax revenues (equal to 40 percent of total agricultural tax expenditures).
Korea	Offers agricultural concessions on tax imposed on fossil fuels, worth USD 1.1 billion in 2017.
Poland	Provides rebates for fuel used in agriculture, which cost USD 247 million in 2018.
United Kingdom	Offers lower excise rates on fuel used in agricultural production, worth USD 879 million annually.

Source: (OECD, 2020).[258]

feed – most notably soy – which is a significant driver of deforestation and associated emissions in tropical countries. By creating incentives for farmers to use animal feed less efficiently, these input subsidies risk exacerbating the GHG emissions associated with the production, processing and transport of animal feed.

How it can be done

Subsidizing agricultural inputs incentivizes farmers to use them less efficiently. As a result, removing or redirecting these subsidies holds potential to reduce emissions and also increase efficiency of resource use.

Firstly, public **support for fertiliser use should be redesigned** to align with climate mitigation objectives without impacting agricultural yield. The best approach for doing so will depend on national circumstances. While low-income countries often struggle with the underuse of fertiliser – resulting in yield gaps and food insecurity – high-income countries typically struggle with fertiliser overuse, driving pollution and avoidable GHG emissions.[260]

In high-income countries where farmers often do not require support for fertilisers to maintain yields, governments can use three levers to realign this support with climate mitigation: remove fertiliser subsidies altogether; channel support for fertilisers to income support if their purpose is increasing the viability of rural livelihoods; or channel support for fertilisers to public goods and services that benefit the agricultural sector as a whole. South Korea, for instance, phased out fertiliser subsidies gradually between 1996 and 2005 and at the same time spent USD 1 billion in equipping the livestock industry with waste treatment and processing facilities.[261]

In 1986, New Zealand began phasing out support for fertilisers – along with all forms of coupled subsidies – due to the large fiscal burden and environmental concerns.[262] While this initially resulted in a sharp decrease in farm income, it also drove farmers to change their practices and inspired agricultural innovation. Overall, only 1 percent of farmers left the industry, whereas fertiliser application declined markedly, efficiency improved, forest cover increased by close to 2 million hectares, and the budgetary burden on the New Zealand government was significantly reduced.

In low-income countries, fertiliser subsidies may be required to improve yields, safeguard food security and alleviate rural poverty. In these cases, governments should combine fertiliser subsidies with extension services that train farmers to use fertilisers efficiently and effectively. In middle-income countries, public support is often needed to promote rural development, while the need to improve yields and increase productivity is often less marked. In these cases, governments should channel support for fertilisers into some form of decoupled subsidy, such as income support.

In both contexts, governments should invest in research to develop low-emission fertilisers and optimize fertiliser application methods to local conditions. The Chinese government, for example, phased out fertiliser subsidies and introduced a slow-release fertiliser commercialization programme in 2017 (Box 8).

Secondly, governments should **move away from providing public support that backs the use of fossil fuels**, including in the agricultural sector. These reforms should be designed to minimise disproportionately impacting incomes of poorer agricultural businesses, especially in low- and middle-income countries where agriculture plays an important role in rural livelihoods.[263] It is, therefore, key that reforms are combined with appropriate policies that either provide income support to those businesses that are most hardly hit or support them in reducing their fossil fuel use and increasing use efficiency.[264]

A recent study modelling the impact of removing fossil fuel subsidies in Nigeria's agricultural sector found that their removal (and the subsequent increase on the cost of fuel) is associated with numerous long-term benefits to the agricultural sector such as increased output, and labor productivity. Interestingly, these positive effects were stronger when subsidies were removed swiftly and completely – as opposed to a partial or gradual removal – which the authors attribute to the stronger price signal driving improved agricultural performance under this scenario.[265]

As with all subsidy removals, removing support for fossil fuel will likely be met with resistance – especially from farmers who rely on intensive fossil fuel use. For example, the Irish government recently announced that it would remove the existing tax concession for fossil fuels used during agricultural production. This generated discontent among farmers who argued that they were being punished for needing fossil fuels, while low-emission technologies that are widely available to other fuel users – such as electric vehicles – are not yet cost-effective for farms.[266]

To manage potential resistance, it is important that fossil fuel subsidy reforms are designed in a way that also minimises losses to farmers and empowers them to achieve the desired emission reductions. Government could, for example, rechannel the additional tax revenues raised from removed fossil fuel concessions to support the transition to agricultural e-mobility (e.g. by providing private charging stations to farms) or they could be earmarked for projects that aim to reduce farmers' dependence on fossil fuel, for example by optimizing production practices.[267] This is the approach taken by the Irish government to accommodate farmers' concerns; EUR 20 million of the carbon tax revenue has been earmarked to pilot results-based financing schemes that compensate farmers for reducing emissions.[268]

And finally, governments should **remove or reform public support for animal feed** for ruminants. For instance, animal feed subsidies could be awarded only where changing animal diets reduces the emissions from livestock, such as supporting particular types of animal feed that are known to reduce methane generation.[269] This can be combined with positive economic incentives by, for example, offering results-based payments for any emission reductions achieved. In many countries, this will require investments in research and development to understand which feed types are best suited for local conditions and to balance any tradeoffs in milk and meat production.

BOX 8. AGRICULTURAL INPUT SUBSIDY REFORM IN CHINA

Between 1998 and 2016, the Chinese government heavily subsidized fertiliser use through numerous policies – such as preferential energy prices and VAT concessions – that lowered the costs of fertiliser production.[270] Low prices combined with limited knowledge, in turn, incentivized farmers to over-apply fertilisers – in some regions as much as 60 percent more than optimum values – and resulted in widespread nitrate and phosphorous pollution. By 2007, fertiliser production, distribution and use generated approximately 30 percent of China's GHG emissions in agriculture.

In 2015, the Chinese government issued a Sustainable Agricultural Development Plan calling for zero growth in fertiliser use by 2020 and removed the VAT concession on fertiliser.[271] By 2017, all fertiliser subsidies had been phased out, and a programme was established to commercialize slow-release fertiliser. In fact, almost all agricultural support programmes announced since 2017 involve some climate considerations. For example, extension services aim at promoting 'green, high-yielding, high efficiency' agriculture.[272]

CHAPTER 5
Redirecting financial markets

Similar to public spending, private financial flows to the land sector are overwhelmingly delivered without consideration for the impact on climate. Business-as-usual private finance for agriculture, forestry and fishing totaled USD 191.6 trillion between 2010–16, or USD 27 trillion per year on average.[xv] And global investments in meat and dairy activities – the top GHG emitters in agriculture along with rice production – topped USD 478 billion between 2015–20.[273]

Private finance for the land sector is projected to soar, driven by the prospect of greater returns on investments. Private sector interest is rising – especially in developing countries – in anticipation of growing demand for food, technological advancements that improve production efficiency and reduce costs, further deregulation of produce, and lower interest rates across developed nations.[27]

The case for reforming or adapting financial regulations is particularly strong. Notably, the lack of convincing results from voluntary initiatives aimed at the disclosure of climate-related risks, the still-weak integration of climate- and nature-related risks into a financial actor's internal risk management controls, and the scant attention paid so far to the climate impact and environmental degradation caused by investment portfolios and lending activity, all demand more comprehensive regulatory action from supervisory authorities.

Financial regulations related to managing climate-related risks and promoting sustainable finance holds potential to steer a substantial amount of 'grey' land-use investments into more climate-consistent enterprises. Re-orienting these private flows towards climate-compatible activities is vital to fully unlock the mitigation and adaptative potential of the land sector. The following adjustments to financial regulations and supervisory approaches are proposed, which are particularly relevant to the land sector:

- Move from voluntary to mandatory disclosure of climate-related risks to increase transparency and allow investors to revisit capital allocation decisions;
- Enhance risk management frameworks to better identify, manage, monitor, and mitigate climate risks, including deforestation risks from soft commodity supply chains;
- Implement financial measures and instruments that actively promote sustainable investments and lending to climate-aligned land sector enterprises.

xv The value refers to gross fixed capital formation as a proxy for investment in activities in the land sector. Data from FAOSTAT *Country Investment Statistics Profile*

5.1 Types of financial regulations

Governments and supervisory authorities can employ a range of policy instruments to shape private sector behaviour and reorient capital flows towards sustainable land use, including by reforming or adjusting financial regulations.

Financial regulations refer to standards that impose restrictions on the operations of financial institutions such as banks and capital market intermediaries. These policy instruments primarily aim to ensure stability within financial systems, but they are also used to improve market efficiency and integrity, increase access to credit, protect investors and, more recently, promote sustainability.[275]

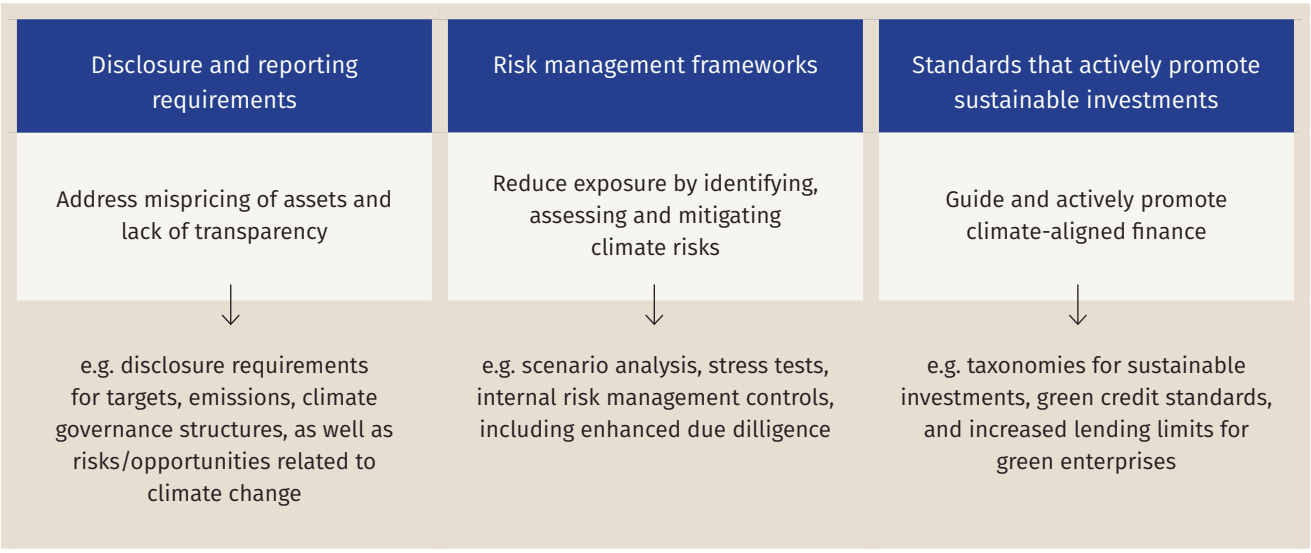
Financial regulations come in the form of laws that regulate the functioning of the financial sector, as well as through other (binding and non-binding) supervisory instruments created by financial authorities. These authorities vary from country to country but often include the central bank (for the regulation of monetary policies and price stability); supervisory regulatory authorities (for the regulation of banks, insurance companies and financial firms providing financial services); and agencies or commissions that oversee securities issuances, trade and investment (for the regulation of securities traded in capital markets and commodities futures).

These regulations are largely influenced by international standards developed through a variety of forums, including the Basel Committee on Banking Supervision, the International Organization of Securities Commissions, and the Financial Stability Board. These standards impact the behaviour of financial system actors, resulting in the gradual convergence of financial regulatory practices.[276] In the past decade a number of international forums for co-operation that address climate change concerns in financial regulatory systems have emerged (Box 9).[277]

Among the types of financial regulations that are most relevant to aligning finance flows with climate objectives are those related to prudential rules and standards that increase demand for financial products that more directly promote mitigation.[285] Prudential rules that require regulated financial system actors to control risks and hold adequate capital as defined by capital requirements can safeguard the financial system against climate-related physical and transition risks. In doing so, they can help correct the lack of internalization of these risks by financial firms. When coupled with standards that help create additional demand for greener investments, financial regulations can spur a shift from high to low-carbon investments, including for the land sector.[286]

In this chapter we consider those types of financial regulations that, if properly adapted and implemented, are more likely to directly benefit the land sector, including (Figure 18):

FIGURE 18. Types of financial regulations



Source: Adapted from IMF (2019) Macroeconomic and Financial Policies for Climate Change Mitigation: A Review of the Literature; and Volz, U. (2017). On the role of central banks in enhancing green finance.

BOX 9. EXAMPLES OF INTERNATIONAL FORUMS ADDRESSING CLIMATE-RELATED RISKS IN FINANCE

The Institutional Investors Group on Climate Change (IIGCC) was launched in 2001 and seeks to mobilize capital for the low-carbon transition and ensure resilience against climate change by promoting collaboration among businesses, pension funds, asset managers, and policymakers. It currently has over 275 investor members with EUR 35 trillion in assets.[278]

The Sustainable Banking Network (SBN), launched in 2012, consists of banking regulators and associations from 41 countries – together representing USD 43 trillion, or 85 percent of emerging market's banking assets – which are committed to advancing sustainable finance. Its work prioritizes knowledge sharing and capacity building with the aim of supporting low-income countries in designing and implementing sustainable finance practices.[279]

The Task Force on Climate-related Financial Disclosures (TCFD) was launched in 2015 by the Financial Stability Board to promote the voluntary disclosure of climate risks and opportunities. The TCFD provides a broad framework with recommendations for disclosure. It includes guidelines for applying stress testing and climate scenario analysis to assess climate and environmental risks of investment portfolios, which are to be disclosed systematically.[280]

The Network for Greening the Financial System (NGFS) was launched in 2017 with the dual aim of improving the capacity of financial actors to manage climate risks and incentivizing the deployment of green finance.[281] It consists of financial supervisors, regulators and central banks who share best practices, contributing to the development of climate-related financial risk management and the mobilization of green finance.[282]

The International Platform for Sustainable Finance (IPSF) was launched in 2019 by the European Commission. Its members include the EU and 15 non-EU countries, collectively representing 55 percent of both global GHG emissions and of the global GDP. The IPSF aims at scaling up sustainable private investment by offering a multilateral forum of dialogue between policymakers, creating a space for the exchange of best practices and initiatives, as well as the dissemination of the risks and opportunities associated with sustainable finance.[283]

The International Financial Reporting Standards Foundation (IFRS), established in 2000, is a non-profit organization that aims to develop high-quality, understandable, enforceable and globally accepted accounting standards. In September 2020, the Foundation published a Consultation Paper on Sustainability Reporting, the feedback from which confirmed an urgent need for global sustainability reporting standards and support for the IFRS to play a role in their development. In March 2021, the IFRS announced the formation of a working group, including leading sustainability reporting organizations, such as the IASB, aiming to establish an international sustainability reporting standards board (SSB) within the Foundation's existing governance structure. The objective of the SSB is to develop sustainability disclosure standards, building upon the well-established work of the TCFD. The International Organization of Securities Commissions (IOSCO) has welcomed this initiative, and will participate in the group as an observer, given the essential role it would play in evaluating and endorsing standards issued by the SSB.[284]

- Disclosure and reporting requirements. These aim to ensure that relevant and accurate information is made publicly available so financial system actors can make well-informed financial decisions and regulators can adequately monitor financial activities.[287] Disclosure requirements can cover aspects such as corporate governance of sustainability issues; climate risks and opportunities that arise from climate change; internal risk management processes adopted; and relevant targets and metrics.[288] Disclosure regulations may be used to require financial institutions to disclose funding provided to activities associated with negative climate impacts.[289]

- Risk management frameworks. These focus mostly on ensuring safety of the financial system by limiting the exposure of an individual institution or a whole financial market to both systemic and specific financial risks.[290] This includes climate scenario analysis and stress tests, which quantitatively assess future climate risks to portfolios and assets under different climate scenarios, and enhanced due diligence to account for the impacts of investments and transactions in the land sector.[291]

- Standards and rules that actively promote sustainable finance. These include instruments that can ensure quality and comparability in green financial assets and actively entice financial institutions to invest in sustainable activities. Examples include the use of taxonomies and classification systems that clearly define green, grey and climate misaligned investments, and the active promotion of greener financial instruments via, for example, green credit standards and increasing lending limits to climate-consistent enterprises.[292]

This chapter focuses largely on making private finance climate-compatible by adequately addressing climate-related risks. But issues related to broader nature-related risks are also raised in a number of instances (see Table 5). For investments in the land sector in particular, nature-related risks, including the degradation of ecosystem services and biodiversity losses, can also lead to the loss of value or return on investments.[293] Notably, in many instances climate- and nature-related risks overlap or are intrinsically connected. For example, deforestation is an important climate risk and a major driver for loss of biodiversity. Also, environmental degradation lowers climate resilience, and climate change, in turn, exacerbates the drivers of nature loss.[294]

TABLE 5. Physical and transition risks

	CLIMATE-RELATED RISKS	NATURE-RELATED RISKS	IMPACTS ON THE MARKET
Physical	Risks arising from unexpected shifts in climate patterns and increased severity of extreme weather events, including longer-term shifts in precipitation and temperature and increased variability in weather patterns.[295]	Risks arising from depletion of natural resources and degraded ecosystem services leading to disruptions to business operations or to demand.[296]	Reduced revenue from decreased production capacity, lower sales, increasing operating costs, increased capital costs, direct damages from climate change or acute natural events, and write-offs of assets situated in high-risk areas.[297]
Transition	Risks associated with the transition to a low-carbon economy. These can arise from policies, regulations, technology changes, market responses, and reputational considerations.[298]	Risks associated with regulations and/ or social norms that constrain or penalize nature-related harm caused by business operations.[299]	Reduced revenue due, e.g., to higher carbon prices, limits on emissions, and bans on certain products or technologies. May also include drastic falls in asset values.[300]

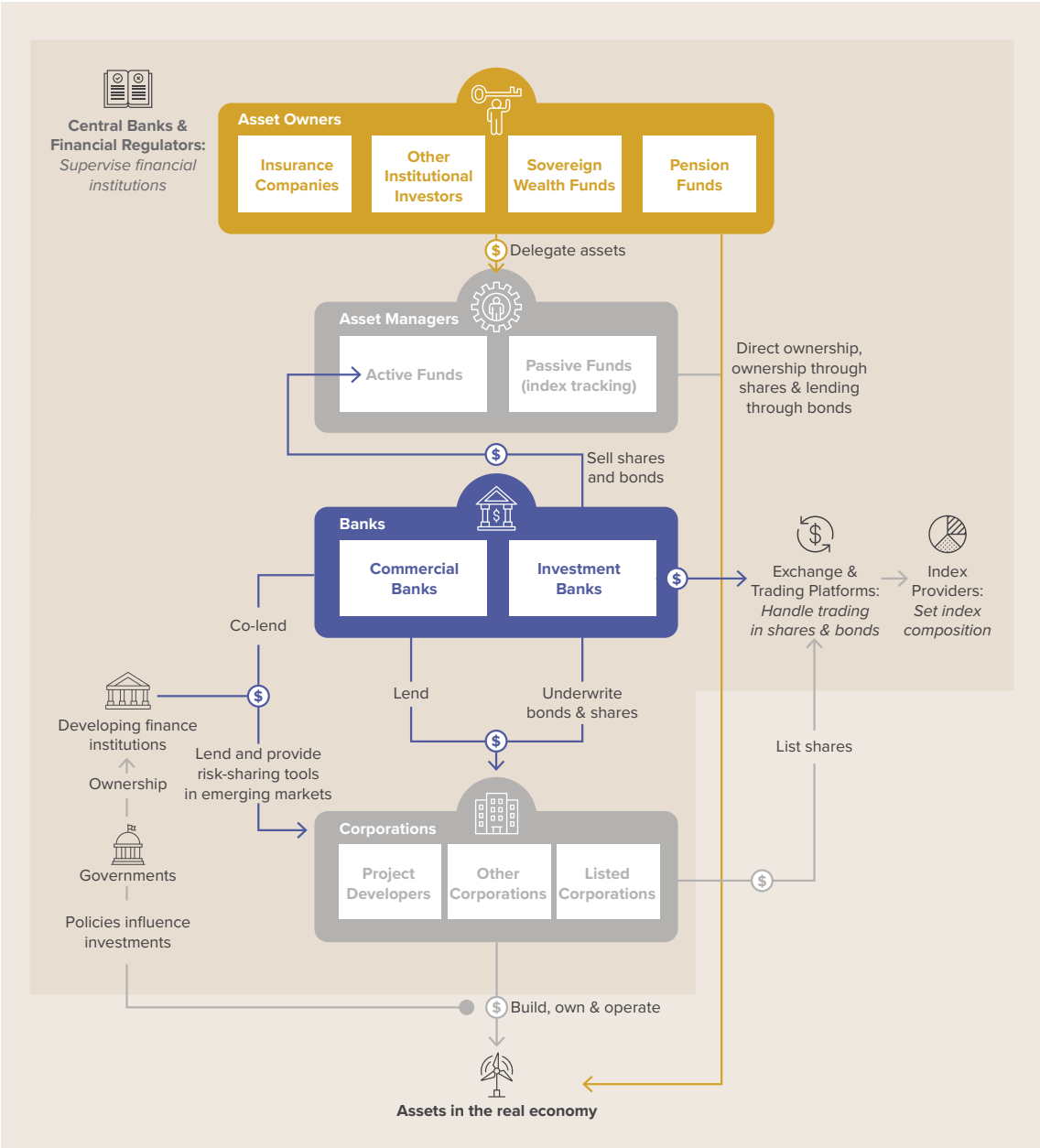
5.2 Where does the money go, and how does it influence GHG emissions?

Financial system actors, including banks, asset managers, institutional investors and publicly listed corporations, are channelling large volumes of finance to the land sector, much of which is driving GHG emissions through financing industrial agriculture and incentivizing tropical forest loss.[301] This finance flows to the land sector through a variety of forms, including investment funds, bank loans, trade finance, revolving credit facilities, stock markets and project finance.[302]

Financial regulations can guide financial system actors in accounting for climate and other environmental factors when providing credit and financial services.[303] Figure 19, below, provides an overview of the various financial actors, financial flows and roles of the various supervisory authorities.

But while regulation has the potential to steer investments towards sustainable land use, this has yet to happen at the necessary pace and scale. Instead, every year billions of dollars are pumped into forest-risk commodities in tropical forest countries via the financial markets with

FIGURE 19. Overview of financial system actors and role of supervisory institutions



Source: reproduced from Mitchell, J., et al. (2020). Deciphering Climate Action Efforts in the Financial Sector. Source: https://rmi.org/insight/breaking-the-code/]

little or no regard for whether this money is driving deforestation. Between 2016–20, around USD 160 billion was invested by financial system actors – mainly banks and fund management firms – in the production of commodities in Southeast Asia, West Africa, and Brazil (all deforestation hotspots).[304] [xvi]

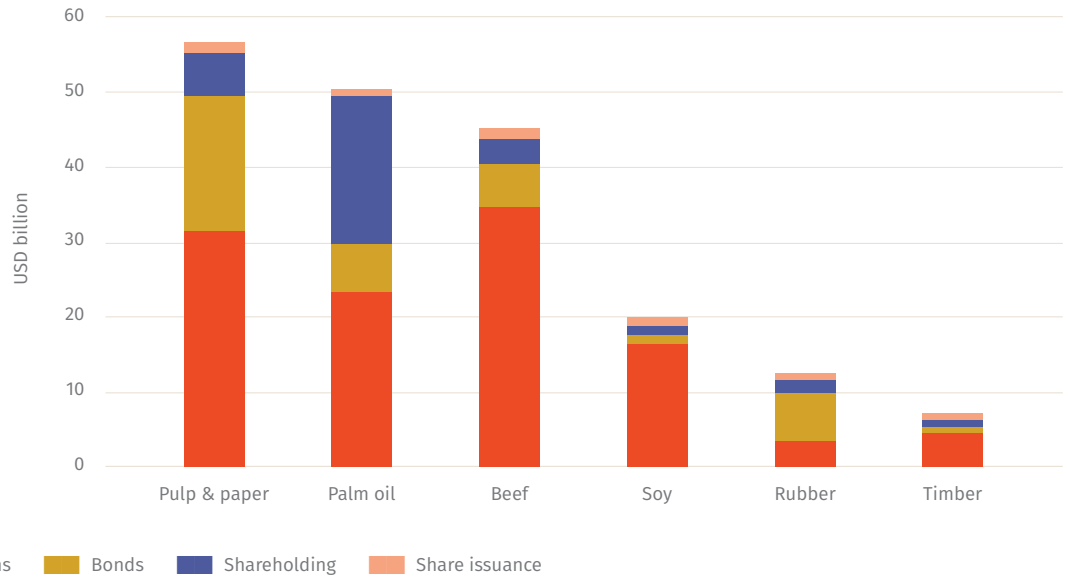
Over 60 percent of this amount (USD 115 billion) was provided by banks through loans to companies producing and trading these commodities.[305] Investment through the acquisition of securities – bonds and shares – accounted for the remaining 40 percent (USD 64 billion) (Figure 20). Investment banks, in particular, play an important role in creating, underwriting and distributing equity and debt securities that may be bought by private investors or traded on public financial markets.[306] For example, in Brazil and Indonesia, banks hold 20-50 percent of the securities in large beef, soy and palm oil companies.[307] Most investment (USD 95.2 billion) went to Brazil, followed by USD 54.2 billion to Southeast Asia and USD 4.5 billion to Central and West Africa. Pulp and paper, palm oil and beef have captured almost 80 percent of these resources (USD 152 billion). These were followed by soy (USD 20 billion), rubber (USD 12 billion) and timber (USD 7 billion) (Figure 19.).[308]

Over the last two decades, an increasing volume of finance has been channelled to the land sector through the financial industry. A growth in the commercialization of financial products associated with agricultural commodities and farmland by banks, agricultural commodity trading firms and investment funds has led to a 'financialization' of the agricultural sector.[310] Through this process, financial system actors have gained greater influence over economic policy and economic outcomes.[311]

Improvements in agricultural investment models and innovations across agricultural value chains, including precision farming and farm robotics, have attracted a wide range of investors who previously did not have a meaningful influence on land use, including pension funds, hedge funds, and high net-worth individuals (Figure 20).[312] As a result, finance and food provisioning are increasingly more intertwined, with agricultural actors becoming progressively more interested in finance and financial players engaging directly in various stages of commodities supply chains.[313]

The continued financialization of agriculture and food-systems directly impacts how land is used around the world and who benefits from it.[314] This process has

FIGURE 20. **Amount of finance delivered through the financial system between 2016-20 per commodity and financial instrument**



Source: Database developed by Profundo for Forest and Finance.[309]

xvi Profundo scrutinized financial services received by over 300 companies that are in some way engaged in the supply chains of beef, soy, palm oil, pulp and paper, rubber and tropical timber – commodities that are significant drivers of deforestation. For more details, see: Warmerdam, W. (2020). Forest & Finance financial research methodology. http://forestsandfinance.org/wp-content/uploads/2020/08/Forests-Finance-financial-research-methodology-01Sep2020.pdf.

intensified competition resulting in the consolidation of a small number of suppliers and buyers in the global agricultural supply chain.[315] For example, the three largest agrochemical companies make up as much as 70 percent of the agrochemical market, whereas the global grain market is similarly dominated by four large companies representing 70 percent of grain production.[316]

But there is still very limited understanding of the direct relationship between finance and the related GHG emissions. The difficulty in determining climate impact lies in reliably and transparently attributing emissions to financial instruments and investors.[xvii] Investors tend to allocate capital using a myriad of financial instruments. Portfolio investments often take place via asset managers whose investment strategies make it especially difficult to map financial flows to specific industries.[317]

Despite difficulties in accurately establishing the link between financial system actors and financed emissions, plenty of evidence exists of the adverse impacts caused by the financial system to climate and nature (Table 5). For instance, in June 2020 the Dutch Central Bank estimated that Dutch financial institutions (including banks, pension funds and insurers) held investments to the tune of EUR 100 billion spread throughout thousands of companies operating in the agriculture, food and textile processing industries.[318] The bank estimates that these investments are likely to have resulted in the loss of 58,000 km^2 of pristine land.[319]

Another study on the role of EU investors in deforestation found that between 2010-15, 40 subsidiaries of 23 large firms involved in the production and trading of agricultural products – all of which had been directly or indirectly linked to land grabbing and illegal deforestation by non-governmental or advocacy groups – received USD 50 billion in loans and over USD 20 billion through share/bond issuances.[320]

In 2020, Planet Tracker assessed equity holdings from the 20 largest Exchange Traded Funds (ETFs) – funds listed on stock exchanges that invest in a collection of shares and financial securities – and concluded that these ETFs and their investors indirectly enabled forest loss by investing in 26 publicly listed companies linked to deforestation.[321]

These 26 companies are engaged in the production, manufacturing and trading of soy and have a combined market capitalization of USD 266 billion.[322]

In fact, the world's top passive asset managers currently hold a significant volume of shares in beef, soy, timber, and pulp and paper firms in the most critical biomes for climate stability and, therefore, can exert significant influence on corporate management practices.[xviii] And while large asset managers have made various public commitments on scaling up their climate actions, so far there is little evidence that they are actually leveraging their financial power to deliver on these commitments.[323]

xvii Whilst the GHG emissions produced by the operation of banks, asset owners and asset managers (the so-called scope 1 and 2 emissions) can be assumed to be low, their 'financed emissions' – i.e., those generated by the companies and projects that are part of the investment portfolios – are expected to be substantial. See *The Economist.* Counting the carbs – More financial firms are setting climate targets. 12 December 2020

xviii According to Galaz et. al., the 'Big Three' – Vanguard, BlackRock, and State Street – hold stocks above the 10% ownership threshold considered to indicate considerable voice in corporate governance in 25% of the companies operating in the Amazon biome, 12,5% in companies operating in the Canada's boreal forests, and of 60% in companies operating in Russia's Boreal Forests. See also Vitali, S., Glattfelder, J. B., & Battiston, S. (2011). The Network of Global Corporate Control. *PLOS ONE, 6*(10), e25995. https://doi.org/10.1371/journal.pone.0025995; Fichtner, J., Heemskerk, E. M., & Garcia-Bernardo, J. (2017). Hidden power of the Big Three? Passive index funds, re-concentration of corporate ownership, and new financial risk†. *Business and Politics,* 19(2), 298–326. https://doi.org/10.1017/bap.2017.6.

5.3 Green redesign recommendations to shift private sector capital

Negative externalities associated with climate change are not being adequately priced, resulting in the blatant under-provision of GHG mitigation by markets. Government intervention can course-correct existing private financial flows and address these market failures.[324] Governments can induce a structural shift in private capital allocation by adapting existing financial regulations. A combination of climate-related prudential requirements and active promotion of sustainable finance can promote new and more climate-friendly agricultural practices and ensure that financial system actors involved in agricultural supply chains have an interest (and duty) to mitigate the adverse impacts of their businesses and redirect financial flows at scale.

While the primary role of financial regulations and supervisory authorities is to maintain the stability of the financial system, there is also legal space for financial rules to foster low-carbon investments. This second goal, although less prominently emphasized, is increasingly being recognised by supervisory authorities (Box 10).

BOX 10. DOUBLE MATERIALITY IN FINANCIAL REGULATIONS

Financial regulations that deal with climate- and nature-related risks are often characterized by a double directionality. A first and more commonly declared objective of these instruments is to secure financial stability by reducing the exposure of financial institutions to (material) physical and transition risks that can affect the performance of companies and investment portfolios. This financial materiality entails better disclosure and management of climate-related risks, helping financial institutions to avoid excessive risk-taking and safeguarding the stability of the financial system.

Another, and less frequently stressed, aspect of these climate-related financial regulations is their ability to change business-as-usual financial practices and shift capital flows towards sustainable investments. Harmonized and better risk disclosure, as well as enhanced management frameworks, contribute to this shift by increasing transparency and helping asset prices reflect all relevant information. This, in turn, both allows and puts pressure on investors and corporations to take more informed decisions and to green their balance sheets.[325] In the context of disclosure requirements for corporates, this is often translated into the need to report how climate risks affect the company's operation, in addition to how the company's activities affect the climate and the environment (referred to as 'double materiality').

Other types of financial regulations can have an even greater impact in redirecting capital. These include taxonomies to guide investors in their investment choices (and prevent greenwashing), green credit allocation, and differentiated capital reserve requirements providing an advantage to green investments. However, the extent to which supervisory authorities such as central banks can more actively promote greening of the financial system through e.g., credit allocation and purchase of green assets is still heavily debated.[326]

In recent years, the EU has begun exploring the possibility of leveraging the influence of financial regulations to further promote low-carbon investments. In a speech given in February 2020, Christine Lagarde, President of the European Central Bank, emphasized that 'central banks need to devote greater attention to understanding the impact of climate change'. She observed that in addition to financial risks caused by the disregard of and delayed response to climate change, there are real and material risks related to the deficient provision of sustainable finance.[327]

Similarly, in a climate-stress test exercise in May 2020, the French Prudential Supervision and Resolution Authority (ACPR) explicitly recognised its twofold mission: to foster an enabling finance environment to transition to a low-carbon economy; and to protect financial institutions against climate risks.[328] More recently, the Bank of England monetary policy mandate was updated to include supporting the transition to a net-zero economy.[329]

In the following section, we present three green redesign recommendations that may be taken by governments and/or supervisory authorities to green their financial systems (Table 8). The first two redesign approaches fall largely under risk-based prudential frameworks that aim first and foremost to protect the financial system. Less directly, these approaches also foster climate-aligned finance by addressing issues such as lack of transparency, mispricing of financial assets and misallocation of capital. The country examples under these two approaches come mostly from developed countries, which tend to adopt an industry-driven approach and focus largely on impacts that climate change may have on the financial system.[330]

The third approach, in turn, moves towards regulatory measures that can be taken by countries and supervisory authorities to more actively promote sustainable (climate-aligned) finance. Examples of these measures come mostly from developing countries, several of which have tended to focus on how the financial system can reduce its impact on the climate. Notably, countries such as Bangladesh, Brazil, China, Colombia, Indonesia, Nigeria and Vietnam have already introduced regulations that encourage green investments and enable a faster transition to a low-carbon economy.[331]

The green redesign options articulated below are complementary and to a large extent connected. While certain aspects of these strategies can be implemented simultaneously, binding disclosure requirements along with a common taxonomy that clearly specifies green and climate-consistent enterprises are usually deemed a necessary first step to more informed investment decision-making and the promotion of sustainable investments.

5.3.1 Move from voluntary to mandatory disclosure

The case for change

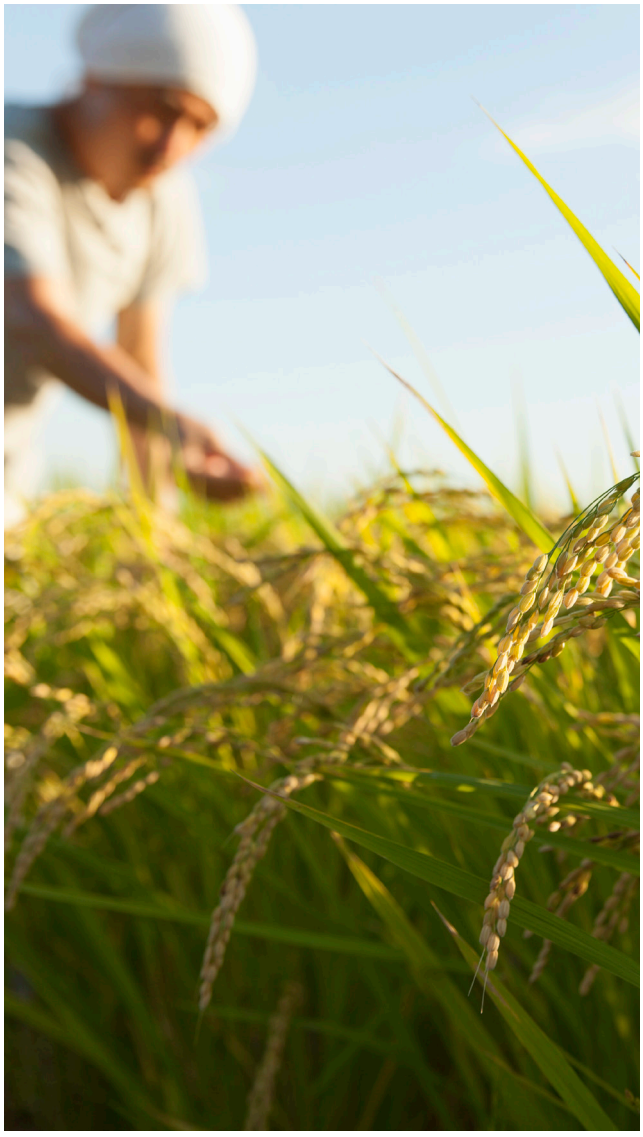
Mandatory disclosure on climate and forests is an essential first step to redirect financial flows to sustainable land investments and the protection of natural capital. Disclosure informs investors of the actual impact of their investments, shining a light on current practices and opening investors and investments to public scrutiny. It also exerts pressure on downstream companies, which face the risk of divestment.

A number of organizations have already established voluntary disclosure frameworks and guidelines for both investors and corporations in response to pressure by the international community, civil society and investors themselves for adequate and consistent information on GHG emissions and climate-related risks. A dozen such initiatives, focusing on different aspects of sustainability and climate reporting, currently exist (Box 11).[332]

However, voluntary frameworks vary considerably in their disclosure requirements, and climate disclosure remains inconsistent and fragmented. Firstly, so far only a handful of countries have established a legal obligation to disclose and manage climate-related risks. Secondly, different methodologies are emerging for reporting financed emissions, which may be leading to more confusion rather than promoting widespread participation.[333] And thirdly, assessing and reporting climate-related risks from investments would require investors to gain access to consistent and comparable data from the corporations in which they invest.

Only a few asset managers and investment banks have so far disclosed their financed emissions.[334] Disclosure is particularly problematic for scope 3 emissions (i.e., those that occur in the value chain, including both upstream and downstream emissions), which comprise the overwhelming majority of GHG emissions from financiers.[335] Also, reporting by investors tends to centre largely on fossil fuel emissions, but lags behind when it comes to mapping and assessing deforestation as a climate (and also a nature-related) risk. Investment in agricultural companies in particular face a number of (often ignored) risks associated with deforestation such as reduced market access, long-term profitability and reputational risks.[336]

Similarly, engagement by corporations in voluntary disclosure, as well as the quality of their reporting, remains insufficient, particularly in the land sector.[337] A large number of agriculture and food companies still have a selective approach to disclosure due to the voluntary nature of the initiatives.[338] For instance, Ernst & Young found that in 2019 the agriculture, food and forest products sector scored the lowest both for coverage and quality of climate-related disclosures of all non-financial sectors.[339] In December 2020, a baseline assessment by the World Benchmark Alliance of the world's 350 most influential agriculture and food companies also showed that half of these do not report on progress to reduce GHG emissions, and only one-quarter actually consider scope 3 emissions.[340]



BOX 11. VOLUNTARY DISCLOSURE INITIATIVES AND LACK OF STANDARDIZATION

Voluntary disclosure initiatives have been around for decades and their scope has evolved over time. Many have moved from disclosure of general sustainability issues to a primary focus on disclosure of more specific climate-related risks (e.g., GHG emissions, water scarcity, deforestation). The first voluntary initiatives for companies, the GHG Protocol and the Global Reporting Initiative (GRI), were established already in the 1990s and early 2000s.[xix] These early guidelines focused on facilitating corporate reporting on environmental issues in general and contributing to capacity-building efforts in this area.[341] The number of voluntary initiatives has grown substantially since then, and many other organizations have joined the effort to incentivize the disclosure of corporate climate-related risks. Examples include the CDP (formerly the Carbon Disclosure Project), the Climate Disclosure Standards Board (CDSB), the Sustainability Accounting Standards Board (SASB), and the International Integrated Reporting Council (IIRC).

More recently, other voluntary initiatives have surfaced with a focus on bringing transparency for financed emissions and portfolio alignment by investors, such as asset managers and investment banks.[342] These initiatives offer different methodologies and tend to focus on different aspects. For instance, the Partnership for Carbon Accounting Financials (PCAF) provides a methodology for assessing the carbon footprint of lending portfolios.[343] In turn, the 2 Degrees Investing Initiative assesses whether investment portfolios align with a transition path to low-carbon development. As such, it goes beyond measuring GHG impacts and includes the setting of targets, the reorienting of flows, and the tracking of progress towards financing a low-carbon transition.[344] Notably, the lack of standardization among initiatives, with each focusing on slightly different aspects and offering different disclosure guidelines, tends to hinder comparability and the usefulness of information.[345]

Under the Task Force on Climate-related Financial Disclosures (TCFD), one of the most prominent disclosure frameworks so far, actual disclosure of climate-related financial information increased only by a modest 6 percent from 2017–19.[346] As a whole, only a minority of the disclosure from financial institutions are in line with the recommendations by the TCFD.[347]

There are also few disclosure initiatives for investors that adequately address nature-related risks, including forests, soil and biodiversity.[348] For instance, the TCFD is centred on climate-related risks more broadly and does not directly address deforestation-related risks. For agriculture, TCFD uses metrics related to emissions, internal carbon prices and water usage, but land cover, land-use change and land practices are currently underrepresented.[349]

Thus, in the absence of convincing results from voluntary initiatives, more comprehensive regulatory action from governments on climate and nature-related disclosure is required to reorient private capital allocation.[350]

So far, only a handful of countries have established a legal obligation to disclose and manage climate-related risks. Well-designed disclosure obligations can avoid a patchwork of rules and more quickly increase reporting and disclosure levels, while at the same time providing leverage on existing voluntary initiatives to enhance the completeness, alignment, consistency and quality of disclosures.[351]

This is echoed by a number of relevant financial forums and actors. For instance, the 2019 Global Risk Report by the World Economic Forum stressed that governments have a clear role in enhancing and accelerating climate action from businesses through regulations that mandate the disclosure of climate-related risks.[352] Similarly, the 2020 report to policymakers by the Global Investors for Sustainable Development Alliance emphasized the importance of mandating reporting of material sustainability factors for both financial and non-financial institutions.[xx]

xix The intergovernmental group of experts has been addressing issues of environmental reporting since the United Nations Conference on Environment and Development (the Earth Summit) was held in 1992.

xx The study also highlighted that harmonized mandatory disclosure would bring about multiple benefits across the whole investment chain. See Global Investors for Sustainable Development Alliance. (2020). Renewed, Recharged and Reinforced. Urgent actions to harmonize and scale sustainable finance (Issue July).

Some financial authorities are also beginning to voice stronger support for regulatory action. The Governor of the Bank of France noted that the absence of a common regulatory framework (or at least comparable frameworks) is a major loophole in the implementation of climate-risk disclosure and reporting.[xxi] Likewise, the European Central Bank (ECB) Director General in June 2020 stated that 'the window for a wait-and-see approach is swiftly closing, because the longer we wait the harder it will be to mitigate these [climate] risks'.[353]

How it can be done

A structural shift in business-as-usual private investments requires comprehensive regulatory action on climate- and forest-related information disclosure by corporations and financial institutions. Regulations should build on but go beyond existing voluntary reporting frameworks. While industry-led initiatives serve an important function of preparing the ground for private sector action on transparency, it is unlikely that self-regulation alone will achieve robust progress on disclosure at the pace and scale necessary for a transformative shift.

Governments can introduce mandatory disclosure by adapting their existing legal frameworks without completely overloading their current systems.[354] In 2019, CDP and the CDSB provided a roadmap with alternatives for G7 countries to take action and embed the TCFD recommendations into national legislation. According to this analysis, most countries would not need new regulatory requirements, but merely clarifications to current requirements accompanied by guidance for supervising and enforcing existing rules.[355]

Careful evaluation and ample consultations with stakeholders are still required to ensure disclosure obligations are sufficiently flexible and avoid imposing excessive burden on companies. At the same time, such flexibility cannot come at the expense of the need for quality, consistency and breadth of key information.[356] In addition to GHG emissions broken down by scope, governments should demand disclosure of risks related to the loss of forests and biodiversity.

xxi According to a statement of the Governor of the Bank of France, on October 29 2020, regulations need to become more specific and prescriptive towards climate-related reporting. He also highlights the need of harmonized and relatively granular reporting standards. See François Villeroy de Galhau. (2020). *Paris 2020 Climate Finance Day.* https://www.bis.org/review/r201030b.htm.

BOX 12. EXAMPLES OF COUNTRY REGULATIONS AND GUIDELINES ADOPTING THE TCFD FRAMEWORK

The UK was among the first countries worldwide to endorse the recommendations of the TCFD in 2017. In November 2020 the UK has announced its intention to make the disclosure of climate-related risks (aligned with the TCFD) mandatory by 2025 across seven key sectors of the economy, including: listed commercial companies; UK-registered companies, banks and building societies; insurance companies; asset managers; life insurers and Financial Conduct Authority (FCA)-regulated pension schemes; and occupational pension schemes.[359] The FCA also requires premium-listed companies to make better climate-related disclosures – consistent with the TCFD recommendations – from 1 January 2021.[360] The decision to make disclosure of climate-related risks mandatory was made after the UK recognised the inability of voluntary approaches to disclosure to deal with the urgency of the climate crisis.[361]

New Zealand has also made climate-related financial disclosures mandatory for a number of organizations in the context of its Zero Carbon Amendment Act, developed in line with the TCFD.[362] The goals are to promote greater transparency, provide more accurate pricing signals in the market and incentivize low-emissions investment[363] Around 200 entities will fall under the scope of the disclosure obligations, including all registered banks, credit unions, asset managers and insurers above certain values in assets managed, and all listed equity and debt issuers.[364] The introduction of such mandatory disclosures has been agreed by the Cabinet, and will be required from 2023 if Parliament approves.[365]

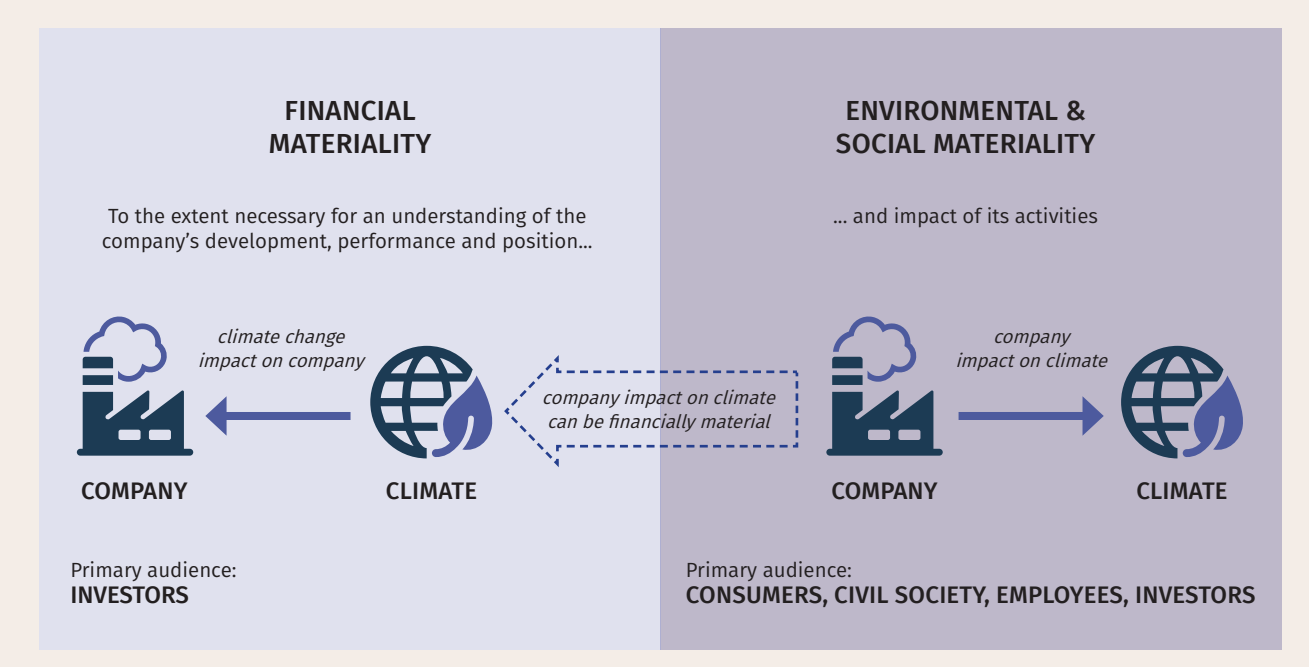
In Singapore, the Monetary Authority of Singapore (MAS) issued the *Guidelines on Environmental Risk Management* for three sectors: asset management, banking and insurance. Released in December 2020, the Guidelines include the disclosure of physical, transition and reputational risks in a broad range of issues beyond climate change, including biodiversity loss, pollution and land use change. Although the MAS guidelines do not include a mandatory framework to disclose climate-related risks, they explicitly advise companies to adopt the recommendations by the TCFD.[366]

As this paper is being written, other countries are announcing their intention to make disclosure mandatory. For instance, in Japan, the government-backed Council of Experts concerning Japan's Stewardship Code and Japan's Corporate Governance Code asked the Financial Services Agency (FSA) and the Tokyo Stock Exchange (TSE) to consider their revisions to the country's corporate governance code. The recommendations from the Council include the enhancement of both the quality and quantity of climate-related disclosure based on the work of TCFD or equivalent international frameworks at Prime Market listed companies.[367]

As far as possible, disclosure regulations for corporations and investors also need to be harmonized,[357] with a critical mass of countries adopting a robust and widely accepted set of definitions, types of climate-related risks, methodologies and reporting approaches. A step in this direction seems to be the recognition by forerunners of mandatory disclosure (i.e., Australia, EU, France, New Zealand, Singapore and the UK) of the importance of the TCFD and alignment of emerging regulations with its recommendations (Box 12).[358]

A key differential in the scope of climate-related disclosures (and sustainability factors more broadly) is whether disclosure rules adequately address double materiality (Figure 21). As of yet, disclosure frameworks have mostly focused on the first aspect, that is, the risks that climate change poses to overall financial stability, relegating the impacts of investments on land and natural capital to a second-tier consideration.[368]

FIGURE 21. **Double materiality in financial disclosure**



Source: reproduced from European Commission (2019). Guidelines on reporting climate-related information. Accessible here: https://ec.europa.eu/finance/docs/policy/190618-climate-related-information-reporting-guidelines_en.pdf

The scope of reporting metrics covered should also be expanded and tailored to fully consider nature-related risks and impacts, including on rate of land-use change, biodiversity and habitat loss, and soil. The Task Force on Nature-related Financial Disclosure is developing a framework to categorize these nature-related risks and can offer a template for supervisory authorities to build on. The framework is heavily based on the TCFD; it also incorporates considerations from other existing frameworks developed by De Nederlandsche Bank and World Economic Forum and identifies physical, transitional and systemic nature-related risks.[369]

Another important aspect refers to whether government regulation adopts a 'comply-or-explain' approach or imposes compulsory disclosure in all instances. Although weaker, a comply-or-explain approach allows corporates to more gradually adapt their internal policies and reporting to include climate-related risks. This is, for instance, the approach adopted by France, New Zealand, Singapore and the UK. It is crucial, however, that this approach be designed so as to avoid creating excessive margin of choice for companies in their application, and that it is accompanied by proper verification mechanisms.[370] Comply-or-explain approaches must not lead to corporates simply opting to omit relevant information.

An undoubtedly more robust regulatory approach would be compulsory (line-item) disclosure. This approach is preferred, as it clearly promotes enhanced disclosure by companies and investors from the get-go. According to CDSB, compulsory disclosure enables immediate and complete transparency that is commensurate to the magnitude of the risks posed by climate change. In order to ensure a degree of flexibility and allow for further capacity development, disclosure could operate on a comply-or-explain basis in the first year of reporting, after which corporations and investors would need to fully report and disclose climate-related risks.[371]

Positive country example

Mandatory disclosure and reporting would be beneficial for all sectors, but they are of particularly acute importance for the land sector. The level of disclosure in all TCFD disclosure categories for companies in the agriculture, food and forest products sector was only 25 percent.[372] TCFD consumer goods companies have had lowest average disclosure rate (18 percent). This contrasts with 30 percent disclosure for materials and building companies and 40 percent for energy companies.[373]

Perhaps the most comprehensive set of rules addressing the mispricing of financial assets and the lack of transparency on climate-related risks comes from the EU

proposal encapsulated in the 'Commission action plan on financing sustainable growth' communicated in March 2018.[374] The Action Plan aims to reorient capital flows toward sustainable investments, to manage financial risk stemming from climate change, and to foster transparency and long-termism in financial economic activity.[375]

One of the key components of the Action Plan is the EU Regulation for Sustainability-related Disclosure (also referred as the Sustainable Finance Disclosure Regulation – SFDR), which introduces disclosure requirements for financial market actors, including asset managers and financial advisors. The main objectives are to prevent greenwashing and ensure comparability among disclosures by providing more transparency in how financial actors include sustainability risks and opportunities in their investment decisions.[xxii] In practice, financial actors will be required to classify their investment funds into three categories in line with their sustainability level (grey, light green and dark green) and to adjust their reporting accordingly.[xxiii] [376]

The SFDR represents a major milestone in disclosure frameworks in that it requires financial institutions to take into account the impacts of their investment portfolios to both society and the environment (i.e. double materiality concept).[377] In this context, the European Supervisory Authorities[xxiv] published, in April 2020, a Joint Consultation Paper setting out the Regulatory Technical Standards for financial market participants and financial advisers (FMPs) to inform end investors on how to consider ESG factors in their investment decisions.[378] FMPs must include relevant information in their principal adverse impact statements, declaring the effects of their investments on climate and the environment, as well as on social and labor matters.[379]

When adverse impacts are identified, the FMPs must also describe and measure the principal adverse impacts using a common set of indicators.[380] For the climate and environment-related indicators, five categories are covered: emissions; energy performance; biodiversity; water; and waste. Particularly relevant for the land sector are the indicators and metrics related to biodiversity, which are further divided as per Figure 22.[381]

Furthermore, the reporting on principal adverse statement must include information about how the FMP identifies and prioritizes principal adverse impacts and how it engages with investee companies on these issues; the extent to which it complies with responsible business frameworks and globally recognised standards for due diligence; and how adverse impacts will be dealt with for the next reference period.[382] [xxv] The disclosure of this information is mandatory for all large FMPs (i.e., with more than 500 employees). Smaller ones, in turn, are required to disclose on a comply or explain basis.[383]

Whereas the SFDR focuses on reporting by financial institutions, the review of the existing Non-Financial Reporting Directive (NFRD) further elaborates on requirements for 'large public interest companies' to report non-financial information relating to a wide range of ESG aspects.[384] The NFRD is closely tied with financial regulations as it creates duties for large publicly traded corporations (i.e., with more than 500 employees) to report material ESG information that will be used by equity and debt investors.[385] Importantly, the NFRD also adopts a double materiality perspective. The NFRD is currently being reviewed by the EU Commission to ensure that the data disclosed by companies is harmonized, to the extent possible, with the data required by investment firms' SFDR reporting.

xxii Some projects labelled as 'green' have been financed without clear evidence of environmental benefit, and capital raised for 'green' purposes has sometimes been used to finance or refinance the issuer's traditional activities.

xxiii The three classifications for investments are: (1) Article 9, or dark green, which applies to products that have explicit sustainable objectives; (2) Article 8, or light green, which covers financial products that promote environmental or social characteristics as part of the broad investment strategy; and (3) Article 6, or grey, which applies to products that either consider ESG risks as part of the investment process or are explicitly declared as non-sustainable.

xxiv Includes the European Banking Authority (EBA), the European Securities and Markets Authority (ESMA), and the European Insurance and Occupational Pensions Authority (EIOPA).

xxv The document states that it is the responsibility of the FMP to obtain the information regarding the principal adverse impacts of their investees. The document lists various means of information that the FMP can use to obtain this data including external market research providers, internal financial analysts and specialists in the area of sustainable investments, undertaking specifically commissioned studies, using publicly available information or shared information from peer networks or collaborative initiatives, or directly engaging with the management of investee companies to better understand the risk of adverse impacts on sustainability factors. See Joint Committee of the European Supervisory Authorities. (2020). *Joint Consultation Paper: ESG Disclosures*. https://www.esma.europa.eu/sites/default/files/jc_2020_16_-_joint_consultation_paper_on_esg_disclosures.pdf. for more information.

FIGURE 22. Biodiversity indicators for financial market participants and financial advisers under the EU's Sustainable Finance Disclosure Regulation

Source: adapted from the Joint Committee of the European Supervisory Authorities (2020)

The public consultation process for the NFRD amendment closed on June 2020, and its adoption by the Commission is expected to take place during the first quarter of 2021. Several of the new disclosure obligations are applicable as of 10 March 2021, and a consultation process has been carried out with the three European Supervisory Authorities (European Banking Authority, European Insurance and Occupational Pensions Authority, and European Securities and Markets Authority), providing advice regarding the content, methodology and presentation of these disclosures at both entity and product level.[386]

5.3.2 Enhance risk management frameworks for the land sector

The case for change

A risk management framework refers to the governance arrangements financial system actors have in place to understand, manage and report the risks to which they are exposed. Effectively integrating climate-related risks into risk management frameworks require financial actors to have a clear governance process and risk management cycle to identify, assess, mitigate and monitor these types of risks.[387] A robust risk management framework can enable the quantification of financial system actors' real exposure, mitigate or prevent climate risks from materializing, and help reorient their business strategies. It can also assist institutions to meet the disclosure requirements discussed in Section 5.3.1 above.[388]

Internal risk management by financial system actors is improving gradually through voluntary initiatives and international non-binding recommendations on responsible business conduct. But more comprehensive solutions that set institutionalized risks management controls – including via scenario analysis and climate stress testing for banks and compulsory risk-based due diligence for corporations – are lacking.

Approaches taken by banks to manage climate-related financial risks are still at an early stage and vary considerably across jurisdictions and between banks.[389] Overall, only a small number of banks have fully incorporated climate risks into their internal risk management framework. Also, few jurisdictions and central banks currently perform climate-related scenario analyses and stress tests or have in place supervisory guidance requesting local banks do so as part of their internal risk management process.[390]

In general, the financial sector shows relatively little expertise in managing and integrating natural capital impacts and overall agricultural sustainability into their credit risk assessments. For instance, a survey of 26 financial research providers found that only nine had any methodological

expertise in evaluating agricultural-related natural capital risks, including GHG emissions, loss of biodiversity, soil quality, water scarcity, energy use and waste.[391]

In fact, few financial institutions have adopted internal policies to combat and prevent deforestation, the largest climate-related risk stemming from commodity supply chains. According to Forest 500, by September 2019, 235 investors managing over USD 16 trillion in assets had signed a statement committing to remove deforestation from their supply chains in the Amazon. But by July 2020 a mere 33 of these investors had actually published a policy to curb forest loss linked their investments.[392]

Similarly, from a company law and duty-of-care perspective, mandatory due diligence requirements addressing deforestation are largely absent. Whilst a number of countries have already imposed compulsory due diligence covering aspects related to human rights and broader environmental issues for non-soft commodities such as timber and mineral products, due diligence requirements for commodities that pose a risk to deforestation remains a major gap for the majority of countries.[393]

Most of the existing initiatives on improved and more comprehensive due diligence are either voluntary, sector-specific or limited to reporting obligations only.[394] Although some national guidance on environmental supply chain due diligence exists, these are largely non-binding and few countries require institutions to actually implement them.[395] As a result, integration by corporations of deforestation risks into their internal risk management systems remains poor.[396]

A 2020 EU level assessment found that only about one-third of businesses undertake due diligence accounting for their impacts on the environment (and human rights).[397] For businesses that do carry out due diligence, only a minor fraction considers the risks and impacts beyond first-tier suppliers.[398] This is despite the fact that the climate and social benefits of mandatory risk-based due diligence are expected to far outweigh the transaction costs for companies. Implementation costs for supply chain due diligence are also expected to be relatively low when compared to company revenues.[399] A recent study by the European Parliamentary Research Service found that mandatory due diligence to halt and reverse global deforestation may reduce global deforestation by about 62 percent.[400]

Notably, where initiatives do solicit information on corporate governance aspects and risk management, implementation levels are rather low, in particular for the land sector. Under the TCFD, implementation of measures related to governance, business strategy and risk management for the agriculture, food and forest sector is the lowest among all sectors, at an average disclosure of 25 percent across the 147 companies investigated during the period 2017-19 (Table 6).[401]

TABLE 6. Percentage of TCFD-aligned disclosures by firms assessed in the agriculture, food and forestry industries

CATEGORY	RECOMMENDED DISCLOSURE	2017	2018	2019
Governance	Board oversight	11%	13%	20%
	Management's role	18%	14%	21%
Strategy	Risks and opportunities	48%	49%	41%
	Impact on organization	31%	31%	35%
	Resilience of strategy	1%	1%	1%
Risk management	Risk ID and assessment	7%	12%	21%
	Risk management processes	17%	17%	26%
	Integration in risk management	4%	7%	14%
Metrics and targets	Climate-related metrics	35%	37%	35%
	Scope 1, 2, 3 GHG emissions	25%	25%	28%
	Climate-related targets	32%	33%	38%

Source: Adapted from TCFD's 2020 Status Report.[402]

How it can be done

Enhancing risk management frameworks for the land sector is likely to require countries to regulate on two connected regulatory areas: (i) incorporating scenario analysis and climate stress tests into supervisory approaches (under the purview of central banks and other relevant supervisory authorities); and (ii) prescribing enhanced due diligence by corporations to address deforestation risks (falling under the remit of company law and duty of care).

One of the main objectives of climate-stress tests is to inform financial system actors about the specific risks that climate change poses for bank loans and asset values.[403] This is valuable information for financial institutions, allowing them to better understand future impacts on their business models, as well as for financial regulators, who can take informed actions in line with the outcomes of the analyses. Traditional stress-testing has been applied by central banks for several years, especially after the 2008 financial crisis, to test the system's resilience against economic shocks.[404]

However, the nature of climate change risks adds layers of difficulty, including deep uncertainty about future impacts, non-linearity, and long-term horizon of impacts.[405] Further, as the realization of the climate scenarios is dependent on whether (and which) mitigation policy actions are taken, the selection of adequate climate-scenarios is essential to properly inform risk-management strategies.[406]

In addressing those issues, a handful of central banks are taking a particularly prominent role. In the UK, for instance, the Prudential Regulation Authority (PRA) released a supervisory statement in 2019 expecting banks and insurers to offer evidence of how they manage and monitor climate-related risks, taking into account the results of scenario analysis and stress tests.[407] Also, the Bank of England (BoE) has announced plans to include climate-stress tests as part of the 2021 Biennial Exploratory Scenario (the Climate BES).[408] The BoE's outlined framework for annual climate stress test exercises builds on the climate scenarios from the Network of Central Banks and Supervisors for Greening the Financial System (NGFS), and assesses risks in three different policy scenarios.[409]

While scenario analysis and climate stress tests can help identify and manage risks at the financial sector and bank portfolio level, an enhanced due diligence tailored to address deforestation risks can be used at the individual loan and transaction level for those counterparties operating with soft commodities. Enhanced (and compulsory) due diligence for deforestation risk commodities can prevent or mitigate adverse impacts eventually caused by large companies and investors to forests and local communities. It not only provides stakeholders a formal avenue to monitor and pressure investors and companies in their duty to identify and address these types of supply chain risks, but it also offers a clear legal basis and remedy for affected parties to act upon.

In terms of scope and reach, due diligence requirements can be differentiated by whether they address only illegal deforestation linked to supply chains or extend beyond the legality of sourcing commodities (thus also covering legal deforestation). The UK might soon become an example of the first approach. The country is currently considering an adjustment to its Environmental Bill in order to introduce a due diligence requirement that is grounded in the forest laws of the country where the relevant commodities are produced.[410]

The EU, in turn, may offer an example of the second approach. The EU is now considering proposing and adopting a due diligence law to stop import of deforestation-linked products that cover both illegal and legal deforestation. A legislative initiative by the European Parliament calls on the Commission to propose mandatory requirements for due diligence for companies placing forest-risk commodities on the EU market. In turn, the Commission has announced its intention to communicate such a legislative proposal in the second quarter of 2021.[411]

Indeed, both illegal and legal deforestation must be addressed if international climate and deforestation-related goals have any chance of succeeding. However, tackling legal deforestation is clearly more contentious and likely to raise many more implementation issues, including from a trade law perspective. Unilateral (demand-side) initiatives will inevitably create considerable barriers for deforestation-risk commodities trying to access a particular foreign market and, as such, careful regulatory design is needed to avoid an unjustified breach of WTO laws.

There is already some experience from which countries can draw upon to design environmental measures that align with the WTO.[412] Among other factors, the legitimacy of an import restriction on forest-risk commodities based on an obligation to undertake due diligence rests on whether the measure is designed to account for the conditions prevailing in tropical countries and

makes a genuine effort to accommodate those countries' concerns. Good faith negotiations with tropical countries are required, along with robust evidence showing that alternative and less detrimental regulatory options have failed to deter deforestation.[413] In addition, the definition of key concepts such as 'deforestation,' 'high-biodiversity value,' and 'high-risk commodities' used by the measure must be objective and fully based on scientific evidence.[414]

Some existing EU initiatives can be useful to inform the design of risk identification controls that address the negative impacts of businesses on the environment and forests, such as the EU Forest Law Enforcement, Governance and Trade Action Plan (EU FLEGT) and the Renewable Energy Directive (Box 13). Whereas the FLEGT provides a good example of a legality-verification system for harvested timber entering the EU market, the EU Renewable Energy Directive setting out sustainability criteria for biofuels may offer lessons on how to objectively define and establish key concepts; these include, for instance, the use of retroactive dates to determine deforestation and the definition of 'high biodiversity value.'[415]

BOX 13. THE EU FLEGT AND THE RENEWABLE ENERGY DIRECTIVE

The main overarching framework policy to fight illegal logging[xxvi] and associated trade by the EU is the EU Forest Law Enforcement, Governance and Trade Action Plan. The FLEGT Action Plan integrates trade and policy efforts to tackle illegal logging, addressing both the supply side and demand side. The two core elements of the EU FLEGT Action Plan are the EU Timber Regulation (EUTR) and the Voluntary Partnership Agreements (VPAs) between the EU and timber-producing countries.

The FLEGT Action Plan has been in place since 2003, and the European Commission, EU Member States and timber producing partner countries all play important roles in its implementation. The FLEGT Action Plan links supply- and demand- side measures, thereby requiring close co-operation between EU actors and governments in the timber producing countries. The EUTR (i) prohibits placing illegal timber on the EU market, (ii) places a due diligence obligation on operators who place timber into the European market,[xxvii] and (iii) requires timber (product) traders to keep records of their suppliers and customers after the timber has been imported. The EUTR determines the legality of timber based on the laws of the country where the timber is produced and harvested.

Positive country examples

A few central banks have initiated climate stress tests and similar exercises to probe the resilience of their banking system. In addition to the Bank of England, climate stress tests introduced in the Netherlands and Australia provide particularly useful insights for the land sector.

De Nederlandsche Bank (DNB) – the central bank of the Netherlands – developed a framework for measuring financial stress under disruptive energy transition scenarios. The methodology applied disaggregated EUR 2.3 trillion in assets held by over 80 Dutch financial institutions in 56 different industries. The stress test showed that financial portfolio values can decline by up to 11 percent, confirming that climate change can have important disruptive consequences for Dutch financial institutions.[416]

Also, a recent study by DNB investigated the impacts of biodiversity loss in financial institutions by assessing both physical and transitional risks. The study found that 36 percent of the portfolios examined (EUR 510 billion out of a total EUR 1,400 billion) were highly or very highly dependent on one or more ecosystem services and exposed to substantial financial losses and disruption of economic activity. For instance, the exposure of financial institutions to pollination-dependent activities, mainly agriculture and food processing, rises to a staggering EUR 28 billion.[417]

In a letter to all regulated entities, the Australian Prudential Regulation Authority (APRA) highlighted the need to tackle data deficits in order to appropriately quantify, assess and price the impacts of physical, transitional and liability risks of climate change. Notably, the APRA emphasized the need to implement scenario analysis, stress testing and disclosure of market-useful information.[418]

xxvi Illegal logging refers to the harvesting of timber in violation of applicable national and sub-national laws and regulations. It usually refers to selective harvesting of timber, rather than clearcutting, which is more commonly referred to as 'illegal deforestation' or 'illegal forest clearance'.

xxvii EU importers are required to have access to information regarding on the source of the timber, assess the risks of illegal timber in the supply chain and mitigate this risk by requiring additional information form a supplier.

In 2018-19, APRA conducted an assessment of the stress testing capabilities of authorized deposit-taking institutions (ADIs) in the country, with a focus on governance and scenario development. Following this assessment, APRA developed, in 2020, specific guidance on how to perform climate-related stress testing, which is currently being applied by Australia's ADIs. The results will be analysed in conjunction with the Reserve Bank of Australia, and the scope of entities implementing climate-stress tests will be widened in the future.[419]

As a result, Australian banks have already started taking steps to include climate-related risks in their risk-management frameworks. For instance, the Commonwealth Bank of Australia, the major lender to Australian farmers, has taken a phased approach and is actively working to incorporate climate change into its risk management framework.[420] In 2018, the Bank adopted climate scenario analysis to identify the strategic risks and opportunities in business lending, mainly focused on transition risks. In 2019, this was extended to identify physical risks in agribusiness lending, with a focus on the grains, livestock and dairy sectors. The outcomes of the analysis forecast substantial profitability declines in all three sectors by 2060. In particular, deterioration of pasture quality is expected to drive a reduction of farm profits as high as 40 percent in livestock regions, and increased heat stress will translate into the same decline for dairy regions.[421]

Furthermore, the bank's 2020 Annual Report finds that the agriculture, forestry and fishing sector is the most emissions-intensive part of the bank's business lending portfolio, representing 44 percent of assessed lending emissions.[422] In light of these outcomes, the bank has followed up with portfolio-level strategic responses and client engagement, adapting its business strategy and identifying adaptive measures to the risks for each sector.[423]

With respect to mandatory due diligence requirements, France is a regulatory forerunner. The country having placed corporate liability on companies through the legal duty of care. In 2017, France enacted the Duty of Vigilance Law requiring large publicly traded companies to develop due diligence that addresses human rights, environmental risks and adverse impacts. In many respects, the French Duty of Vigilance Law is serving as a model for regulatory design by other countries and the EU. By clarifying corporate due diligence obligations, the regulation brings legal certainty to the standard of care required, clarifies responsibilities of corporations, and facilitates access to legal remedies.[424]

A case in point is illustrated by the lawsuit filed by indigenous communities and NGOs to hold a large French retailer accountable for failing to properly implement risk monitoring and cease purchase of meat from suppliers accused of deforestation. The lawsuit is based on the Duty of Vigilance Law and refers to supply chains in operation in Brazil and Colombia. Evidence compiled for case shows that frozen beef products offered by the French retailer in local supermarkets were bought from meatpackers that sourced cattle from hundreds of suppliers allegedly responsible for 50,000 hectares of deforestation between 2008 and 2020.[425]

5.3.3 Actively promote climate-aligned finance and lending to the land sector

Case for change

Despite all recent media discussions and headlines, active promotion of sustainable finance remains a low priority in the financial sector. In a recent survey carried-out by the Basel Committee on Banking Supervision, only a handful of supervisory authorities expressed their intention to explore sustainable finance as potential future work in their respective jurisdictions.[426] For instance, few jurisdictions to date have supervisory guidance in place requiring banks to increase credit availability to green and low-carbon sectors.[427]

In general, private investors are hesitant to finance climate-smart projects or companies in the land sector. The dominant perception among traditional investors remains that climate-smart land use investments generate lower returns while having significant associated risks.[428] Market failures resulting in undervalued natural capital are also appointed in the literature as an important barrier to green private investments, as firms are currently benefitting from the exploitation of mispriced natural resources, with little to no incentive to change their business models.[429] These perceptions and disincentives reinforce the private sector's tendency to maximise short-term capital investments.[430]

Another important challenge to mobilizing green finance to the land sector is the lack of clarity regarding what makes an investment green and sustainable, including the lack of a common set of definitions.[431] There is an urgent need in the market for certainty regarding the environmental and social soundness of different types of investments and economic activities in general, and for the land sector in particular.[432] A study carried out by the Luxembourg Green Exchange and the Global Landscapes Forum concluded that the lack of clear definitions of what is 'green' is an

important barrier to mobilize finance to sustainable land use. Furthermore, the analysis stresses that investors who wish to invest in sustainable land use and biodiversity conservation will be reluctant to do so, largely due to the high risk of greenwashing and lack of clear definitions.[433]

While the majority of the central banks and supervisory authorities are of the view that climate-related financial risks can be integrated into supervisory approaches without necessarily altering their mandates,[434] most central banks and supervisory authorities have yet to use prudential rules to more actively incentivize long-term green investments.[435] Notably, some supervisory authorities and jurisdictions consider that lowering capital adequacy requirements to actively promote sustainable investments is risky and can only be justified once there is greater empirical evidence that green exposures have lower financial risks than non-green exposures.[436]

How it can be done

In an effort to tackle the uncertainty around definitions and reduce the risk of greenwashing, a number jurisdictions have begun following a common taxonomy to legislate and formally define the different types and categories of sustainable finance.[437] When properly designed, taxonomies provide a consistent definition and categorization of activities, allowing investors to identify green and sustainable activities, enhance market clarity and confidence, and reduce the possibilities for greenwashing.[438]

The proper functioning of taxonomies requires corporations to disclose data regarding the extent to which their economic activities are aligned with the taxonomy's definitions of sustainable. This data is then used by asset and portfolio managers to classify their portfolios accordingly.[439] Thus, a vital factor to consider is the availability of data, and the extent to which this data is standardized. This is a central issue in the uptake of taxonomies, as standardized data would allow for aggregation and assessment of compliance in a consistent and comparable way.[440] Ideally, companies should be able to gather and provide the required data without overstretching their financial and human resources, which is particularly important for smaller corporates and financial system actors.[441]

For optimal results, taxonomies should be adaptable to evolving knowledge and technologies. Similarly, as there are multiple potential emissions pathways to achieve a certain climate objective, the design of the taxonomy should allow for future adjustment of transition pathways, depending on the results and progress achieved over time.[442] Taxonomies can also expand from the central objective to create a *lingua franca* for green investments and also consider measuring the stocks or flows of green investments in the economy to assess these against specific environmental objectives (e.g., climate neutrality or a 1.5°C alignment). This could be done by quantifying the financial flows to different categories of the taxonomy and comparing them with the forecasted investment requirements to achieve a certain environmental objective.[443]

The classification system and definitions provided by taxonomies can address one side of the issue, namely the lack of clarity and information about which investments are green. However, further regulatory action is required to incentivize these financial flows. There is a range of other policy instruments that central banks and financial regulators can deploy, some of which include minor adjustments to existing instruments.[444]

One example is green credit policy instruments, including subsidized loan rates for priority sectors, differential rediscount rates, credit floors, and credit ceilings.[445] Differential rediscount rates applied by central banks to commercial banks are the most used of these policies, and aim to incentivize commercial banks' lending to priority green sectors at lower loan rates.[446] Further, a set of policies addressing green credit allocation can promote green lending and investment to climate-sensitive sectors, including agriculture and forestry. A few central banks have been implementing these types of measures by, for instance, setting a minimum proportion of lending from banks to sustainable economic activities and sectors, creating concessional green refinancing windows and extending concessional loans to banks lending sustainable economic activities.[447]

Another example is market-making to promote green investments and operations.[448] This can be done by developing guidelines on sustainable finance that can create an enabling environment in the banking sector. Similarly, central banks and financial regulators can develop green bond guidelines to encourage the issuance of green bonds by financial system actors.[449]

Positive country examples

A few developing countries stand out when it comes to the promotion of green finance and lending activities. For instance, in Vietnam, a set of decisions and guidelines issued by supervisory authorities between 2015-17 encourage credit institutions, including commercial banks,

cooperatives and nonbank credit institutions, to develop products that lend to green businesses and projects. While clearer enforcement mechanisms by the State Bank of Vietnam are still lacking, these guidelines provide a template for credit institutions to accelerate funding of projects in areas that conserve and use natural resources efficiently.[450]

Although the issued guidelines apply only to credit institutions (thus, not yet covering insurers and asset managers), Vietnam is currently one of the few members of the Sustainable Banking Network to require credit institutions to report annually values of their green finance and the percentage of their total investments classified as green finance.[451] As a result, by June 2019 loans for green enterprises were about USD 13.8 billion, a 32 percent increase from 2018. Loans for green agriculture and sustainable silviculture corresponded, respectively, to 45 percent and 5 percent of the total amount of green credit provided by banks in Vietnam.[452]

Despite the more recent deforestation trends and setbacks in forest governance in Brazil, the country's banking system also shows great potential for promoting sustainable investments and conservation in the land sector.[453] In 2008 the Brazilian National Monetary Council took a first step by demanding banks to require from farmers evidence of land title and compliance with environmental conditions. This simple requirement led farmers to reduce their deforestation activities in order to access finance, and it resulted in a substantial reduction in credit flows to those who were non-compliant.[454] As a result, deforestation fell by 15 percent in the Amazon during the period 2008-2011.[455]

More recently, Brazil increased working capital loan limits to those producers who are duly registered with the federal environmental registry (or *Cadastro Ambiental Rural*), with the Central Bank signaling another potential increase in credit limit. According to an analysis by Souza et al. (2020), although more could be required from borrowers (such as, requesting evidence of no prior forest-related liability), the Brazilian rural credit system could work to drive implementation of forest laws.[456]

An expansion in credit limit to verified sustainable farmers produces little interference with the operation of the financing system. While banks can still decide how much they will actually lend based on an assessment of internal credit risks, an official credit limit expansion offers the possibility to reward producers who are on track with compliance of forestry laws. Costs related to implementation of these measures are generally low and refer mostly to training local bank managers on the opportunities for extending increased credit to qualifying producers.[457]

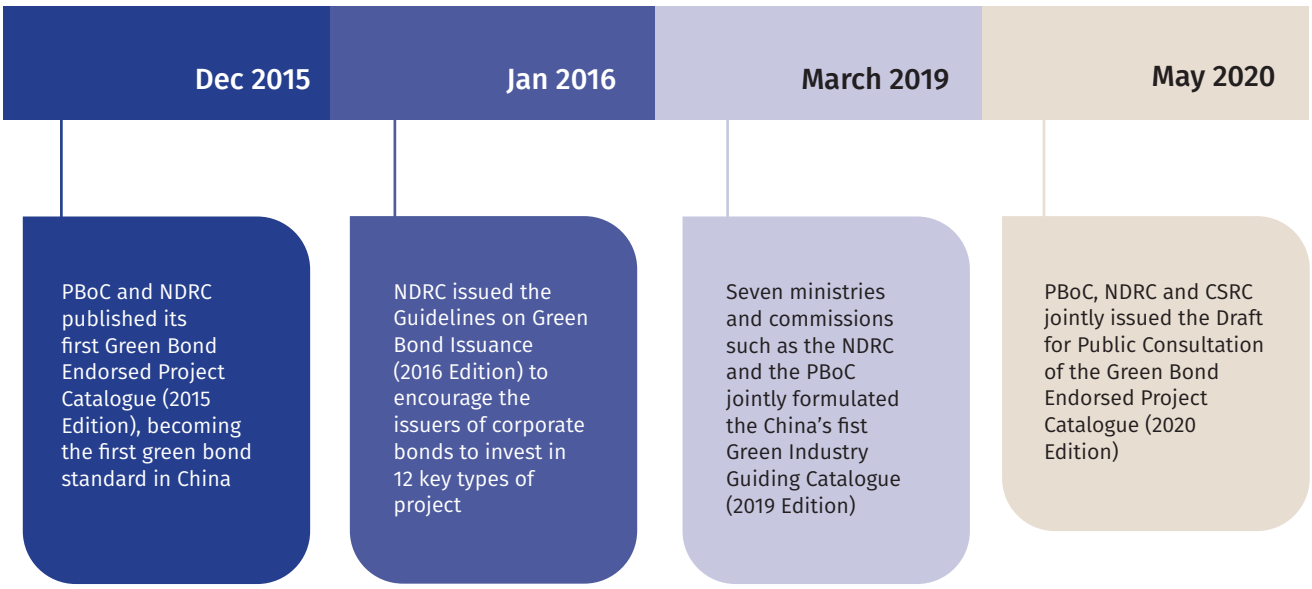
China is another notable example. Since 2015 China has launched several sustainable finance initiatives that assisted in the categorization of green investments and activities (Figure 23). The first of such initiatives was the Green Bond Endorsed Project Catalogue (*2015 Edition*), published by the People's Bank of China (PBoC) and the National Development and Reform Commission (NDRC).[458] The catalogue was the first green bond standard in China and served as a basis for the subsequent definitions and taxonomy.[459]

In 2016, the NDRC issued the *Guidelines on Green Bond Issuance,* with the objective of encouraging issuers of corporate bonds to invest in 12 project categories, ranging from energy-efficiency to green urbanization. However, the release of the guidelines generated confusion, as these were perceived as another green standard, in some instances overlapping or contradicting from the *2015 Project Catalogue*. For instance, green bonds issued by financial entities are subject to the *PBoC Green Bond Endorsed Project Catalogue (2015 Edition),* while green domestic corporate bonds (and in general non-listed companies) are subject to NDRC's 2016 Green Bond Guidelines. In addition, green bonds issued by listed companies and corporate asset-backed securities are subject to the Green Bond Verification Guidelines issued by the China Securities Regulatory Commission (CSRC).[xxviii] This multi-agency regulatory scheme has caused confusion for market participants and left room for policy arbitrage and potential greenwashing.

In an effort to tackle the confusion, in 2019 China issued the *Green Industry Guiding Catalogue.* The new catalogue, jointly formulated by seven ministries and institutions including the NDRC and the PBoC, clarified the definition and classification of green industries and green projects, and unified the previously fragmented supervisory approach to green bond standards in the country.[460]

xxviii China's Green Bond Assessment and Verification Guidelines introduce regulatory requirements for verifiers, including the required qualifications and credentials, verification methods, and reporting requirements. See more details in https://www.greenfinanceplatform.org/financial-measures-database/china%e2%80%99s-green-bond-verification-guidelines

FIGURE 23. A timeline of China's green taxonomy



Source: adapted from Natrixis GSH, retrieved from Rui, C. (2020). A greener green bond catalogue: the incoming China's unified Taxonomy notches new win.

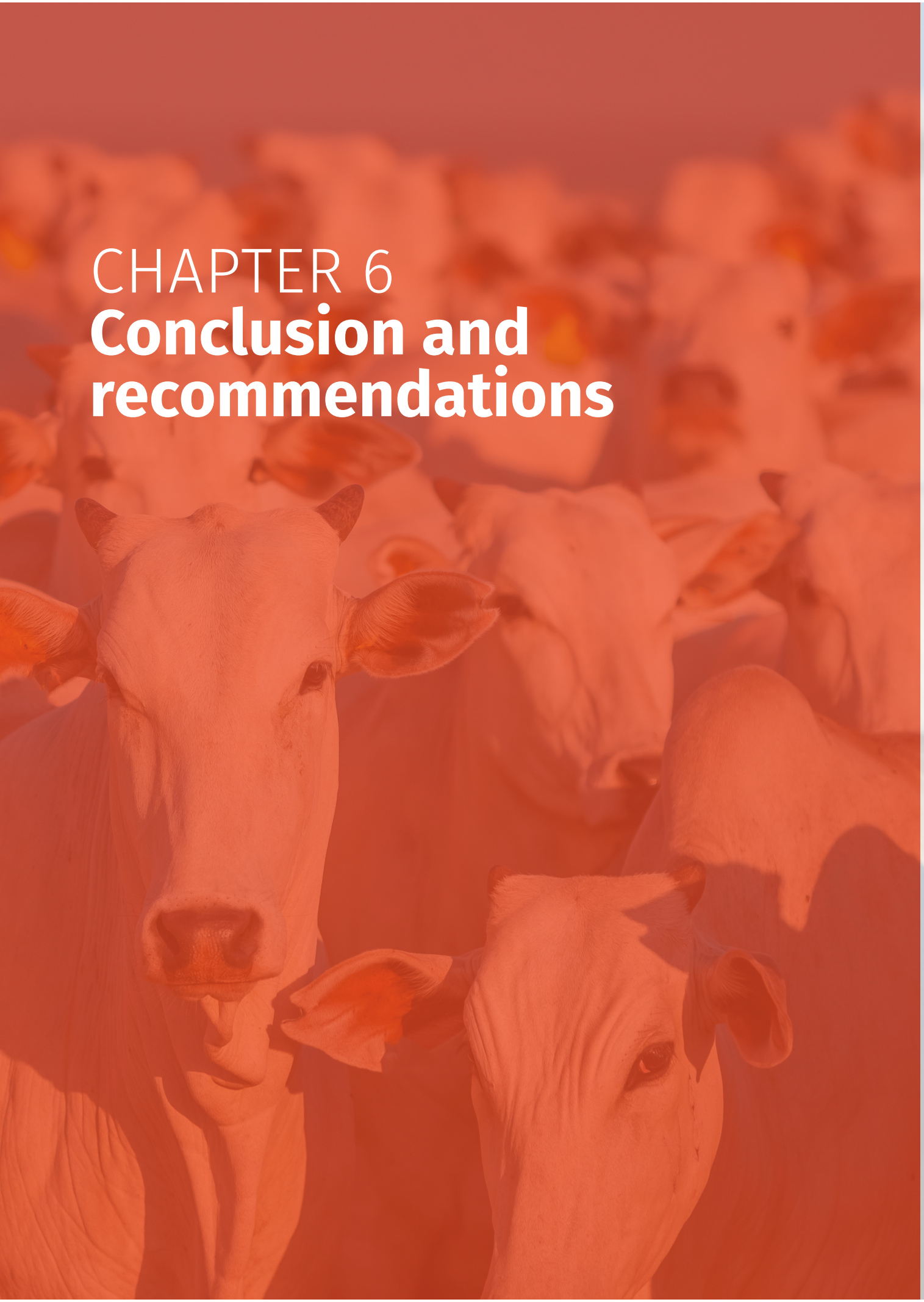
In May 2020, the PBoC, NDRC and CSRC also issued a draft for public consultation of the *Green Bond Endorsed Project Catalogue (2020 Edition),* which aims to unify previous categorizations and definitions, and serve as a reference for green bond approval and registration, third-party evaluation, rating and related information disclosure.[461] This builds on the previously issued Project Catalogues (i.e., the *2015 Project Catalogue* and the *2019 Green Industry Guiding Catalogue*), offering a highly granular, four-level classification for green investments and activities.

The structure of the *2020 Catalogue* is primarily based on the *2019 Green Industry Guiding Catalogue*. They both have a similar number of project classifications and descriptions, with the *2020 Catalogue* including an adjustment to the classification method of level II and III project categories. Most notably, the *2020 Catalogue* eliminates projects related to the use of fossil fuels, which were included in both previous editions.[xxix] Compared to the *2015 Catalogue*, project coverage is greatly broadened in the *2020 Catalogue*. The level-III categories are extended from 38 to 204, allowing for greater specificity of a project's definitions and broadening the potential number of projects that could be identified as green. Table 7 shows some selected categories from the 2*020 Catalogue* that are relevant for the land-use sector.

xxix This includes the clean utilization of coal, and several level-III projects directly related to fossil fuels, such as clean fuel oil production, clean coal production and ultra-low emission renovation of coal-fired power plants.

TABLE 7. Selected categories from China's Green Bond Endorsed Project Catalogue (2020 Edition)

SECTOR	AREA	PROGRAMME	ACTIVITY
Cleaner production industry	Green agriculture	Comprehensive management in agriculture	Production of low-toxic and low-residue pesticides and alternatives
			Treatment of livestock and poultry husbandry waste and pollution
Ecological and environment-related industry	Ecological agriculture	Conservation of agricultural resources	Modern agriculture, seed industry and the protection of animal, plants and germplasm
			Protection of forest genetic resources
			Management of crop protection areas and protection zones
		Green agricultural supply	Green organic agriculture
			Green animal husbandry
	Ecological protection Climate-related metrics Scope 1, 2, 3 GHG emissions Climate-related targets	Conservation and restoration of natural ecosystems 35% 25%	Protection of natural forest resources
			Maintenance and operation of ecological function areas
			Projects converting farmland back to forests or grasslands and restoring grazing land
			Restoration and protection of wetlands
		Supply of ecological products	Forest carbon sequestration, tree and grass planting, forestry seedlings and ornamental flowers



CHAPTER 6
Conclusion and recommendations

This study seeks to support governments in their efforts to achieve Article 2.1(c) of the Paris Agreement by recommending how countries can reorient finance flowing to the land sector. As long as grey finance flowing to the land sector dwarfs climate-aligned green finance, efforts to lower the sector's emissions trajectory will not succeed. Governments must therefore (i) create a conducive environment for sustainable land use and prosperous rural economies; and (ii) create incentives for climate-aligned private investments. To do so, we explore opportunities for redirecting public support to agriculture and financial markets.

Our recommendations are presented as a package of measures that are largely complementary. They can be implemented in parallel by climate-ambitious countries, although the best policy mix will need to be carefully evaluated given the national circumstances of individual countries.

Opportunities for redirecting public support to agriculture include:

- Making support conditional upon achieving environmental objectives;
- Rechannelling production support to public goods and services;
- Avoiding the use of public support to promote the consumption of ruminant meat;
- Removing or redirecting support provided for agricultural inputs.

Opportunities for redirecting financial markets include:

- Moving from voluntary to mandatory disclosure of climate-related risks to increase transparency and allow investors to revisit capital allocation decisions;
- Enhancing risk management frameworks to better identify, manage, monitor and mitigate climate risks, including deforestation risks from soft commodity supply chains;
- Implementing financial measures and instruments that actively promote sustainable investments and lending to climate-aligned land sector enterprises.

Fully aligning land sector finance with the long-term goals of the Paris Agreement will require sustained political commitment. To work towards aligning land sector finance with the Paris Agreement, policymakers need to (i) map out the policy framework influencing how finance is currently flowing to the land sector; (ii) evaluate the impact and effectiveness of policies in place; (iii) identify the opportunities for redirecting finance by redesigning the policy incentives in place; and (iv) take action to reduce or remove emissions from the land sector through reorienting the policy incentives in place.

Fully aligning land sector finance with the long-term goals of the Paris Agreement will require sustained political will from governments – backed by institutional and technical capacity – to remove policy obstacles and structural barriers that prevent greener investments. In particular, governments need to recalibrate their public support towards a greater provision of public goods and the avoidance of negative externalities; adapt financial regulations not only to protect the financial system from climate change, but also to foster a shift in financial flows to green investments; and ensure a more suitable domestic policy environment for private sector investments in the land sector. This means creating a conducive investment environment that is able to move private capital held by larger investors, asset managers and companies into sustainable, low-carbon, and deforestation-free enterprises.

Governments also need to make climate mitigation a priority, and act on it. The agricultural sector remains an important source of GHGs globally, while also being most vulnerable to climate impacts. Yet governments and markets continue to offer farmers and corporations more incentives to exploit natural assets than to use them sustainably. This jeopardizes the ability of the land to continue to provide the food, water, fibre and building materials we need to sustain a growing global population. It also puts the many millions of low-income farmers directly at risk of losing their livelihoods as a result of dangerous climate change. Policymakers who are serious about tackling the climate crisis need to ensure that the policy frameworks they have in place do not harm the future of the people they represent. Revisiting the impact and effectiveness of the policies they have in place in the land sector is a key part of this.

In this report, we recommend reforming or adapting existing fiscal and financial policy instruments to better align finance flows with Article 2.1(c) of the Paris Agreement. Importantly, we propose the repurposing of policy instruments – rather than designing new instruments altogether – and the shifting of financial support – rather than removal – to facilitate a just rural transition. This capitalizes on the opportunities to use

TABLE 8. Summary of green redesign recommendations for public support to agriculture

RECOMMENDATION	REDESIGN CONSIDERATIONS
Make support conditional upon achieving environmental objectives	• Make compliance with all relevant legislation a condition to qualify for support and/or require farmers to adhere to standards and regulations in order to qualify for support. • Offer graduated payments awarded for emission reductions or removals with increasingly. ambitious performance targets, which are either practice- or performance-based. • Build environmental considerations into land and property tax valuations.
Rechannel production support to public goods and services	• Provide funding to drive agricultural innovation and improve productivity. • Provide agricultural training and extension services to farmers. • Invest in collective infrastructure for storage, processing and transportation to reduce food loss. • Provide environmental information services.
Avoid using public support to promote the consumption of ruminant meat	• Adjust value-added tax rates applied to ruminant meat. • Eliminate or reduce ruminant meat provided through public catering and encourage healthier diets. • Implement conditionality for public funds used for marketing, including restricting the use of public funds for meat marketing and allocating budget to the promotion of low-carbon protein alternatives.
Remove or redirect government support provided for agricultural inputs	• Remove fertiliser subsidies, redirect support to incomes or channel support to goods and services in high-income countries. • Provide extension services alongside fertiliser subsides in middle- and low-income countries or redirect support to income support. • Remove fossil fuel subsidies. • Remove or redirect subsides for animal feed.

existing knowledge, expertise and resources to ensure climate-aligned finance flows to land use.

In order to **redirect public support to agriculture** (Table 8) we focus on the levers/incentives that are within policymakers' remit to adjust in order to influence land use decisions, namely, which commodities to produce and how to farm. For **redirecting financial markets** (Table 9), we consider measures that may be taken by governments and supervisory authorities to green their financial systems. These recommendations are presented as a package of measures and are largely complementary. They can be implemented in parallel by climate-ambitious countries, although the best policy mix for individual countries will need to be carefully evaluated.

To ensure land sector finance is aligned with the Paris Agreement policymakers should:

i. **Map out how the policy framework influences how finance is flowing to the land sector.** The policies impacting the land sector go beyond those simply developed for agriculture and forestry. They also include the financial regulations that determine the economic environment through which private finance flows to the land sector, and the many other legal, regulatory and other financial incentives that influence investment decisions and the ability of land users to access finance.

ii. **Evaluate the impact and effectiveness of the policies in place.** Many of the incentives that remain in place today have already achieved their intended policy objective, or these objectives are no longer relevant.[462] In other cases, the policy objectives themselves may be obscure, or the method through which support is provided fails to bring the country closer to achieving the stated objective of the support.[463] There is a clear need to reexamine the support provided to the land sector to determine who benefits from that support, whether it is effective in achieving its intended objectives, and what the environmental and social impacts of the support are.

iii. **Identify opportunities for redirecting finance by redesigning the policy incentives in place.** This includes evaluating how best to reorient policy incentives to achieve contemporary policy goals and align with low-carbon development. It also includes identifying which parties will benefit from the redesign, when these benefits will be delivered, any associated costs, and how trade-offs between socio-economic and environmental

TABLE 9. Summary of green redesign recommendations for redirecting financial markets

RECOMMENDATION	REDESIGN CONSIDERATIONS
Move from voluntary to mandatory disclosure	• Increase overall transparency, comparability and quality of disclosures. • Harmonize disclosure obligations by aligning domestic requirements with a common disclosure framework. • Directly adopt (or gradually integrate) a double materiality approach to disclosure. • Provide detailed metrics for reporting on forests, soil, and biodiversity impacts.
Enhance risk management frameworks for the land sector	• Adopt (through legislation or supervisory guidance) more comprehensive risk management controls for financial system actors. • Integrate scenario analysis and climate-related stress tests into supervisory approaches (that also covers the agricultural sector). • Impose a legal duty of care and mandatory due diligence for financial system actors that addresses the risk of deforestation within global commodity supply chains.
Active promotion of climate-aligned finance to the land sector	• Introduce (through legislation or supervisory guidance) taxonomies that clearly define the different categories of green and sustainable finance, including for the land sector. • Develop green lending guidance that covers the agricultural sector. • Increase lending limits for farmers and companies that provide evidence of being climate-aligned.

goals will be addressed. This report identifies where such opportunities lie within public support to agriculture and financial markets. The suitability of the measures outlined in this report will depend on individual country contexts and capacities, and some may be more attractive and have greater potential for shifting finance than others depending on the national policy context, including where and how public support is awarded today.

iv. **Take action to reduce or remove emissions from the land sector through reorienting the policy incentives in place.** Making green policy changes can be a long and politically challenging process. With only 10 years to bend the trend on our GHG emissions trajectory, there is no time for additional delay. Governments – especially those most responsible for the emissions in our atmosphere today – must make climate change mitigation a priority and ensure that this is embedded in every facet of their policy frameworks. Pursuing a green economy presents significant opportunities. Between 2009-18 the global green economy demonstrated an annual growth rate of 8 percent, and in 2020 it was materially larger than the oil and gas sector.[464] Many governments, jurisdictions and businesses are waking up to the need to mitigate climate change - and the economic opportunities that arise from doing so.

References

1. United Nations Framework Convention on Climate Change. (2015). Adoption of the Paris Agreement. *Twenty-First Session.* Presented at the Conference of the Parties, Paris. https://unfccc.int/resource/docs/2015/cop21/eng/l09r01.pdf.

2. Roe, S., Streck, C., Obersteiner, M., Frank, S., Griscom, B., Drouet, L., et al. (2019). Contribution of the land sector to a 1.5 °C world. *Nature Climate Change,* 9(11), 817–828. Retrieved from https://doi.org/10.1038/s41558-019-0591-9.

3. Heine, D.; Batmanian, G. and Hayde, E. (2021) Executive Summary. In *Designing Fiscal Instruments for Sustainable Forests.* Climate Investment Funds, International Bank for Reconstruction and Development, The World Bank Group

4. Locke, A. and Lowe, A. (2021) Shifting finance for sustainable land use: Repurposing public support to agriculture. Overseas Development Institute

5. Bellmann, C. (2019). Subsidies and sustainable agriculture: Mapping the policy landscape. *Hoffmann Centre and Chatham House.* Retrieved from https://hoffmanncentre.chathamhouse.org/article/subsidies-and-sustainable-agriculture/.

6. Searchinger, T. D., Malins, C., Dumas, P., Baldock, D., Glauber, J., Jayne, T., et al. (2020). Revising Public Agricultural Support to mitigate climate change. *World Bank Group.* Retrieved from https://openknowledge.worldbank.org/bitstream/handle/10986/33677/K880502.pdf?sequence=4&isAllowed=y.

7. Feedback. (2020). *Butchering the Planet: The big-name financiers bankrolling livestock corporations and climate change.* Retrieved March 18, 2021, from https://feedbackglobal.org/wp-content/uploads/2020/07/FeedbackReport-ButcheringPlanet-Jul20-HighRes.pdf.

8. Just Rural Transition 2030 Vision (2019). Retrieved from https://justruraltransition.org/vision-statement/

9. Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science,* 360(6392), 987–992. Retrieved from https://doi.org/10.1126/science.aaq0216.

10. Aytac, D. (2018). Optimal taxation of consumption in the scope of changing. *IntechOpen.* Retrieved from https://www.intechopen.com/books/taxes-and-taxation-trends/optimal-taxation-of-consumption-in-the-scope-of-changing.

11. Partnership for Market Readiness; Carbon Pricing Leadership Coalition. (2018). *Guide to communicating carbon pricing.* World Bank Group. Retrieved March, 17, 2021, from https://openknowledge.worldbank.org/handle/10986/30921

12. Guarnaschelli, S., Limketkai, B., Vandeputte, P. (2018). Financing sustainable land use – Unlocking business opportunities in sustainable land use with blended finance. *KOIS Investment.* Retrieved November 4 2020, from https://assets.ctfassets.net/bbfdx7vx8x8r/7iGPF09ucEeweAU8yOe0eU/eeabb872454c6687e98a434a270d5b2c/Kois_FinancingSLU.pdf

13. University of Cambridge Institute for Sustainability Leadership. (2020). *Banking beyond deforestation – How the banking industry can help halt and reverse deforestation: 2020.* Retrieved March 17, 2021, from https://www.cisl.cam.ac.uk/resources/sustainable-finance-publications/banking-beyond-deforestation; Global Canopy. (2020). *How financial institutions are exposed to deforestation risks: 2020.* Retrieved March 17, 2021, from https://globalcanopy.org/insights/

14. Hill, B., & Blandford, D. (2007). Taxation concessions as instruments of agricultural policy. *Agriculture Economics Society.* DOI: 10.22004/ag.econ.7976

15. Bellmann, C. (2019).

16. International Labour Organization. (2018). *World employment social outlook: Greening with jobs: 2018.* Retrieved from http://www.ilo.org/wcmsp5/groups/public/---dgreports/---dcomm/---publ/documents/publication/wcms_628654.pdf ; Georgeson, L. and Maslin. M. (2019). Estimating the scale of the US green economy within the global context. *Palgrave Communications,* 5, 121. Retrieved from https://doi.org/10.1057/s41599-019-0329-3

17. Clements, L.; Dai, L. and Hugo, C.l. (2020). Investing in the green economy – sizing the opportunity. *FTSE Russell.* December 2020. Retrieved from https://content.ftserussell.com/sites/default/files/investing_in_the_green_economy___sizing_the_opportunity_final_0.pdf?_ga=2.107853761.2132965583.1615729251-826573630.1615729251

18. Climate Watch (no date) *Historical GHG Emissions.* Available at https://www.climatewatchdata.org/ghg-emissions?breakBy=countries&end_year=2018&regions=TOP&start_year=1990

19. Heine, D.; Batmanian, G. and Hayde, E. (2021) Executive Summary. In *Designing Fiscal Instruments for Sustainable Forests.* The World Bank Group

20. 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: 2019.* Retrieved March 17, 2021 https://www.ipcc.ch/srccl/.

21. IPCC. (2019).

22. OECD. (2020a). *Agricultural Policy Monitoring and Evaluation: 2020.* Retrieved from https://www.oecd-ilibrary.org/agriculture-and-food/agricultural-policy-monitoring-and-evaluation-2020_928181a8-en.

23. OECD. (2020a).

24. OECD. (2020a).

25. World Bank. (2018a). *Realigning agricultural support to promote climate-smart agriculture: 2018.* Retrieved March 17, from http://documents1.worldbank.org/curated/en/734701543906677048/pdf/132660-REPLACEMENT-PUBLIC-Realigning-Agricultural-Support-CSA-v2.pdf.

26. Dasgupta, P. (2021). *The economics of biodiversity: The Dasgupta Review.* London, England: HM Treasury. Retrieved March 18, 2021, from https://www.gov.uk/government/publications/final-report-the-economics-of-biodiversity-the-dasgupta-review

27. IPCC. (2019).

28. IPCC. (2019).

29. IPCC. (2019).

30. United Nations Framework Convention on Climate Change. (UNFCCC). (2015) 'Paris Agreement' Bonn: UNFCCC. Retrieved from https://unfccc.int/sites/default/files/english_paris_ agreement.pdf

31. Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., Dumas, P., & Matthews, E. (2018). Creating a sustainable food future. Retrieved from https://www.wri.org/publication/creating-sustainable-food-future

32. Buchner, B., Clark, A., Falconer, A., Macquarie, R., Meattle, C., Tolentino, R., et al. (2019). Global landscape of climate finance 2019. Retrieved from https://www.climatepolicyinitiative.org/publication/global-landscape-of-climate-finance-2019/.

33. Global Commission on the Economy and Climate. (2016). *The sustainable infrastructure imperative: Financing for better growth and development: October 2016.* Retrieved March 17, 2021 from http://newclimateeconomy.report/2016/wp-content/uploads/sites/4/2014/08/NCE_2016Report.pdf.

34. IPCC. (2019).

35. Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., et al. (2018).

36. Gibbs, D., & Harris, N. (2019). *Goal 1 assessment: Striving to end natural forest loss.* Retrieved March 17, 2021, from https://forestdeclaration.org/images/uploads/resource/NYDF2020_Goal_1_Assessment.pdf.

37. Gibbs, D., & Harris, N. (2019).

38. Global Forest Watch. (n.d.). Impact of supply chains on forest resources. *Deforestation & Commodities.* Retrieved January 9, 2021, from https://www.globalforestwatch.org/topics/commodities/.

39. Poore, J., & Nemecek, T. (2018). Reducing food's environmental impacts through producers and consumers. *Science,* 360(6392), 987–992. Retrieved from https://doi.org/10.1126/science.aaq0216.

40. Department of Economic and Social Affairs & United Nations Department of Economic and Social Affairs. (2019). World population prospects 2019 database. Retrieved March 18, 2021, from https://population.un.org/wpp/.; Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., et al. (2018).

41. Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., et al. (2018).

42. Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., et al. (2018).

43. Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., et al. (2018).

44. Searchinger, T., Waite, R., Hanson, C., Ranganathan, J., et al. (2018).

45. Roe, S. et al. (2019).

46. Roe, S. et al. (2019).

47. OECD. (2019a). *Agricultural policy monitoring and evaluation: 2019.* Retrieved March 17, 2021, from https://www.oecd-ilibrary.org/agriculture-and-food/agricultural-policy-monitoring-and-evaluation_22217371

48. Whiteman, A., Wickramasinghe, A. & Piña, L. (2015). Global trends in forest ownership, public income and expenditure on forestry and forestry employment. *Forest Ecology and Management,* 352, pp.99-108 https://doi.org/10.1016/j.foreco.2015.04.011

49. Pendrill, F., Persson, U. M., Godar, J., & Kastner, T. (2019). Deforestation displaced: trade in forest-risk commodities and the prospects for a global forest transition. *Environmental Research Letters,* 14(5), 055003. Retrieved from https://doi.org/10.1088/1748-9326/ab0d41.

50. Kissinger, G. M., Herold, M., & de Sy, V. (2012). Drivers of deforestation and forest degradation: *A synthesis report for REDD+ policymakers. Lexeme Consulting.* Retrieved from https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/65505/6316-drivers-deforestation-report.pdf

51. Ritchie, H. (2021). *The world has lost one-third of its forest, but an end of deforestation is possible: 2021. Our World in Data.* Retrieved from https://ourworldindata.org/world-lost-one-third-forests

52. Ritchie, H. (2021).

53. Ritchie, H. (2021).

54. United Nations Framework Convention on Climate Change. (UNFCCC). (2015). 'Paris Agreement' Bonn: UNFCCC. Retrieved from https://unfccc.int/sites/default/files/english_paris_ agreement.pdf

55. Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., & Tanaka, M. (2018). Climate change challenges for central banks and financial regulators. *Nature Climate Change,* 8(6), 462–468. Retrieved from https://doi.org/10.1038/s41558-018-0175-0

56. Jachnik, R., Mirabile, M., & Dobrinevski, A. (2019). Tracking finance flows towards assessing their consistency with climate objectives. *OECD Environment Working Papers,* No. 146, OECD Publishing, Paris. Retrieved from https://doi.org/10.1787/82cc3a4c-en.

57. Crumpler, K., Meybeck, A., Federici, S., Salvatore, M., Damen, B., Gagliardi, G., et al. (2020). A common framework for agriculture and land use in the nationally determined contributions. *Environment and Natural Resources Management Working Papers No. 85.* Rome, FAO. Retrieved from https://doi.org/10.4060/cb1589en

58. OECD. (2019b). *The impacts of climate change mitigation policies in agriculture: Finding the balance: August 2019.* Joint Working Party on Agriculture and the Environment. Retrieved March 17, 2021, from https://www.oecd.org/officialdocuments/publicdisplaydocumentpdf/?cote=COM/TAD/CA/ENV/EPOC(2019)9/FINAL&docLanguage=En

59. Nachmany, M., & Fankhauser, S. (2016, November 14). The global climate legislation study - 2016 update. Retrieved January 9, 2021, from https://www.lse.ac.uk/granthaminstitute/publication/2015-global-climate-legislation-study/.

60. Food and Agriculture Organization. (2020).

61. Schoenmaker. D., Tilburg R., & Wijffels. H., (2015). What role for financial supervisors in addressing systemic environmental risks? UNEP Inquiry. Retrieved from http://unepinquiry.org/wp-content/uploads/2016/02/Working-paper-15-april.pdf.

62. OECD. (2019b).

63. Government of Ireland. (2019). *Climate action plan 2019 to tackle climate breakdown: 2019.* Retrieved March 17, 2021, from https://www.gov.ie/pdf/file=https://assets.gov.ie/25419/c97cdecddf8c49ab976e773d4e11e515.pdf#page=null.

64. Government of Ireland. (2019).

65. Parsons, K. & Hawkes, C. (2019). *Brief 5: Policy coherence in food Systems: Rethinking food policy: A fresh approach to policy and practice. London: Centre for Food Policy.* City, University of London. Retrieved March 17, 2021, from https://www.city.ac.uk/__data/assets/pdf_file/0018/504621/7643_Brief-5_Policy_coherence_in_food_systems_WEB_SP.pdf

66. Fujimori, S., Hasegawa, T., Rogelj, J., Su, X., Havlik, P., Krey, V., et al. (2018). Inclusive climate change mitigation and food security policy under 1.5 °C climate goal. *Environmental Research Letters,* 13(7), 074033. Retrieved from https://doi.org/10.1088/1748-9326/aad0f7; Fujimori, S., Hasegawa, T., Krey, V., Riahi, K., Bertram, C., Bodirsky, B. L., et al. (2019). A multi-model assessment of food security implications of climate change mitigation. *Nature Sustainability,* 2(5), 386–396. Retrieved from https://doi.org/10.1038/s41893-019-0286-2.

67. Giovanni et al. (2015).

68. Cui, Z., Zhang, H., Chen, X. et al. (2018). Pursuing sustainable productivity with millions of smallholder farmers. *Nature,* 555, 363–366. Retrieved from https://doi.org/10.1038/nature25785; Harris, B. (2018). China cut fertilizer use and still increased crop yields. This is how they did it. *World Economic Forum,* 2018. Retrieved from https://www.weforum.org/agenda/2018/03/this-is-how-china-cut-fertilizer-use-and-boosted-crop-yields/#:~:text=The%20detailed%20guidance%20led%20to,the%20study%20published%20in%20Nature.

69. Inter-American Development Bank. (n.d.). *FINANCIAL INNOVATION LAB | IADB.* Retrieved February 15, 2021, from https://www.iadb.org/en/financial-innovation-lab/financial-innovation-lab.

70. Knoch, M., & Van der Plasken, C. (2020). O mercado emergente de finanças verdes no Brasil - *Principais participantes, produtos e desafios.* Retrieved from http://www.labinovacaofinanceira.com/wp-content/uploads/2020/07/mercado_financasverdes_brasil.pdf.

71. Andriamihaja, O. R., Metz, F., Zaehringer, J. G., Fischer, M., & Messerli, P. (2021). Identifying agents of change for sustainable land governance. *Land Use Policy,* 100, 104882. Retrieved from https://doi.org/10.1016/j.landusepol.2020.104882.

72. Palmer, D., Fricska, S., & Wehrmann, B. (2009). Towards improved land governance. *FAO.* Retrieved from https://uni.unhabitat.org/wp-content/uploads/2014/06/TOWARDS-IMPROVED-LAND-GOVERNANCE-Land-and-Tenure-Working.pdf.

73. Shekhar, S., Xiong, H., & Zhou, X. (Eds.). (2017). Land use planning. *In Encyclopedia of GIS* (pp. 1115–1115). Retrieved from https://doi.org/10.1007/978-3-319-17885-1_100656.

74. Steinhäußer, R., Siebert, R., Steinführer, A., & Hellmich, M. (2015). National and regional land-use conflicts in Germany from the perspective of stakeholders. *Land Use Policy,* 49, 183–194. Retrieved from https://doi.org/10.1016/j.landusepol.2015.08.009.

75. Brown, G., Sanders, S., & Reed, P. (2018). Using public participatory mapping to inform general land use planning and zoning. *Landscape and Urban Planning,* 177, 64–74. Retrieved from https://doi.org/10.1016/j.landurbplan.2018.04.011.

76. Henríquez-Dole, L., Usón, T. J., Vicuña, S., Henríquez, C., Gironás, J., & Meza, F. (2018). Integrating strategic land use planning in the construction of future land use scenarios and its performance: The Maipo River Basin, Chile. *Land Use Policy,* 78, 353–366. Retrieved from https://doi.org/10.1016/j.landusepol.2018.06.045.

77. Bonsu, N. O., Dhubháin, Á. N., & O'Connor, D. (2017). Evaluating the use of an integrated forest land-use planning approach in addressing forest ecosystem services conflicting demands: Experience within an Irish forest landscape. *Futures,* 86, 1–17. Retrieved from https://doi.org/10.1016/j.futures.2016.08.004.

78. Hurtt, G., Zhao, M., Sahajpal, R., Armstrong, A., Birdsey, R., & Campbell, E., et al. (2019). Beyond MRV: high-resolution forest carbon modeling for climate mitigation planning over Maryland, USA. *Environmental Research Letters, 14*(4), 045013. Retrieved from https://doi.org/10.1088/1748-9326/ab0bbe.

79. Kaim, A., Cord, A. F., & Volk, M. (2018). A review of multi-criteria optimization techniques for agricultural land use allocation. *Environmental Modelling & Software,* 105, 79–93. Retrieved from

80. Department for International Development. (2014). *Secure property rights and development: Economic growth and household welfare. Property rights evidence paper.* Retrieved March 18, 2021, from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/304551/Property-rights-evidence-paper.pdf

81. Higgins, D.; Balint, T.; Liversage, H. & Winters, P. (2018). Investigating the impacts of increased rural land tenure security: A systematic review of the evidence. *Journal of Rural Studies,* 61, pages 34-62. Retrieved from https://doi.org/10.1016/j.jrurstud.2018.05.001

82. NYDF Assessment Partners. (2020). Goal 10 assessment: Strengthening governance and empowering communities. New York Declaration on Forests Progress Assessment. *Climate Focus* (coordinator and editor). Retrieved March 18, 2021, from www.forestdeclaration.org

83. Garnett, S.T., Burgess, N.D., Fa, & J.E. et al. (2018). A spatial overview of the global importance of Indigenous lands for conservation. *Nature* 1, 369–374. Retrieved from https://doi.org/10.1038/s41893-018-0100-6 ; Fa, J. E., Watson, J. E., Leiper, I., Potapov, P., Evans, T. D., Burgess, N. D., & et al. (2020). Importance of Indigenous Peoples' lands for the conservation of Intact Forest Landscapes. *Frontiers in Ecology and the Environment,* 18(3). Retrieved from https://doi.org/10.1002/fee.2148.

84. Schuster, R; Germain, R.R; Bennet, J. R.; Reo, N. J. & Arcese. (2019). Vertebrate biodiversity in indigenous-managed lands in Australia, Brazil, and Canada equals that in protected areas. *Environmental Science & Policy,* Volume 101, pages 1-6. Retrieved from https://doi.org/10.1016/j.envsci.2019.07.002

85. Baragwanath, K., & Bayi, E. (2020). Collective property rights reduce deforestation in the Brazilian Amazon. *PNAS* 117 (34) 20495-20502. Retrieved from https://doi.org/10.1073/pnas.1917874117

86. Rights and Resources Initiative. (2020). *Estimate of the area of land and territories of Indigenous Peoples, local communities, and Afro- descendants where their rights have not been recognized.* Retrieved March 18, 2021, from https://rightsandresources.org/wpcontent/uploads/2020/09/Area-Study-Final-1.pdf

87. Baragwanath, K. & Bayi, E. (2020).

88. Tradecraft Exchange. (2020). *Our land. Our rights: Land grabbing in Liberia and the case for a new UK law.* Retrieved March 18, 2021, from https://static1.squarespace.com/static/59242ebc03596e804886c7f4/t/5e21c33c7cc7f93faf1e1731/1579271043; Human Rights Watch (2019). *Rainforest mafias: How violence and impunity fuel deforestation in Brazil's Amazon: September 2019.* Retrieved March 18, 2021, from https://www.hrw.org/report/2019/09/17/rainforest-mafias/how-violence-and-impunity-fuel-deforestation-brazils-amazon

89. Ignaciuk, A. & Chit Tun, N. A. (2019). Achieving agricultural sustainability depends on gender equality. Retrieved from https://www.ifpri.org/blog/achieving-agricultural-sustainability-depends-gender-equality; Kaaria, S. and Osorio, M. (2018). The gender gap in land rights. *Food and Agriculture Organization of the United Nations*. Retrieved March 18, 2021, from http://www.fao.org/3/I8796EN/i8796en.pdf

90. SME Finance Forum. (2015). *Financing to support women in the agricultural sector.* Retrieved March 18, 2021, from https://www.smefinanceforum.org/post/financing-to-support-women-in-the-agricultural-sector-0.

91. FAO. (2011). *Women in agriculture: Closing the gender gap for development.* Retrieved March 18, 2021, from http://www.fao.org/publications/sofa/2010-11/en/

92. FAO. (2011).

93. FAO. (2018). *The gender gap in land rights: 2018.* Retrieved March 18, 2021, from http://www.fao.org/3/I8796EN/i8796en.pdf

94. Namubiru-Mwaura, E. (2014). Land tenure and gender: Approaches and challenges for strengthening rural women's land rights. Retrieved March 18, 2021, from https://openknowledge.worldbank.org/handle/10986/21033

95. OECD iLibrary | Agricultural support estimates (Edition 2020). (n.d.). Retrieved January 9, 2021, from https://www.oecd-ilibrary.org/agriculture-and-food/data/oecd-agriculture-statistics/agricultural-support-estimates-edition-2020_466c3b98-en.

96. Bellmann, C. (2019).

97. Locke, A. and Lowe, Alex. (2021). Repurposing Public Support to Agriculture: A Review, Overseas Development Institute

98. OECD. (2020c). *Taxation in agriculture*. Retrieved March 18, 2021, from https://www.oecd-ilibrary.org/agriculture-and-food/taxation-in-agriculture_073bdf99-en.

99. Locke, A. and Lowe, Alex (2021).

100. Mamun, A., Martin, W., & Tokgoz, S. (2021). Reforming agricultural support for improved environmental outcomes. *Applied Economic Perspectives and Policy,* n/a(n/a), 1–30. Retrieved from https://doi.org/10.1002/aepp.13141

101. World Bank. (2019). Agriculture, forestry, and fishing, value added percentage of GDP data. Retrieved January 9, 2021, from https://data.worldbank.org/indicator/NV.AGR.TOTL.

102. World Bank. (2019).

103. Hill, B., & Blandford, D. (2007).

104. Bellman, C. (2019).

105. Vorley, B., & Cotula, L. (2012). T*ipping the Balance: Policies to shape agricultural investments and markets in favour of small-scale farmers.* Retrieved March 18, 2021, from https://pubs.iied.org/g03470.

106. Locke, A. and Lowe, A. (2021).

107. Searchinger, T. D. et al. (2020a).; OECD (Edition 2020). (n.d.).

108. World Bank. (n.d.). World development report 2008: Agriculture for development. Retrieved March 18, 2021, from, https://openknowledge.worldbank.org/handle/10986/5990.

109. Bellmann, C. (2019).

110. World Bank. (n.d.-a). Employment in agriculture (% of total employment) (modeled ILO estimate) | Data. Retrieved January 9, 2021, from https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS.

111. World Bank. (n.d.a).

112. Lebedys, A., & Li, Y. (2014). C*ontribution of the forestry sector to national economies, 1990 - 2011.* Rome: Food and Agriculture Organization of the United Nations. (2020). Retrieved March 18, 2021, from http://www.fao.org/3/i4248e/i4248e.pdf

113. OECD. (n.d.). *Towards sustainable land use: Aligning biodiversity, climate and food policies.* Retrieved January 9, 2021, from https://www.oecd-ilibrary.org/environment/towards-sustainable-land-use_3809b6a1-en

114. United Nations Food and Agriculture Organization. (2016). *The agriculture sectors in the intended nationally determined contributions: Analysis* (p. 92). Retrieved March 18, 2021, from http://www.fao.org/publications/card/en/c/7b020094-a986-4c93-8fa7-7e222b2cd649/

115. OECD iLibrary (2020) Agricultural support estimates (Edition 2020). (n.d.).

116. Buchner, B. et al. (2019).

117. Searchinger, T. D. et al. (2020).

118. Searchinger, T. D. et al. (2020).

119. Laborde, D., Mamun, A., Martin, W., Piñeiro, V., & Vos, R. (2020). *Modeling the impacts of agricultural support policies on emissions from agriculture*. Agriculture and Food Discussion Paper, World Bank. August 2020. Retrieved March 18, 2021, from https://www.ifpri.org/publication/modeling-impacts-agricultural-support-policies-emissions-agriculture

120. Searchinger, T. D. et al. (2020).

121. Food and Agriculture Organization. (N.d.). What is Conservation Agriculture? | Conservation Agriculture | Food and Agriculture Organization of the United Nations. Retrieved January 9, 2021, from http://www.fao.org/conservation-agriculture/overview/what-is-conservation-agriculture/en/.

122. Clark, R., Reed, J., & Sunderland, T. (2018). Bridging funding gaps for climate and sustainable development: Pitfalls, progress and potential of private finance. *Land Use Policy,* 71, 335–346. Retrieved from https://doi.org/10.1016/j.landusepol.2017.12.013; Powlson, D. S., Stirling, C. M., Thierfelder, C., White, R. P., & Jat, M. L. (2016). Does conservation agriculture deliver climate change mitigation through soil carbon sequestration in tropical agro-ecosystems? *Agriculture, Ecosystems & Environment,* 220, 164–174. Retrieved from https://doi.org/10.1016/j.agee.2016.01.005.

123. Searchinger, T. D. et al. (2020).

124. OECD iLibrary | Agricultural support estimates (Edition 2020). (n.d.). January 9, 2021, https://www.oecd-ilibrary.org/agriculture-and-food/data/oecd-agriculture-statistics/agricultural-support-estimates-edition-2020_466c3b98-en.

125. Bellman, C. (2019).

126. OECD iLibrary | Agricultural support estimates (Edition 2020). (n.d.).

127. OECD iLibrary | Agricultural support estimates (Edition 2020). (n.d.).

128. Searchinger, T. D. et al. (2020).

129. Bellmann, C. (2019).

130. Bellmann, C. (2019).

131. OECD iLibrary | Agricultural support estimates (Edition 2020). (n.d.).

132. Hill, B., & Blandford, D. (2007).

133. International Food Policy Research Institute (2019). *Reforming agricultural support for improved environmental outcomes.* IFPRI Discussion Paper. Retrieved March 18, 2021, from https://www.ifpri.org/publication/reforming-agricultural-subsidies-improved-environmental-outcomes. Gautam, M., Hayde, E. and Zang, Y. (2021) Chapter 12: Agriculture, Subsidies, and Forests. In Designing Fiscal Instruments for Sustainable Forests. The World Bank Group

134. Bellmann, C. (2019).

135. OECD. (2020c).

136. Bellmann, C. (2019).

137. Goldman, E., Weisse, M. J., Harris, N. and Schneider, M. (2020). Estimating the Role of Seven Commodities in Agriculture-Linked Deforestation: Oil Palm, Soy, Cattle, Wood Fiber, Cocoa, Coffee, and Rubber. Technical Note. WRI. Retrieved from https://files.wri.org/s3fs-public/estimating-role-seven-commodities-agriculture-linked-deforestation.pdf?c5LkqUrzu26_c17r7DE9AZB6mGWN5g7o

138. Cortus, B. G., Unterschultz, J. R., Jeffrey, S. R., & Boxall, P. C. (2009). The impacts of agriculture support programs on wetland retention on grain farms in the prairie pothole region. *Canadian Water Resources Journal / Revue Canadienne Des Ressources Hydriques,* 34(3), 245–254. Retrieved from https://doi.org/10.4296/cwrj3403245.

139. Lubowski, R. N., Bucholtz, S., Claassen, R., Roberts, M., Cooper, J., Gueorguieva, A., et al. (n.d.). Environmental effects of agricultural land-use change: The role of economics and policy. Retrieved January 27, 2021, from http://www.ers.usda.gov/publications/pub-details/?pubid=45621.

140. Mamun, A. et al. (2021).

141. Morgan, S. N., Mason, N. M., Levine, N. K., & Zulu-Mbata, O. (2019). Dis-incentivizing sustainable intensification? The case of Zambia's maize-fertilizer subsidy program. *World Development,* 122, 54–69. Retrieved from https://doi.org/10.1016/j.worlddev.2019.05.003

142. Zimmermann A. et al. (2012). Auswirkungen der agrarpolitik 2014-2017, aktualisierung der wichtigsten ergebnisse des ART-Berichts Nr. 744, [Consequences of the agricultural policy for 2014-2017, Update of the principal results set out in ART Report no. 744], *Agroscope Reckenholz Tänikon.*

143. Boffey, D. (2020, February 14). EU spending tens of millions of euros a year to promote meat eating. Retrieved from https://www.theguardian.com/environment/2020/feb/14/eu-spending-tens-of-millions-of-euros-a-year-to-promote-meat-eating

144. Miller, S. (2015). Tax policies, agriculture and the environment. *Michigan State University.* Retrieved from https://doi.org/10.22004/AG.ECON.211085

145. Cnossen, S. (2018). VAT and agriculture: lessons from Europe. *International Tax and Public Finance,* 25(2), 519–551. Retrieved from https://doi.org/10.1007/s10797-017-9453-4

146. OECD. (2020c).

147. Gallet, C. A. (2010). Meat meets meta: A quantitative review of the price elasticity of meat. *American Journal of Agricultural Economics,* 92(1), 258–272. Retrieved from https://doi.org/10.1093/ajae/aap008.

148. Bellmann, C. (2019).; Hill, B., & Blandford, D. (2007).

149. Cnossen, S. (2018).

150. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

151. Backus, G. (2017). Manure management: An overview and assessment of policy instruments in the Netherlands. Retrieved March 18, 2021 https://elibrary.worldbank.org/doi/pdf/10.1596/29250.

152. Gautam, M., Hayde, E. and Zang, Y. (2021) Chapter 12: Agriculture, Subsidies, and Forests. In Designing Fiscal Instruments for Sustainable Forests. The World Bank Group

153. Aytac, D. (2018).

154. Holden, S. T. (2018). Fertilizer and sustainable intensification in Sub-Saharan Africa. *Global Food Security,* 18, 20–26. Retrieved from https://doi.org/10.1016/j.gfs.2018.07.001.

155. World Bank. (n.d.). *World Development Report 2008: Agriculuture for Development.* https://openknowledge.worldbank.org/handle/10986/5990.

156. Vorley, B., & Cotula, L. (2012). Tipping the balance: Policies to shape agricultural investments and markets in favour of small-scale farmers. Retrieved from https://pubs.iied.org/g03470.

157. IFAD. (2013). *Smallholders, food security, and the environment.* Retrieved March 18, 2021, from https://www.ifad.org/documents/38714170/39135645/smallholders_report.pdf/133e8903-0204-4e7d-a780-bca847933f2e

158. Mikolajczyk, S.; Mikulcak, F., Thompson, A. and Long, I. (2021) Unlocking smallholder finance for sustainable agriculture in Southeast Asia. (publication pending)

159. Hill, B., & Blandford, D. (2007).

160. Jenkins, M. & Mulcahy, S. (2018). Businesses' lobbying practices. Transparency International. Retrieved March 18, 2021 from https://knowledgehub.transparency.org/assets/uploads/helpdesk/Businesses-Lobbying-Practices_2018.pdf

161. Tetlow, G., Marshall, J., Pope, T., Rutter, J., & Sodhi, S. (2020). Overcoming the barriers to tax reform. Retrieved from https://www.instituteforgovernment.org.uk/sites/default/files/publications/overcoming-barriers-tax-reform.pdf.

162. Gautam, M., Hayde, E. and Zang, Y. (2021) Chapter 12: Agriculture, Subsidies, and Forests. In Designing Fiscal Instruments for Sustainable Forests. The World Bank Group

163. World Bank Group. (2018b). *Guide to communicating carbon pricing: December 2018.* Retrieved March 19, 2021, from https://openknowledge.worldbank.org/handle/10986/30921

164. Lampkin, N., Stolze, M., Meredith, S., de Porras, M., Haller, L., & Mészáros, D. (2020). *Using Eco-schemes in the new CAP: a guide for managing authorities.* Retrieved March 19, 2021, from https://orgprints.org/37227/.

165. TAPPC. (2021). *TAPP Coalition and other NGO's submit recommendations for UNFCCC working group on agriculture* (COP26 Climate Summit 2021). Retrieved January 17, 2021, from https://www.tappcoalition.eu/nieuws/15125/tapp-coalition-and-other-ngo-s-submit-recommendations-for-unfccc-working-group-on-agriculture--cop26-climate-summit-2021-.

166. Bellmann, C. (2019).

167. Searchinger, T. D. et al. (2020).

168. Dessart, F. J., Barreiro-Hurlé, J., & van Bavel, R. (2019). Behavioural factors affecting the adoption of sustainable farming practices: a policy-oriented review. *European Review of Agricultural Economics,* 46(3), 417–471. Retrieved from https://doi.org/10.1093/erae/jbz019.

169. Searchinger, T. D. et al. (2020).

170. Claassen, R., Breneman, V. E., Bucholtz, S., Cattaneo, A., Johansson, R., & Morehart, M. J. (2004). *Environmental compliance in U.S. agricultural policy: Past performance and future potential.* (Agricultural Economic Reports No. 34033). Retrieved from https://econpapers.repec.org/paper/agsuerser/34033.htm.; Stubbs, M. (2014). *Conservation compliance and U.S. farm policy.* Retrieved from http://www.nationalaglawcenter.org/wp-content/uploads/assets/crs/R42459.pdf.

171. Bas-Defossez, F., Hart, K., & Mottershead, D. (2020). *Keeping track of climate delivery in the CAP?* (p. 24). Retrieved from https://ieep.eu/uploads/articles/attachments/13e4df53-1932-4cf6-ae7c-311b89fb9dca/NABU%20Climate%20tracking%20briefing%20IEEP%20FINAL.pdf?v=63748800992.

172. Öko-Institut. (2020). *Summary of the short study: Improving the contribution of the Common Agricultural Policy to climate change mitigation.* Retrievied March 18, 2021 from https://www.germanwatch.org/sites/default/files/Summary%20Improving%20the%20contribution%20of%20the%20CAP%20to%20climate%20change%20mitigation.pdf ; Bas-Defossez, F. et al. (2020).

173. World Bank Group. (2018b).

174. Searchinger, T. D. et al. (2020).

175. Locke, A. and Lowe, A. (2021).

176. Sterly, S., Jongeneel, R., Pabst, H., Silvis, H., Connor, J., Freshwater, D., et al. (2018). *A comparative analysis of global agricultural policies: lessons for the future CAP.* Research for AGRI Committee. Retrieved from http://op.europa.eu/en/publication-detail/-/publication/f6f26587-9d3c-11e9-9d01-01aa75ed71a1.

177. Lampkin, N., Stolze, M., Meredith, S., de Porras, M., Haller, L., & Mészáros, D. (2020).

178. European Commission. (2021). *List of potential agricultural practices that eco-schemes could support.* Retrieved March 18, 2021, from https://ec.europa.eu/info/sites/info/files/food-farming-fisheries/key_policies/documents/factsheet-agri-practices-under-ecoscheme_en.pdf.

179. Nyssens, C., & Dupeux, B. (2020). *The European Commission must not greenwash the Common Agricultural Policy | CAP Reform.* Retrieved January 25, 2021, from http://capreform.eu/the-european-commission-must-not-greenwash-the-common-agricultural-policy/ ; Pe'er, G., Bonn, A., Bruelheide, H., Dieker, P., Eisenhauer, N., Feindt, P. H., et al. (2020). Action needed for the EU Common Agricultural Policy to address sustainability challenges. *People and Nature,* 2(2), 305–316. https://doi.org/10.1002/pan3.10080.

180. Gaymard, S., Goujon, B., & Lefebvre, M. (2020). Adherence to environmental regulation in the European Union Common Agricultural Policy: Social representations and conditionality among French Farmers. *Journal of Agricultural & Food Information,* 21(3–4), 104–125. Retrieved from https://doi.org/10.1080/10496505.2020.1772078.

181. Espinosa-Goded, M., Barreiro-Hurlé, J., & Dupraz, P. (2013). Identifying additional barriers in the adoption of agri-environmental schemes: The role of fixed costs. *Land Use Policy,* 31, 526–535. https://doi.org/10.1016/j.landusepol.2012.08.016.

182. Wyatt, P. (2019). From a property tax to a land tax – who wins, who loses? *Land Use Policy,* 88, 104172. Retrieved from https://doi.org/10.1016/j.landusepol.2019.104172.

183. OECD. (2020c)

184. OECD. (2020c).; Lincoln Institute. (2007). *The property tax in developing countries: Current practice and prospects.* Retrieved from https://www.lincolninst.edu/publications/working-papers/property-tax-developing-countries; Kelly, R. (2013). *Making the Property Tax Work.* International Center for Public Policy, 40.

185. Searchinger, T. D. et al. (2020).

186. International Center for Trade and Sustainable Development. (2014). *Low-carbon agriculture in Brazil.* Retrieved March 19, 2021, from https://seors.unfccc.int/applications/seors/attachments/get_attachment?code=YNX7N72XA7YZ2P27JFC6R64JLKQO0Y9B.

187. Searchinger, T. D. et al. (2020).; Costa Jr., N. B. da, Baldissera, T. C., Pinto, C. E., Garagorry, F. C., Moraes, A. de, & Carvalho, P. C. de F. (2019). Public policies for low carbon emission agriculture foster beef cattle production in southern Brazil. *Land Use Policy,* 80, 269–273. Retrieved from https://doi.org/10.1016/j.landusepol.2018.10.014.

188. de Mello Brandão Vinholis, M., Macchione Saes, M. S., Carrer, M. J., & Meirelles de Souza Filho, H. (2021). The effect of meso-institutions on adoption of sustainable agricultural technology: A case study of the Brazilian Low Carbon Agriculture Plan. *Journal of Cleaner Production,* 280, 124334. Retrieved from https://doi.org/10.1016/j.jclepro.2020.124334.

189. Searchinger, T. D. et al. (2020).

190. Bellmann, C. (2019).

191. Bellmann, C. (2019).

192. Mikolajczyk, S., Mikulcak, F., Thompson, A., Long, I., (2020).

193. OECD. (2017). *Agricultural policies should shift from price support to greater emphasis on encouraging a resilient and sustainable food sector: 2017.* Retrieved February 4, 2021, from https://www.oecd.org/newsroom/agricultural-policies-should-shift-from-price-support-to-greater-emphasis-on-encouraging-a-resilient-and-sustainable-food-sector.htm.

194. OECD. (2001). OECD Glossary of Statistical Terms - General Services Support Estimate (GSSE) Definition. Reteivev February 8, 2021, from https://stats.oecd.org/glossary/detail.asp?ID=1100.

195. Gautam, M., Hayde, E. and Zang, Y. (2021) Chapter 12: Agriculture, Subsidies, and Forests. In Designing Fiscal Instruments for Sustainable Forests. The World Bank Group

196. OECD. (2019c). Innovation, productivity and sustainability in food and agriculture: Main Findings from Country Reviews and Policy Lessons. Retrieved March 18, 2021, from https://www.oecd-ilibrary.org/agriculture-and-food/innovation-productivity-and-sustainability-in-food-and-agriculture_c9c4ec1d-en.

197. OECD. (2019c).

198. Laborde, D., Mamun, A., Martin, W., Piñeiro, V., Vos, R. (2020).

199. Fan, S., Cho, E. E., & Rue, C. (2018). Returns to public agricultural and rural investments in China. *China Agricultural Economic Review,* 10(2), 215–223. Retrieved from https://doi.org/10.1108/CAER-11-2017-0211.

200. Beintema, N., Pratt, A. N., & Stads, G.-J. (2020). Key trends in Global agricultural research investment (p. 8). Retrieved from https://www.asti.cgiar.org/sites/default/files/pdf/Global-update-ASTI-note.pdf.

201. OECD. (2019c).

202. Kallas, Z., Serra, T., & Gil, J. M. (2010). Farmers' objectives as determinants of organic farming adoption: the case of Catalonian vineyard production. *Agricultural Economics,* 41(5), 409–423. https://doi.org/10.1111/j.1574-0862.2010.00454.x; D'Emden, F. H., Llewellyn, R. S., & Burton, M. P. (2008). Factors influencing adoption of conservation tillage in Australian cropping regions*. *Australian Journal of Agricultural and Resource Economics,* 52(2), 169–182. https://doi.org/10.1111/j.1467-8489.2008.00409.x.

203. Pan, D., Kong, F., Zhang, N., & Ying, R. (2017). Knowledge training and the change of fertilizer use intensity: Evidence from wheat farmers in China. *Journal of Environmental Management,* 197, 130–139. Retrieved from https://doi.org/10.1016/j.jenvman.2017.03.069.

204. Nash, J., Peña, O., Galford, G., Gurwick, N., Pirolli, G., White, J., et al. (2017). *Reducing food loss in agricultural development projects through value chain efficiency.* Retrieved March 18, 2021, from https://ccafs.cgiar.org/resources/publications/reducing-food-loss-agricultural-development-projects-through-value.

205. CIGAR (2012). *Final report: Achieving food security in the face of climate change*. 64. Retrieved March 19, 2021, from https://cgspace.cgiar.org/bitstream/handle/10568/35589/climate_food_commission-final-mar2012.pdf

206. Rosegrant, M. W., Magalhaes, E., Valmonte-Santos, R. A., & Mason-D'Croz, D. (2015). *Returns to Investment in Reducing Postharvest Food Losses and Increasing Agricultural Productivity Growth* (p. 46). https://www.ifpri.org/publication/returns-investment-reducing-postharvest-food-losses-and-increasing-agricultural.

207. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

208. Gromko, D., & Abdurasulova, G. (2019). *Climate change mitigation and food loss and waste reduction: Exploring the business case.* Retrieved March 18, 2021 https://cgspace.cgiar.org/handle/10568/100165.

209. Lore, T. A., Omore, A. O., & Staal, S. J. (2005). *Types, levels and causes of post-harvest milk and dairy losses in sub-Saharan Africa and the Near East: Phase two synthesis report* [Report]. Retrieved March 18, 2021, from https://cgspace.cgiar.org/handle/10568/3741.

210. Nash, J., Peña, O., Galford, G., Gurwick, N., Pirolli, G., White, J., et al. (2017).

211. Ziska, L. H., Bradley, B. A., Wallace, R. D., Bargeron, C. T., LaForest, J. H., Choudhury, R. A., et al. (2018). Climate change, carbon dioxide, and pest biology, managing the future: Coffee as a case study. *Agronomy,* 8(8), 152. Retrieved from https://doi.org/10.3390/agronomy8080152.

212. Ministry of Agriculture, Nature and Food Quality. (2011). *Agriculture and horticulture: December 2011.* Retrieved March 19, 2021, from https://www.government.nl/topics/agriculture/agriculture-and-horticulture.

213. OECD. (2020c).

214. OECD. (2019c).

215. Hermans, F., Geerling-Eiff, F., Potters, J., & Klerkx, L. (2019). Public-private partnerships as systemic agricultural innovation policy instruments – Assessing their contribution to innovation system function dynamics. *NJAS - Wageningen Journal of Life Sciences,* 88, 76–95. https://doi.org/10.1016/j.njas.2018.10.001.

216. USDA. (2019). *Agricultural total factor productivity growth indices for individual countries, 1961-2016: 2019.* Retrieved March 3, 2021, from https://www.ers.usda.gov/data-products/international-agricultural-productivity/.

217. Happer, C., & Wellesley, L. (2019). Meat consumption, behaviour and the media environment: a focus group analysis across four countries. *Food Security,* 11(1), 123–139. Retrieved from https://doi.org/10.1007/s12571-018-0877-1.

218. Davis, K. F., Gephart, J. A., Emery, K. A., Leach, A. M., Galloway, J. N., & D'Odorico, P. (2016). Meeting future food demand with current agricultural resources. *Global Environmental Change,* 39, 125–132. https://doi.org/10.1016/j.gloenvcha.2016.05.004.

219. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

220. Henders, S., Persson, U. M., & Kastner, T. (2015). Trading forests: land-use change and carbon emissions embodied in production and exports of forest-risk commodities. *Environmental Research Letters,* 10(12), 125012. Retrieved from https://doi.org/10.1088/1748-9326/10/12/125012.

221. Davis, K. F. et al. (2016).

222. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

223. Steck, C., & et al. (2018). *Reducing beef consumption: strategic options for the United States, Brazil and China.*

224. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

225. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

226. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

227. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

228. Temme, E. H. M., Vellinga, R. E., de Ruiter, H., Kugelberg, S., van de Kamp, M., et al. (2020). Demand-side food policies for public and planetary health. *Sustainability,* 12(15), 5924. Retrieved from https://doi.org/10.3390/su12155924

229. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

230. Greenpeace. (n.d.). *Feeding the problem: The dangerous intensification of animal farming in Europe.* Greenpeace European Unit. Retrieved March 19, 2021, from https://www.greenpeace.org/eu-unit/issues/nature-food/1803/feeding-problem-dangerous-intensification-animal-farming

231. Allen, A. (2011, October 3). U.S touts fruit and vegetables while subsidizing animals that become meat. *The Washington Post.* Retrieved from https://www.washingtonpost.com/

232. Simon, D. R. (2013). Meatonomics: How the rigged economics of meat and dairy make you consume too much – and how to eat better, live longer and spend smarter. *Conari press.* ISBN: 978-1-57324-620-0

233. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

234. Broeks, M. J., Biesbroek, S., Over, E. A. B., van Gils, P. F., Toxopeus, I., Beukers, M. H., et al. (2020). A social cost-benefit analysis of meat taxation and a fruit and vegetables subsidy for a healthy and sustainable food consumption in the Netherlands. *BMC Public Health,* 20(1), 643. Retrieved from https://doi.org/10.1186/s12889-020-08590-z.

235. Searchinger, T., Waite, R., Hanson, C., & Ranganathan, J. (2018).

236. Boffey, D. (2020, February 14). EU spending tens of millions of euros a year to promote meat eating. *The Guardian.* Retrieved from https://www.theguardian.com/environment/2020/feb/14/eu-spending-tens-of-millions-of-euros-a-year-to-promote-meat-eating.

237. Purdy, C. (2020). Meat production is bad for the planet. Why subsidize it? *QUARTZ.* Retrieved from https://qz.com/1802977/climate-concerns-put-public-funding-for-meat-industries-into-question/

238. Apostolidis, C., & McLeay, F. (2016). Should we stop eating like this? Reducing meat consumption through substitution. *Food Policy,* 65, 74–89. Retrieved https://doi.org/10.1016/j.foodpol.2016.11.002. ; Silva, C., Fisher, P. (2017). Environmental and Health Cost of Meat: How to Reduce Consumption? *JSM Nutritional Disorders.* Retrieved from https://www.jscimedcentral.com/NutritionalDisorders/nutritionaldisorders-1-1004.pdf

239. Broeks, M. J., Biesbroek, S., Over, E. A. B., van Gils, P. F., Toxopeus, I., Beukers, M. H., et al. (2020).

240. Searchinger et al (2019); Gallet, C. (2010). Meat meets meta: A quantitative review of the price elasticity of meat. *American Journal of Agricultural Economics,* 92(1), 258-272. Retrieved from http://www.jstor.org/stable/40647981

241. Charlebois, S., McCormick, M., & Juhasz, M. (2016). Meat consumption and higher prices: Discrete determinants affecting meat reduction or avoidance amidst retail price volatility. *British Food Journal,* 118(9), 2251–2270. Retrieved from https://doi.org/10.1108/BFJ-03-2016-0121

242. European Commission. (2020). *Commnication from the commission to the European Parliament, The Council, The European Economic and Social Commitee and the Commitee of the Regions.* Retrieved March 19, 2021, from https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:52020DC0381&from=EN

243. EPHA & HCWH EUROPE. (2019). *Public procurement for sustainable food environments.* Retrieved March 19, 2021, from https://sustainableprocurement.org/fileadmin/templates/sp_platform/lib/sp_platform_resources//tools/push_resource_file.php?uid=64b994e8.

244. EPHA & HCWH EUROPE. (2019).

245. Cerutti, A. K., Ardente, F., Contu, S., Donno, D., & Beccaro, G. L. (2018). Modelling, assessing, and ranking public procurement options for a climate-friendly catering service. *The International Journal of Life Cycle Assessment,* 23(1), 95–115. Retrieved from https://doi.org/10.1007/s11367-017-1306-y.

246. EPHA & HCWH EUROPE. (2019).

247. Streck, C., Vennard, D., Galt, H., Chagas, T., & Bakhtary, H. (2018). Reducing beef consumption: Strategic options for the United States, Brazil and China. Climate Focus

248. Nutri, V. (2018, December 20). Cardápio escolar sustentável é lançado em São Paulo. Retrieved from http://vegnutri.com.br/cardapio-escolar-sustentavel-e-lancado-em-sao-paulo/

249. Tiehen, L. (2020). Taking a Closer Look at Supplemental Nutrition Assistance Program (SNAP) Participation and Expenditures. Retrieved March 3, 2021, https://www.ers.usda.gov/amber-waves/2020/august/taking-a-closer-look-at-supplemental-nutrition-assistance-program-snap-participation-and-expenditures/.

250. Shenkin, J. D., & Jacobson, M. F. (2010). Using the Food Stamp Program and other methods to promote healthy diets for low-Income consumers. *American Journal of Public Health,* 100(9), 1562–1564. Retrieved from https://doi.org/10.2105/AJPH.2010.198549.

251. Shenkin, J. D., & Jacobson, M. F. (2010).

252. Evaluation of the EU agricultural promotion policy. (n.d.). Retrieved February 3, 2021, https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/1859-Evaluation-of-the-EU-agricultural-promotion-policy/public-consultation.

253. European Commission. (2020). *Work Programme for 2021 in the framework of Regulation (EU) No 1144/2014 of the European Parliament and of the Council of 22 October 2014 on information provision and promotion measures concerning agricultural products implemented in the internal market and in third countries.* Retrieved March 19, 2021, from https://ec.europa.eu/info/food-farming-fisheries/key-policies/common-agricultural-policy/market-measures/promotion-eu-farm-products_en.

254. Cab direct. (n.d.). *Fertilizer subsidies - Which way forward?* Retrieved March 19, 2021, from https://www.cabdirect.org/?target=%2fcabdirect%2fabstract%2f20173122499 ; OECD. (2020a).

255. Laborde Debucquet, D., Mamun, A., Martin, W., Piñeiro, V., & Vos, R. (2020). Modeling the impacts of agricultural support policies on emissions from agriculture. *International Food Policy Research Institute.* Retrieved from https://doi.org/10.2499/p15738coll2.133852

256. Wuepper, D., Le Clech, S., Zilberman, D., Mueller, N., & Finger, R. (2020). Countries influence the trade-off between crop yields and nitrogen pollution. *Nature Food,* 1(11), 713–719. Retrieved from https://doi.org/10.1038/s43016-020-00185-6.

257. OECD. (2020c).

258. Gerber, P. J., Steinfeld, H., Henderson, B., Mottet, A., Opio, C., Dijkman, J., et al. (2013). Tackling climate change through livestock: a global assessment of emissions and mitigation opportunities. T*ackling Climate Change through Livestock: A Global Assessment of Emissions and Mitigation Opportunities.* https://www.cabdirect.org/cabdirect/abstract/20133417883.

259. Huang, Y., Hickman, J. E., & Wu, S. (2018). Impacts of enhanced fertilizer applications on tropospheric ozone and crop damage over sub-Saharan Africa. *Atmospheric Environment,* 180, 117–125. Retrieved from https://doi.org/10.1016/j.atmosenv.2018.02.040

260. Cassou, E. (2018). The greening of farm support programs: international experiences with agricultural subsidy reform (p. 68). Retrieved March 19, 2021, from http://documents1.worldbank.org/curated/en/827371554284501204/pdf/The-Greening-of-Farm-Support-Programs-International-Experiences-with-Agricultural-Subsidy-Reform.pdf.

261. Vitalis, V. (2007). Agricultural subsidy reform and its implications for sustainable development: The New Zealand experience. *Environmental Sciences,* 4(1), 21–40. Retrieved from https://doi.org/10.1080/15693430601108086.

262. Coxhead, I., & Grainger, C. (2018). Fossil fuel subsidy reform in the developing world: Who wins, who loses, and why? *Asian Development Review,* 35(2), 180–203. Retrieved from https://doi.org/10.1162/adev_a_00119.

263. OECD. (2020d). *Designing fossil fuel subsidy reforms in OECD and G20 countries: A robust sequential approach methodology.* OECD Environment Working Papers No. 168. Retrieved March 19, 2021, from https://www.oecd.org/environment/designing-fossil-fuel-subsidies-reforms-in-oecd-and-g20-countries-d888f461-en.htm

264. Akinyemi, O., Alege, P. O., Ajayi, O. O., Adediran, O. S., & Urhie, E. (2017). A simulation of the removal of fuel subsidy and the performance of the agricultural sector in Nigeria using a Dynamic Computable General Equilibrium approach. *Covenant Journal of Business and Social Sciences,* 8(1). Retrieved from http://journals.covenantuniversity.edu.ng/index.php/cjbss/article/view/510.

265. Bielenberg, K. (n.d.). The Big Read: "You can't put cattle on the bus" - the post-budget carbon tax backlash in rural Ireland. Retrieved February 9, 2021, from https://www.independent.ie/business/farming/forestry-enviro/environment/the-big-read-you-cant-put-cattle-on-the-bus-the-post-budget-carbon-tax-backlash-in-rural-ireland-38591231.html.

266. Riedner, L., Mair-Bauernfeind, C., Zimek, M., Brudermann, T., & Stern, T. (2019). E-mobility in agriculture: differences in perception between experienced and non-experienced electric vehicle users. *Clean Technologies and Environmental Policy,* 21, 55–67. Retrieved from https://doi.org/10.1007/s10098-018-1615-2.

267. Government of Ireland. (2020). *Budget 2021 the use of carbon tax funds 2021.* Retrieved March 19, 2021, from http://budget.gov.ie/Budgets/2021/Documents/Budget/Carbon%20tax%20document.pdf.

268. Yáñez-Ruiz, D. R., Morgavi, D., Misselbrook, T., Melle, M., Dreijere, S., Aes, O., et al. (2017). *Mini-paper: Feeding strategies to reduce methane and ammonia emissions.* Retrieved from https://ec.europa.eu/eip/agriculture/sites/agrieip/files/fg18_mp_feeding_strategies_2017_en.pdf.

269. Huang, Y., Hickman, J. E., & Wu, S. (2018).

270. Searchinger, T. D. et al. (2020).; Cassou, E. (2018).

271. Cassou, E. (2018).

272. Feedback. (2020). *Butchering the Planet: The big-name financiers bankrolling livestock corporations and climate change*. https://feedbackglobal.org/wp-content/uploads/2020/07/FeedbackReport-ButcheringPlanet-Jul20-HighRes.pdf.

273. Food and Agriculture Organization of the United Nations. (2018). *Agricultural investment funds for development. Descriptive analysis and lessons learned from fund management, performance and private–public collaboration |Policy Support and Governance*. Retrieved January 9, 2021, from http://www.fao.org/policy-support/tools-and-publications/resources-details/fr/c/1189068/.

274. Labonte, M. (2017, August 17). Who regulates whom? An overview of the u. S. Financial regulatory framework [Report]. UNT Digital Library. Retrieved from https://digital.library.unt.edu/ark:/67531/metadc1020797/

275. Lee, E. (2014). *The soft law nature of Basel III and international financial regulations (SSRN Scholarly Paper No. ID 2553666).* Retrieved from https://papers.ssrn.com/abstract=2553666.

276. Spiegel, A., Wiener, D., Schneider-Roos, K., & Diamant, N. (2019). *The missing link: linking financial stability with environmental stability.* https://www.sustainablefinance.ch/upload/rm/the-missing-link-policy-recommendations.pdf?_=1551198565000.

277. IIGCC. (2021). https://www.iigcc.org/resources/

278. SBN. (2020). *Sustainable banking network: background.* Retrieved from https://www.ifc.org/wps/wcm/connect/4f5b57a2-6cb1-4317-9864-36b73b9d53f9/SBN+Background+20201102.pdf?MOD=AJPERES&CVID=nm8elvP.

279. Task Force on Climate-related Financial Disclosures. (2020). 2020 Status Report. Retrieved from https://assets.bbhub.io/company/sites/60/2020/09/2020-TCFD_Status-Report.pdf.

280. Network for Greening the Financial System. (2019). *A call for action: Climate change as a source of financial risk.* Retrieved March 19, 2021, from https://www.ngfs.net/sites/default/files/medias/documents/ngfs_first_comprehensive_report_-_17042019_0.pdf.

281. Network for Greening the Financial System. (2019).

282. International Platform on Sustainable Finance. (2020). *Annual report.* Retrieved March 19, 2021, from https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/international-platform-sustainable-finance-annual-report-2020_en.pdf.

283. The International Financial Reporting Standards Foundation. (n.d.). About us. Retrieved April 2, 2021, from https://www.ifrs.org/about-us/. The International Financial Reporting Standards Foundation (2021). *IFRS Foundation Trustees announce strategic direction and further steps based on feedback to sustainability reporting consultation.* Retrieved April 2, 2021, from https://www.ifrs.org/news-and-events/2021/03/trustees-announce-strategic-direction-based-on-feedback-to-sustainability-reporting-consultation/; International Organization of Securities Commissions. (2021). Media release. Retrieved February 24, 2021, from https://www.iosco.org/news/pdf/IOSCONEWS594.pdf.; The International Financial Reporting Standards Foundation. (2021). *IFRS Foundation Trustees announce working group to accelerate convergence in global sustainability reporting standards focused on enterprise value.* Retrieved April 14, 2021, from https://www.ifrs.org/news-and-events/news/2021/03/trustees-announce-working-group/#:~:text=The%20Trustees%20of%20the%20IFRS,board%20under%20the%20governance%20of

284. IMF. (n.d.). *Macroeconomic and financial policies for climate change mitigation: A review of the literature.* Retrieved March 19, 2021, from https://www.imf.org/en/Publications/WP/Issues/2019/09/04/Macroeconomic-and-Financial-Policies-for-Climate-Change-Mitigation-A-Review-of-the-Literature-48612 ; Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., & Tanaka, M. (2018). Climate change challenges for central banks and financial regulators. *Nature Climate Change,* 8(6), 462–468. Retrieved from https://doi.org/10.1038/s41558-018-0175-0 ; Park, H., & Kim, J. D. (2020). Transition towards green banking: role of financial regulators and financial institutions. *Asian Journal of Sustainability and Social Responsibility,* 5(1), 5. Retrieved from https://doi.org/10.1186/s41180-020-00034-3.

285. IMF. (n.d.).; UNEP. (2017). *On the role of central banks in enhancing green finance.* Retrieved from http://unepinquiry.org/wp-content/uploads/2017/02/On_the_Role_of_Central_Banks_in_Enhancing_Green_Finance.pdf.

286. Labonte, M. (2020).

287. Task Force on Climate-related Financial Disclosures. (2017). *Recommendations of the Task Force on Climate-related Financial Disclosures* (p. 74). Retrieved March 19, 2021, from https://www.fsb-tcfd.org/recommendations/.

288. Monasterolo, I., Battiston, S., Janetos, A. C., & Zheng, Z. (2017). Vulnerable yet relevant: the two dimensions of climate-related financial disclosure. *Climatic Change,* 145(3), 495–507. Retrieved from https://doi.org/10.1007/s10584-017-2095-9.

289. Campiglio, E., Dafermos, Y., Monnin, P., Ryan-Collins, J., Schotten, G., & Tanaka, M. (2018). Climate change challenges for central banks and financial regulators. *Nature Climate Change,* 8(6), 462–468. Retrieved from https://doi.org/10.1038/s41558-018-0175-0

290. Feridun, M., & Güngör, H. (2020a). Climate-related prudential risks in the banking sector: A review of the emerging regulatory and supervisory practices. *Sustainability,* 12(13), 5325. Retrieved from https://doi.org/10.3390/su12135325.; Labonte, M. (2020).; Monasterolo, I. et al. (2017).

291. Campiglio, E. et al. (2018).; WWF. (2019). *The nature of risk: A framework for understanding nature-related risk to business.* Retrieved March 19, 2021, from https://c402277.ssl.cf1.rackcdn.com/publications/1255/files/original/WWF_Nature_of_Risk.FINAL2.pdf?1568216828.

292. WWF. (2019).; Global Canopy & Vivid Economics. (2020). The case for a task force on nature-related financial disclosures. https://globalcanopy.org/wp-content/uploads/2020/11/Task-Force-on-Nature-related-Financial-Disclosures-Full-Report.pdf.

293. WWF. (2019).

294. Task Force on Climate-related Financial Disclosures. (2020).

295. Global Canopy & Vivid Economics. (2020). *The Case for a Task Force on Nature-related Financial Disclosures.* Retrieved March 19, 2021, from https://globalcanopy.org/insights/publication/the-case-for-a-task-force-on-nature-related-financial-disclosures/

296. Feridun, M., & Güngör, H. (2020b). Climate-Related Prudential Risks in the Banking Sector: A Review of the Emerging Regulatory and Supervisory Practices. *Sustainability,* 12(13), 5325. Retrieved from https://doi.org/10.3390/su12135325.

297. Task Force on Climate-related Financial Disclosures. (2020).

298. Global Canopy & Vivid Economics. (2020).

299. Feridun, M., & Güngör, H. (2020b).

300. Guarnaschelli, S., Limketkai, B., & Vandeputte, P. (2018). Financing sustainable land use – Unlocking business opportunities in sustainable land use with blended finance". KOIS Investment. Retrieved November 4 2020, from, https://assets.ctfassets.net/bbfdx7vx8x8r/7iGPF09ucEeweAU8yOe0eU/eeabb872454c6687e98a434a270d5b2c/Kois_FinancingSLU.pdf

301. University of Cambridge Institute for Sustainability Leadership. (2020).; Global Canopy. (2020). *How financial institutions are exposed to deforestation risks.* Retrieved March 19, 2021, from, https://globalcanopy.org/insights/

302. International Institute for Sustainable Development. (IISD). Finance Research Institute, Development Research Center of the State Council, & United Nations Environment Programme. (2015). Greening China's financial system. Retrieved March 19, 2021, from https://www.iisd.org/publications/greening-chinas-financial-system.

303. Forest & Finance. (2020).

304. Forest & Finance. (2020).

305. Forest & Finance. (2020).

306. Tropical Forest Alliance. (2017). *The role of the financial sector in deforestation-free supply chains.* Retrieved from https://www.tropicalforestalliance.org/assets/Uploads/TFA2020_Framing_Paper_130117.pdf.

307. Forest & Finance. (2020).

308. Forest & Finance. (2020). *Is your money destroying rainforests and violating rights?* http://forestsandfinance.org/wp-content/uploads/2020/08/FF_Briefing_Sep_2020-EN.pdf; Warmerdam, W. (2020).Retrieved March 18, 2021, from https://www.ran.org/wp-content/uploads/2020/09/FF_Briefing_2020-EN.pdf

309. Clapp. J. (2014). Financialization, distance and global food politics. *The Journal of Peasant Studies,* 41(5), 797–814. Retrieved from https://doi.org/10.1080/03066150.2013.875536.

310. Palley, T. (2008). Financialization: What it is and why it matters, IMK Working Paper, No. 04/2008, Hans-Böckler-Stiftung, Institut für Makroökonomie und Konjunkturforschung (IMK). Retrieved from http://nbn-resolving.de/urn:nbn:de:101:1-20080818136

311. Batini, N. (2019, July 1). Transforming agri-food sectors to mitigate climate change: The role of green finance. Retrieved January 9, 2021, http://elibrary.duncker-humblot.com/journals/id/25/vol/88/iss/2028/art/11160/.

312. Fairbairn, M. (2014). 'Like gold with yield': evolving intersections between farmland and finance. *The Journal of Peasant Studies,* 41(5), 777–795. Retrieved from https://doi.org/10.1080/03066150.2013.873977.

313. Batini, N. (2019, July 1).

314. IPES. (2017). *Too big to feed: Exploring the impacts of mega-mergers, concentration, concentration of power in the agri-food sector.* Retrieved March 19, 2021, from http://www.ipes-food.org/_img/upload/files/Concentration_FullReport.pdf.

315. Mooney, P. (2017).; Clapp, J. (2015). ABCD and beyond: From grain merchants to agricultural value chain managers. *Canadian Food Studies / La Revue Canadienne Des Études Sur l'alimentation,* 2, 126. https://doi.org/10.15353/cfs-rcea.v2i2.84.

316. Ouma, S. (2016). From financialization to operations of capital: Historicizing and disentangling the finance–farmland-nexus. *Geoforum,* 72, 82–93. Retrieved from https://doi.org/10.1016/j.geoforum.2016.02.003

317. Dutch Netherlands Bank. (2020). *Indebted to nature: Exploring biodiversity risks for the Dutch financial sector.* De Nederlandsche Bank (DNB) and PBL Netherlands Environmental Assessment Agency. Retrieved March 19, 2021, from https://www.dnb.nl/en/actueel/dnb/dnbulletin-2020/indebted-to-nature/

318. Dutch Netherlands Bank. (2020).

319. Gregory, M. (2016). *Financing land grabs and deforestation: the role of EU banks and investors.* Retrieved March 19, 2021, from https://www.fern.org/fileadmin/uploads/fern/Documents/Financing%20land%20grabs%20final.pdf.

320. Baldock, C., Mcluckie, M., Mosnier, F., & Willis J. (2020). Exchange traded deforestation. *Briefing Paper: December 2020.* Retrieved from https://planet-tracker.org/tracker-programmes/food-and-land-use/land-use/; Deforestation free funds. (n.d.). Deforestation Free Funds. Retrieved March 19, 2021, from https://www.deforestationfreefunds.org

321. Baldock, C., Mcluckie M., Mosnier F., & Willis J. (2020).

322. Vanguard. (2020). *Vanguard Investment Stewardship Insights Climate risk governance: What Vanguard expects of companies and their boards.* Retrieved March 19, 2021, from https://about.vanguard.com/investment-stewardship/perspectives-and-commentary/ISCLRG_062020.pdf; Fink, L. (2020). A Fundamental Reshaping of Finance: Larry Fink's Letter to CEOs. January 10, 2021, https://www.

blackrock.com/corporate/investor-relations/larry-fink-ceo-letter; State Street Will Achieve Carbon Neutrality in 2020 and Commits to More Absolute Reductions. (2020, August 10). January 10, 2021, https://newsroom.statestreet.com/press-releases/press-release-details/2020/State-Street-Will-Achieve-Carbon-Neutrality-in-2020-and-Commits-to-More-Absolute-Reductions/default.aspx.; Vanguard. (2020). Fink, L. (2020). State Street Will Achieve Carbon Neutrality in 2020 and Commits to More Absolute Reductions. (2020, August 10).

323. Krogstrup, S. & Oman, W. (2019). *Macroeconomic and financial policies for climate change mitigation: A Review of the Literature: 2019.* IMF Working Paper WP/19/185. Retrieved March 19, 2021, from https://www.imf.org/en/Publications/WP/Issues/2019/09/04/Macroeconomic-and-Financial-Policies-for-Climate-Change-Mitigation-A-Review-of-the-Literature-48612

324. Condon, M. et al. (2021). *Mandating disclosure of climate-related financial risk: February 2021.* Institute for Policy Integrity and Environmental Defense Fund. Retrieved March 19, 2021, from https://policyintegrity.org/files/publications/Mandating_Climate_Risk_Financial_Disclosures.pdf

325. Spiegel, A. et al. (2019).; Krogstrup, S. & Oman, W. (2019).

326. Lagarde, C. (2020, February 27). Climate change and the financial sector. Speech by Christine Lagarde, President of the ECB, at the launch of the COP 26 Private Finance Agenda. January 10, 2021, https://www.ecb.europa.eu/press/key/date/2020/html/ecb.sp200227_1~5eac0ce39a.en.html.

327. Autorité de Contrôle Prudentiel et d Résolution. (2020). *Scenarios and main assumptions of the ACPR pilot climate exercise.* Retrieved March 19, 2021, from https://acpr.banque-france.fr/en/scenarios-and-main-assumptions-acpr-pilot-climate-exercise.

328. Marchant, C. (2021). *Bank of England remits updated with increased focus on environment.* March 4, 2021. Environmental Finance. Retrieved March 19, 2021, from https://www.environmental-finance.com/content/news/bank-of-england-remits-updated-with-increased-focus-on-environment.html

329. Park, H., & Kim, J. D. (2020).

330. Park, H., & Kim, J. D. (2020).

331. Bergman, M., Karp, B., Sacksteder, E., Grader, S., Mi, F., O'Brien, W, et al. (2020, November 25). In global first, the United Kingdom moves toward mandatory climate-related disclosures by 2025. Retrieved January 10, 2021, from https://www.paulweiss.com/practices/sustainability-esg/publications/in-global-first-the-united-kingdom-moves-toward-mandatory-climate-related-disclosures-by-2025?id=38652.

332. Davidson, B. (2019, October 1). Is it time to make climate-related corporate disclosures mandatory? | ACCA Global. Retrieved January 10, 2021, from https://www.accaglobal.com/hk/en/member/member/accounting-business/2019/10/corporate/mandatory-disclosures.html.

333. See, for instance, the in depth assessment of the barriers in the financial market to scale up green investments, with the lack of disclosures by corporates being an highly relevant driver: Ameli N., Drummond P., Bisaro A., Grubb M., & Chenet H. (2020). Climate finance and disclosure for institutional investors: why transparency is not enough. *Climatic Change,* 160, 565–589. Retrieved from https://doi.org/10.1007/s10584-019-02542-2

334. OECD. (2019). *Enhancing disclosure and due diligence for climate-related risks.* Forum on Green Finance and Investment 2019. OECD. Retrieved March 19, 2021, from https://www.oecd.org/cgfi/forum/Disclosure-and-Due-diligence-for-Climate-related-Risks-background-session-note-CGFI-Forum-2019.pdf; Making sense of banks' climate targets. (2020, December 12). *The Economist.* https://www.economist.com/finance-and-economics/2020/12/12/making-sense-of-banks-climate-targets.

335. Chain Reaction Research. (2019). *The chain: Deforestation as a climate risk for investors: June 2019.* Retrieved March 19, 2021 from https://chainreactionresearch.com/the-chain-deforestation-as-a-climate-risk-for-investors/

336. Davidson, B. (2019, October 1).; CDP (2019). *The money trees – The role of corporate action in the fight against deforestation; CDP. (2019). 70% of the companies fail to disclose impacts on world's forests: July 2019.* Retrieved March 19, 2021, from https://www.cdp.net/en/articles/media/70-of-companies-fail-to-disclose-impact-on-worlds-forests; Robinson, N. (2019, August 1). *Are we headed towards mandatory climate disclosure?* | Climate Disclosure Standards Board. Retrieved January 10, 2021, from https://www.cdsb.net/mandatory-reporting/947/are-we-headed-towards-mandatory-climate-disclosure.; Task Force on Climate-related Financial Disclosures. (2020).; 100% Climate Disclosure. (2018). *Methodology.* https://climatedisclosure100.info/wp-content/uploads/2018/10/100-Club-Criteria.pdf.

337. Climate Disclosure Standards Board. (2020). *The state of EU environmental disclosure in 2020.* https://www.cdsb.net/nfrd2020.; Climate Disclosure Standards Board. (2020).; Martin, R. (2020). *Insights into integrated reporting 4.0. The story so far: 2020.* https://integratedreporting.org/resource/insights-into-integrated-reporting-4-0-the-story-so-far-acca/

338. Nelson, M. (2020). *How the agriculture sector adopted climate-related disclosures.* Ernest & Young, June 2020. Retrieved March 19, 2021, from https://www.ey.com/en_us/climate-change-sustainability-services/how-the-agriculture-sector-adopted-climate-related-disclosures

339. World Benchmarking Alliance. (2020). *Assessing the word's 350 most influential food and agriculture companies on their commitments – Baseline assessment: December 2020.* Food and Agriculture Benchmark. Retrieved March 19, 2021, from https://www.worldbenchmarkingalliance.org/publication/food-agriculture/

340. UNCTAD secretariat. (2020). *Climate-related financial disclosures in mainstream entity reporting: Good practices and key challenges: September 2020.* [Note by the UNCTAD secretariat]. Geneva: United Nations. Retrieved March 19, 2021, from https://unctad.org/system/files/official-document/ciiisard94_en.pdf

341. *The Economist*. (12 December, 2020).

342. Partnership for Carbon Accounting Financials. (2020). *The global GHG accounting and reporting standard for the financial industry* (p. 134). Retrieved March 19, 2021, from https://carbonaccountingfinancials.com/files/downloads/PCAF-Global-GHG-Standard.pdf.

343. Credit Portfolio Alignment. (2020). *An application of the PACTA methodology by Katowice Banks in partnership with the 2 Degrees Investing Initiative*. Retrieved March 19, 2021, from https://2degrees-investing.org/wp-content/uploads/2020/09/Katowice-Banks-2020-Credit-Portfolio-Alignment.pdf.

344. CDSB. (2020). *Progress towards a comprehensive corporate reporting system: September 2020.* Retrieved January 10, 2021, https://www.sasb.org/blog/progress-towards-a-comprehensive-corporate-reporting-system/.

345. Task Force on Climate-related Financial Disclosures. (2020). *100% climate disclosure: 2018.* Retrieved March 19, 2021, from https://assets.bbhub.io/company/sites/60/2020/10/TCFD_Booklet_FNL_Digital_March-2020.pdf

346. ECB. (2020). *Guide on climate-related and environmental risks: November 2020*. Retrieved March 19, 2021, from https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks~58213f6564.en.pdf?1f98c498cb869019ab89194a118b9db4 ; Task Force on Climate-related Financial Disclosures. (2020).; OECD. (2019). *Enhancing disclosure and due diligence for climate-related risks. forum on green finance and investment: October 2019.* Retrieved March 19, 2021, from https://www.oecd.org/cgfi/forum/Disclosure-and-Due-diligence-for-Climate-related-Risks-background-session-note-CGFI-Forum-2019.pdf; *The Economist*. (12 December 2020).

347. Bluet, B., & Emfel, M. (2020, August 28). Taskforce on Nature-related Financial Disclosure (TNFD). Retrieved March 3, 2021, from https://wwf.panda.org/discover/our_focus/finance/?666111/Global-Call-for-a-Taskforce-on-Nature-related-Financial-Disclosure-TNFD.; Global Canopy & Vivid Economics. (2020). The case for a task force on nature-related financial disclosures. Retrieved March 19, 2021, from https://globalcanopy.org/insights/publication/the-case-for-a-task-force-on-nature-related-financial-disclosures/#:~:text=The%20Case%20for%20a%20Task%20Force%20on%20Nature%2Drelated%20Financial%20Disclosures,-Publication%20%2F%2023%20Sep&text=Nature%20and%20the%20ecosystem%20services,to%20businesses%20across%20the%20economy.&text=Yet%20at%20the%20same%20time,nature%20at%20an%20unprecedented%20rate.

348. Steinweg, T., Rijk, G., & Piotrowski, M. (2021). Chain reaction research applies TCFD-aligned framework to assess deforestation risks, chain reaction research. Retrieved March 19, 2021, from https://chainreactionresearch.com/report/chain-reaction-research-applies-tcfd-aligned-framework-to-assess-deforestation-risks/; Global Canopy & Vivid Economics. (2020).

349. Davidson, B. (2019, October 1).

350. Robinson, N. (2019, August 1).

351. World Economic Forum. (2019). *The global risks report 2019.* Retrieved March 19, 2021, from http://www3.weforum.org/docs/WEF_Global_Risks_Report_2019.pdf.World

352. ECB. (2020). *Ramping up climate-related and environmental risk supervision. Supervision Newsletter: November 2020*. Retrieved March 19, 2021, from https://www.bankingsupervision.europa.eu/press/publications/newsletter/2020/html/ssm.nl201118_4.en.html

353. Climate disclosure standards board and CDP. (2019). *Roadmap for adopting the TCFC recommendations: 2019.* Retrieved March 19, 2021, from https://www.cdsb.net/sites/default/files/roadmap_for_adopting_the_tcfd_recommendations.pdf.

354. Climate Disclosure Standards Board and CDP. (2019).

355. Global Investors for Sustainable Development Alliance. (2020). *Renewed, recharged and reinforced. Urgent actions to harmonize and scale sustainable finance: July, 2020.* Retrieved March 19, 2021, from https://www-un-org.eur.idm.oclc.org/development/desa/financing/sites/www.un.org.development.desa.financing/files/2020-08/Renewed, Recharged and Reinforced (GISD 2020) vF.pdf

356. Global Investors for Sustainable Development Alliance. (2020).

357. Climate disclosure standards board and CDP. (2019).; Global Investors for Sustainable Development Alliance. (2020).

358. HM Treasury. (2020).

359. Financial Conduct Authority. (2020). *Proposals to enhance climate-related disclosures by listed issuers and clarification of existing disclosure obligations* (Policy Statement No. PS20/17). Retrieved March 19, 2021, from https://www.fca.org.uk/publication/policy/ps20-17.pdf.; Financial Conduct Authority. (2020, November 9). *Green Horizon Summit: Rising to the climate challenge*. Retrieved December 2, 2021, from https://www.fca.org.uk/news/speeches/green-horizon-summit-rising-climate-challenge.

360. HM Treasury. (2020).

361. Ministry for the Environment. (2020). *Mandatory climate-related financial disclosures: September 2020*. Retrieved January 13, 2021, from https://www.mfe.govt.nz/climate-change/climate-change-and-government/mandatory-climate-related-financial-disclosures.

362. Ministry for the Environment. (2020).

363. Ministry for the Environment. (2020).

364. Ministry for the Environment. (2020).

365. Monetary Authority of Singapore. (2020a). *Guidelines on environmental risk management (Asset Managers): 2020.* Retrieved March 19, 2021, from https://www.mas.gov.sg/-/media/MAS/Regulations-and-Financial-Stability/Regulations-Guidance-and-Licensing/Securities-Futures-and-Fund-Management/Regulations-Guidance-and-Licensing/Guidelines/Guidelines-on-Environmental-Risk-

Management-for-Asset-Managers.pdf; Monetary Authority of Singapore. (2020b). *Guidelines on environmental risk management (Banks): 2020.* Retrieved March 19, 2021 https://www.mas.gov.sg/-/media/MAS/Regulations-and-Financial-Stability/Regulations-Guidance-and-Licensing/Commercial-Banks/Regulations-Guidance-and-Licensing/Guidelines/Guidelines-on-Environmental-Risk---Banks/Guidelines-on-Environmental-Risk-Management-for-Banks.pdf; Monetary Authority of Singapore. (2020c). *Guidelines on environmental risk management (Insurers): 2020.* Retrieved March 19, 2021, from https://www.mas.gov.sg/-/media/MAS/Regulations-and-Financial-Stability/Regulations-Guidance-and-Licensing/Insurance/Regulations-Guidance-and-Licensing/Guidelines/Guidelines-on-Environmental-Risk-Management-Insurers.pdf.

366. Responsible Investor (2021). *Japanese firms should disclose sustainability efforts, says proposed governance code update.* 6th April 2021, from https://www.responsible-investor.com/articles/japanese-firms-should-disclose-sustainability-efforts-says-proposed-governance-code-update

367. Brydon, D. (2019). *Assess, assure and inform improving audit quality and effectiveness. Report of the independent review into the quality and effectiveness of audit.* Retrieved March 19, 2021, from https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/852960/brydon-review-final-report.pdf.

368. McCraine, S., et al. (2019).; Global Canopy & Vivid Economics. (2020).; De Nederlandsche Bank. (2020).

369. Navarra, C. (2020). *Corporate due diligence and corporate accountability. European added value unit: 2020.* European Parliamentary Research Service (EPRS). Retrieved March 19, 2021, from https://www.europarl.europa.eu/RegData/etudes/STUD/2020/654191/EPRS_STU(2020)654191_EN.pdf

370. CDSB. (2020). *CDSB warns a comply or explain approach is not sufficient in reaction to UK FCA's Proposals to enhance climate-related disclosure by listed issuers and clarification of existing disclosure obligations: March 2020.* Retrieved March 19, 2021 https://www.cdsb.net/listing-requirement/1019/cdsb-warns-comply-or-explain-approach-not-sufficient-reaction-uk-fca%E2%80%99s

371. EU Technical Expert Group of Sustainable Finance. (2020). *Usability guide: EU Green Bond Standard.* Retrieved March 19, 2021, from https://ec.europa.eu/info/sites/info/files/business_economy_euro/banking_and_finance/documents/200309-sustainable-finance-teg-green-bond-standard-usability-guide_en.pdf.

372. EU Technical Expert Group of Sustainable Finance. (2020).; European Central Bank (2020). *Guide on climate-related and environmental risks: November 2020.* Retrieved March 19, 2021, from https://www.bankingsupervision.europa.eu/ecb/pub/pdf/ssm.202011finalguideonclimate-relatedandenvironmentalrisks~58213f6564.en.pdf?1f98c498cb869019ab89194a118b9db4

373. Heinsbroek, A., & Boom, J. (2020). *Unravelling EU sustainability regulation: how disclosure and taxonomy work: October 2020.* Retrieved January 10, 2021, from https://www.duurzaam-beleggen.nl/blog/unravelling-eu-sustainability-regulation-how-disclosure-and-taxonomy-work/.

374. OECD. (2020d). Building environmental resilience and responding to global crisis through supply chain due diligence: June 2020. OECD Global Forum on Responsible Business Conduct. Retrieved March 19, 2021, from https://mneguidelines.oecd.org/globalpartnerships/responsible-supply-chains-asia/background-note-building-environmental-resilience-and-responding-to-global-crises-through-supply-chain-due-diligence.pdf

375. Joint Committee of the European Supervisory Authorities. (2020). *Joint consultation paper: ESG disclosures: 2020.* Retrieved March 19, 2021, from https://www.esma.europa.eu/sites/default/files/jc_2020_16_-_joint_consultation_paper_on_esg_disclosures.pdf.

376. Joint Committee of the European Supervisory Authorities. (2020).

377. Joint Committee of the European Supervisory Authorities. (2020).

378. Joint Committee of the European Supervisory Authorities. (2020).

379. O'Malley, A. & Bredin C. (2021, February 15). The new ESG framework: *Principal adverse impact reporting.* Retrieved March 19, 2021, from https://www.mondaq.com/ireland/wealth-asset-management/947990/the-new-esg-framework-principal-adverse-impact-reporting#:~:text=The%20%22principal%20adverse%20impact%20statement,employee%20matters%2C%20respect%20for%20human.

380. Joint Committee of the European Supervisory Authorities. (2020).

381. Heinsbroek, A., & Boom, J. (2020, October 30).

382. Non-Financial Reporting Directive. (2014) – *Directive 2014/95/EU of the European Parliament and the Council of 22 October 2014 amending Directive 2013/34/EU as regards disclosure of non-financial and diversity information by certain large undertakings and groups.* Retrieved March 19, 2021, from https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A32014L0095

383. PWC. (2020). Sustainable finance disclosure regulation (SFDR). Retrieved from https://www.pwc.ch/en/publications/2020/sustainable-finance-disclosure-regulation.pdf.; Stehl, K., Ng, L., Feehily, M., & Bührle, D. S. (2020). *EU Advances ESG Related Reforms to Financial Services Regulations | Lexology.* January 2021. Retrieved from https://www.lexology.com/library/detail.aspx?g=756e422d-4f61-4dbe-a908-106714a9d823.

384. DNB; European Banking Authority. (2020). *On management and supervision of ESG risks for credit institutions and investment firms.* EBA Discussion Paper, 30 October 2020, EBA/DP/2020/03. Retrieved March 19, 2021, from https://www.eba.europa.eu/calendar/discussion-paper-management-and-supervision-esg-risks-credit-institutions-and-investment

385. MSCI

386. Basel Committee on Banking Supervision. (2020). *Climate-related financial risks: a survey of current initiatives: April 2020.* Bank for

International Settlements. Retrieved March 19, 2021, from https://www.bis.org/bcbs/publ/d502.pdf

387. ECB. (2020). *Guide on climate-related and environmental risks; and Basel Committee on Banking Supervision (2020). Climate-related financial risks: a survey of current initiatives. Bank for International Settlements: April 2020.* Retrieved March 2021, from https://www.bis.org/bcbs/publ/d502.pdf

388. Ascui, F., & Cojoianu, T. F. (2019). Implementing natural capital credit risk assessment in agricultural lending. *Business Strategy and the Environment,* 28(6), 1234–1249. Retrieved from https://doi.org/10.1002/bse.2313

389. Forest 500. (2020). *Fuelling the fires: why investors need to do more to the protect the Amazon*. Global Canopy. Retrieved March 20, 2021, from https://globalcanopy.org/insights/publication/fuelling-the-fires-why-investors-need-to-do-more-to-protect-the-amazon/

390. Smit, L. et al. (2020). *Study on due diligence requirements through the supply chain.* British Institute of International and Comparative Law, Civic Consulting, and London School of Economics and Political Science. Retrieved March 20, 2021, from https://op.europa.eu/en/publication-detail/-/publication/8ba0a8fd-4c83-11ea-b8b7-01aa75ed71a1/language-en

391. Navarra, C. (2020).

392. Navarra, C. (2020).

393. Steinweg, T., Rijk, G., & Piotrowski, M. (2021).

394. Navarra, C. (2020).

395. Smit, L. et al. (2020).

396. Regardless of the industry, firm size, and maturity in supply chain management, the costs for full OECD Due Diligence implementation are relatively low compared to company sales. Blome, C. et al. (2016). *Stopping conflict minerals with the OECD Guidance for responsible mineral supply chains: Status Quo in Europe.* University of Sussex. Retrieved March 20, 2021, from http://sro.sussex.ac.uk/id/eprint/65452/; Navarra, C. (2020).

397. Navarra, C. (2020).

398. Task Force on Climate-related Financial Disclosures. (2020).

399. Task Force on Climate-related Financial Disclosures. (2020).

400. European Banking Authority. (2020).

401. Ellfeldt, A. (2020). *How a climate 'Stress Test' can foresee collapsing banks: December 2020.* Retrieved January 19, 2021, from https://www.scientificamerican.com/article/how-a-climate-stress-test-can-foresee-collapsing-banks/.

402. For a detailed discussion regarding the uncertainty and tipping points posed by climate change see: Weitzman, M. L. (2009). On modeling and interpreting the economics of catastrophic climate change. *Review of Economics and Statistics,* 91(1), 1–19. Retrieved March 19, 2021, from https://doi.org/10.1162/rest.91.1.1.; Solomon, S., Plattner, G.K., Knutti, R., & Friedlingstein, P. (2009). Irreversible climate change due to carbon dioxide emissions. *Proceedings of the National Academy of Sciences,* 106(6), 1704–1709. Retrieved from https://doi.org/10.1073/pnas.0812721106

403. Battiston, S., Monasterolo, I., & Mandel, A. (2019). CLIMAFIN Handbook: Pricing Forward-Looking Climate Risks Under Uncertainty. *SSRN Electronic Journal.* Retrieved from https://doi.org/10.2139/ssrn.3476586.; and Avery Ellfeldt. (2020, December 4).

404. Prudential Regulation Authority, Supervisory Statement SS3/19.

405. The BES is the part of the Bank's stress testing framework used to explore less well-understood risks that are not neatly linked to the financial cycle. For more details of the 2021 BES see: Bank of England. (2020). *The Bank of England is restarting the Climate Biennial Exploratory Scenario (CBES): March 2020.* Retrieved March 20, 2021, from https://www.bankofengland.co.uk/news/2020/november/the-boe-is-restarting-the-climate-biennial-exploratory-scenario.

406. I.e., earlier and delayed policy action to reach the Paris Agreement target; as well as a 'no additional policy action' scenario where the Paris target is not met, resulting in more severe physical risks. Bank of England. (2019). *The 2021 biennial exploratory scenario on the financial risks from climate change.* Retrieved March 20, 2021, from https://www.bankofengland.co.uk/-/media/boe/files/paper/2019/the-2021-biennial-exploratory-scenario-on-the-financial-risks-from-climate-change.pdf?la=en&hash=73D06B913C73472D0DF21F18DB71C2F454148C80.

407. UK Government. (2020). *Environment Bill: 2020.* Retrieved March 20, 2021, from https://www.gov.uk/government/publications/environment-bill-2020; Forest Trends. (2020). *Meaningful supply chain legislation: Lessons from the US Tariffs Act for regulating the trade in forest-risk commodities: July 2020.* Retrieved March 20, 2021, from https://www.forest-trends.org/blog/meaningful-supply-chain-legislation-lessons-from-the-us-tariffs-act-for-demand-for-regulating-the-trade-in-forest-risk-commodities/

408. European Parliament resolution of 22 October 2020 with recommendations to the Commission on an EU legal framework to halt and reverse EU-driven global deforestation (2020/2006(INL). Retrieved March 20, 2021, from https://www.europarl.europa.eu/doceo/document/TA-9-2020-0285_EN.html

409. Partiti, for instance, provides a detailed rationale for how such measures can be justified under Article XX of that GATT, in particular under XX(g), which aims to protect exhaustible natural resources such as flora and fauna. Partiti, E. (2019). *Regulating trade in forest-risk commodities.* TILEC Discussion Paper. Tilburg University. ISSN 2213-9419. Retrieved March 20, 2021, from http://ssrn.com/abstract=3406718.

410. Partiti, E. (2019).

411. Partiti, E. (2019).

412. Partiti, E. (2019).; Geraets, D. (2014). *The WTO Consistency of the European Union Timber Regulation.* Journal of World Trade, Volume 48, Issue 2 (2014) pp. 433 – 455. Retrieved March 20, 2021, from https://ees.kuleuven.be/klimos/papers/klimos_policybrief_4_wto_consistency_of_the_eu_timber_regulation.pdf

413. Vermeulen, R., Schets, E., Lohuis, M., Kölbl, B., Jansen, D.J., & Heeringa. W., (2019). The Heat is on: A framework measuring financial stress under disruptive energy transition scenarios [Working Paper]. Retrieved March 20, 2021, from https://www.dnb.nl/en/publications/research-publications/working-papers-2019/the-heat-is-on-a-framework-for-measuring-financial-stress-under-disruptive-energy-transition-scenarios/. Robert Vermeulen et al. (2019).

414. Toor, J., Piljic, D., Schellekens, G., Oorschot, M., & Kok. M., (2020). Indebted to nature: Exploring biodiversity risks for the Dutch financial sector. Retrieved March 20, 2021, from https://www.dnb.nl/media/4c3fqawd/indebted-to-nature.pdf.

415. Australian Prudential Regulation Authority. (2020). *To: All APRA-Regulated Entities. Understanding and managing the financial risks of climate change: February 2020.* Retrieved March 19, 2021, from https://www.apra.gov.au/sites/default/files/2020-02/Stress%20testing%20assessment%20findings%20and%20feedback.pdf.

416. Australian Prudential Regulation Authority. (2020).

417. Commonwealth Bank of Australia. (2020). *2020 Annual Report.* Retrieved March 20, 2021, from https://www.commbank.com.au/content/dam/commbank/about-us/shareholders/pdfs/results/fy20/cba-2020-annual-report.pdf.

418. Commonwealth Bank of Australia. (2019). *Our approach to addressing climate change: 2019.* Retreived March 20, 2021 from https://www.commbank.com.au/content/dam/commbank-assets/about-us/docs/tcfd-2019.pdf.

419. Commonwealth Bank of Australia. (2020).

420. Commonwealth Bank of Australia. (2020).

421. Navarra, C. (2020).

422. Steinweg, T., Rijk, G., & Piotrowski, M. (2021).; Vert, A. (2021). Casino sue in court. March 3, 2021. Retrieved March 20, 2021, from https://envol-vert.org/en/non-classe-en/2021/03/casino-sue-in-court/

423. Basel Committee on Banking Supervision. (2020). *Climate-related financial risks: a survey of current initiatives.* Bank for International Settlements: April 2020. Retrieved March 20, 2021, from https://www.bis.org/bcbs/publ/d502.pdf

424. Basel Committee on Banking Supervision. (2020).

425. Chahine, P., & Liagre, P. (2020). *How can Green Bonds catalyse investments in biodiversity and sustainable land-use projects?* Retrieved March 20, 2021, from https://www.globallandscapesforum.org/wp-content/uploads/2020/10/How-can-Green-Bonds-catalyse-investments-in-biodiversity-and-sustainable-land-use-projects-v12_Final.pdf.; Guarnaschelli, S., Limketkai, B., & Vandeputte, P. (2018). *Financing sustainable land use: Unlocking business opportunities in sustainable land use with blended finance: 2018.* Retrieved March 20, 2021, from https://assets.ctfassets.net/bbfdx7vx8x8r/7iGPF09ucEeweAU8yOe0eU/eeabb872454c6687e98a434a270d5b2c/Kois_FinancingSLU.pdf.

426. Clark, R., Reed, J., & Sunderland, T. (2018). Bridging funding gaps for climate and sustainable development: Pitfalls, progress and potential of private finance. *Land Use Policy,* 71(November 2017), 335–346. Retrieved from https://doi.org/10.1016/j.landusepol.2017.12.013

427. Clark, R., Reed, J., & Sunderland, T. (2018).

428. OECD. (2020b).

429. OECD. (2020b).

430. Chahine, P. & Liagre, L. (2020).

431. Basel Committee on Banking Supervision. (2020).

432. Feridun, M. (2020). Climate-related prudential risks in the banking sector and emerging regulatory and supervisory practices. The FinReg Blog, Global Financial Markets Center, Duke University School of Law, posted on 15 July 2020.

433. Basel Committee on Banking Supervision. (2020).

434. OECD. (2020b).

435. OECD. (2020b).

436. OECD. (2020b).

437. OECD. (2020b).

438. OECD. (2020b).

439. OECD. (2020b).

440. OECD. (2020b).

441. Dikau, S. & Volz, U. (2018). Central banking, climate change and green finance (No. 867). Retrieved March 20, 2021, from https://www.adb.org/sites/default/files/publication/452676/adbi-wp867.pdf.

442. Volz. U. (2017).

443. Volz. U. (2017).

444. Park, H., & Kim, J. D. (2020).

445. Park, H., & Kim, J. D. (2020).

446. Park, H., & Kim, J. D. (2020).

447. Sustainable Banking Network and International Finance Corporation. (2018 and 2019). *Country progress report: Vietnam*. Retrieved March 20, 2021, from https://www.ifc.org/wps/wcm/connect/abf1be6f-18ba-4bb5-a7b1-af5137636f95/SBN+Country+Progress+Report+-+Vietnam.pdf?MOD=AJPERES&CVID=m7472JH; Directive no. 03/CT-NHNN on Promoting Green Credit Growth and Environmental and Social Risks Management in Credit Granting Activities; Decision no. 1552/QĐNHNN on Action Plan of the banking sector to implement the National Green Growth Strategy until 2020.; and Request No. 9050/NHNN-TD on Guidelines and Requirements of Statistics on Green Credit applied for Credit Institutions.

448. Sustainable Banking Network and the International Finance Corporation. (2018 and 2019).

449. Vietnam Investment Review. (2019). *Banks spur green credit for sustainable development: November 2019.* Retrieved March 20, 2021, from https://www.vir.com.vn/banks-spur-green-credit-for-sustainable-development-72059.html

450. Souza, P., Herschmann, S., and Assuncao, J. (2020). *Rural Credit Policy in Brazil: Agriculture, Environmental Protection and Economic Development: December 2020.* Climate Policy Initiative. Retrieved March 20, 2021, from https://www.climatepolicyinitiative.org/publication/rural-credit-policy-in-brazil-agriculture-environmental-protection-and-economic-development/

451. Souza, P., Herschmann, S., and Assuncao, J. (2020).

452. Assuncao, J., et al. (2015). The Effect of rural credit on deforestation: Evidence from the Brazilian Amazon. T*he Economic Journal,* 130: 290-330, 2015. Retrieved from https://doi.org/10.1093/ej/uez060

453. Souza, P., Herschmann, S., and Assuncao, J. (2020).

454. Souza, P., Herschmann, S., and Assuncao, J. (2020).

455. Rui, C. (2020). A *Greener Green Bond Catalogue: The incoming China's unified Taxonomy notches new win: February 2021.* Retrieved March 20, 2021, from https://gsh.cib.natixis.com/our-center-of-expertise/articles/a-greener-green-bond-catalogue-the-incoming-china-s-unified-taxonomy-notches-new-win.

456. OECD. (2020b).; Rui, C. (2020).

457. Chen Rui. (2020).

458. Chen Rui. (2020).

459. Hill, B., & Blandford, D. (2007).

460. Bellman, C. (2019).

461. Clements, L.; Dai, L. and Hugo, C. (2020). *Investing in the green economy – sizing the opportunity: December 2020.* FTSE Russell. Retrieved March 20, 2021, from https://content.ftserussell.com/sites/default/files/investing_in_the_green_economy___sizing_the_opportunity_final_0.pdf?_ga=2.107853761.2132965583.1615729251-826573630.1615729251

July 2021

SHIFTING FINANCE TOWARDS SUSTAINABLE LAND USE:
Aligning public incentives with the goals of the Paris Agreement

CLIMATE FOCUS

ODI

SUSTAINABLE DEVELOPMENT SOLUTIONS NETWORK
A GLOBAL INITIATIVE FOR THE UNITED NATIONS