cefc

Measuring what matters

An approach for natural capital investors

Australian Government

A message from Australia's 'green bank'

Australian agriculture is an $80 billion business conducted across half of our land mass, with diverse enterprises delivered via large-scale multi-site portfolios, location based aggregations and smaller-scale family farms.

Its role as a key economic driver can hardly be overstated, whether considered through an historical lens, or in the context of forecast growth and the ongoing contribution to our national prosperity.

The sector draws its strength from its reliance on experienced and expert farmers, its embrace of technology and its enduring commitment to product innovation. The intersection of these factors has seen it lift yields, capture new markets and capitalise on a market-leading reputation for high quality produce, delivered at volume and on time.

This description is in no way sentimental. Rather, it brings together the core ingredients of a sector-wide approach that is drawing growing interest from institutional investors, including dedicated sustainable investors such as the CEFC and those representing some of the world's biggest pension funds, including recent CEFC investment partner CDPQ.

And this matters in the race for capital to finance our transition to net zero emissions. The sectors that demonstrably deliver on the twin economic and environmental demands of a net zero future will be those that attract long term capital, at scale, so they are positioned at the forefront of this seismic economic transformation.

CEFC investments in agriculture showcase this transition, with commitments to lower emissions, improve land protection and increase biodiversity. Investment commitments are important of course, but they are not the full picture. Measurement, reporting and analysis are important too, as investors, managers and regulators consider the impact of capital in the context of broader emissions pathways and ambitions.

For the CEFC and the institutional investors we work with, credible, comparable and reliable metrics are a foundational element of investment decisions, alongside well-established factors such as capital returns, risk and financial management. We recognise too that transparency and consistency in accounting for the full value and costs of using natural systems will strengthen the appeal of the natural capital sector as a high value investable asset class.

As we strengthen our own approach to metrics and reporting for agriculture and forestry, we are pleased to share our thinking with other investors making similar decisions.

We give you a collated view of everything from assessing the relative value of different reporting frameworks to identifying decarbonisation priorities, defining metrics and capturing the right data to measure, monitor and assess performance, with the shared end goal of avoiding emissions where we can and sequestering the remainder where necessary.

We are pleased to recommend this report to you: *Measuring what matters: an approach for natural capital investors.*

Ian Learmonth
CEFC, CEO

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CEFC, Head of Natural Capital

Measuring what matters

About this report

As a specialist investor in Australia's transition to net zero emissions, the CEFC sees natural capital assets as a strategic priority in a low carbon future.

Industries that rely on natural assets such as agriculture and forestry will need to consider their carbon impact on the landscape and how to improve the long-term sustainable performance of land use activities, while also protecting and strengthening broader environmental outcomes. Investments to reconfigure how landscapes are designed, rethinking future business models and sequestering carbon through incorporating value accretive carbon farming projects will present as opportunities to capitalise.

For investors, national and global policy developments around emissions and biodiversity are reshaping investment considerations. Navigating emerging financial accounting, industry and regulatory standards can be challenging and may create barriers in assessing "what does good look like?".

This report provides guidance on the consistent measurement of emissions reduction activities across agriculture and forestry assets. It may assist investors in those sectors screen investment strategies and hold asset managers and operators to account for emissions reduction. This may facilitate the flow of capital into replicable sustainable activities, allowing investors and financiers to compare projects more easily and prioritise investments according to their own sustainability goals.

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Acknowledgement of Country

The CEFC acknowledges the Traditional Owners and Custodians of this land, and we pay our respects to all Elders, past and present. We recognise their continuing connections to country, water and culture.

Institutional investors and sustainable agriculture

The CEFC has committed more than $440 million to the agriculture and forestry sectors (to 31 March 2024).

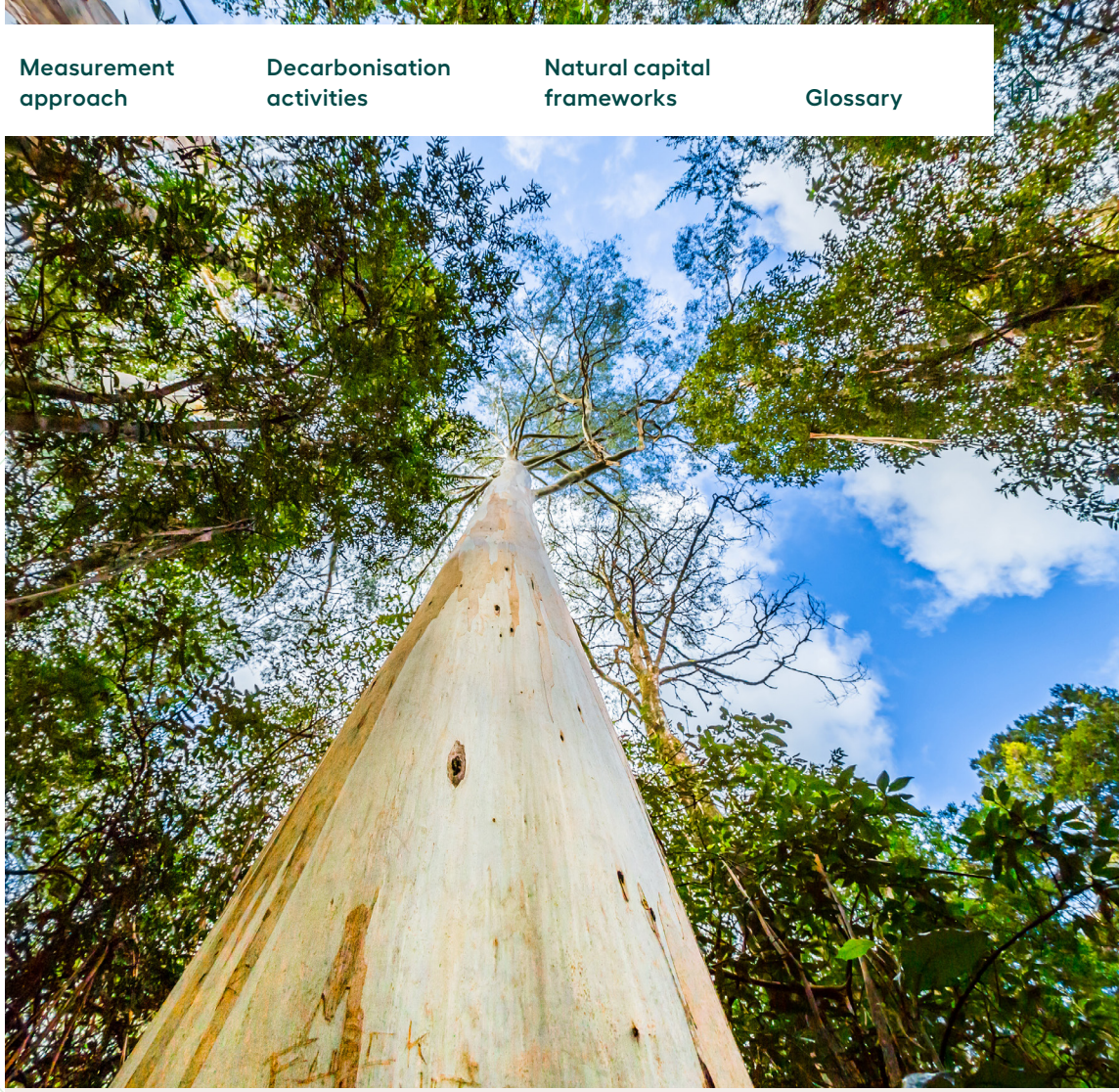
Along the way we have benefited from the experience of our co-investors, asset managers and Australia's scientific leadership in achieving sustainability outcomes. This has included working with CDPQ, a global investment group, to create Australia's Wilga Farming sustainable agricultural platform.

Based on this experience, we are pleased to share our insights into how institutional investors in the natural capital arena can use relevant metrics to enhance the assessment of decarbonisation activities and the ways that this can lead to the flow-on of broader environmental outcomes.

This practical guidance includes an overview of priority activities that can reduce, avoid or sequester emissions in the agriculture and forestry sectors; an approach to defining metrics and establishing ongoing monitoring; and an overview of the available measurement approaches. We have used the production environment in Australia and global approaches and frameworks to arrive at the metrics, but the metrics can be applied to other key agriculture and forestry markets given the key activities that drive emissions are well accepted globally.

In developing this guidance, we have considered key international frameworks and protocols, including the ISIC for classification of activities, as well as the TFND, SBTN, SBTi, Climateworks, the NCMC and the GHG Protocol to formulate the measurement approaches for each priority activity.

As with all investments, decisions will be made on a case-by-case basis, reflecting production systems and the relevant environmental conditions. The analysis in *Measuring what matters: an approach for natural capital investors*, was prepared by the CEFC with the assistance of EY.



> "This practical guidance includes an overview of priority activities that can reduce, avoid or sequester emissions; an approach to defining metrics and establishing ongoing monitoring; and an overview of the available measurement approaches and tools.

Natural capital emissions

The widespread adoption of sustainable agricultural practices, such as no-till farming, variable rate technologies, crop rotation, efficient breeding and genetics selection of animals, and the use of cover crops between growing seasons, can reduce greenhouse gas emissions, while making the soil healthier and farmland more fertile and potentially more productive over time.

Reducing agricultural emissions is a global effort, with decarbonisation investment in agriculture and forestry assets at the national level. Understanding the global view of sector emissions can support investment analysis of different markets.

Agriculture, forestry and other land use accounted for 13 to 21 per cent of global greenhouse gas emissions over 2010-2019.[1] This figure may be up to one third when the broader food system is considered, including food processing, transport, packaging and waste.[2]

Agriculture sector emissions relate to the biological processes associated with commodity production.

Additional energy-related emissions, from fuel-use in farm machinery and electricity consumption, are often measured as part of energy and electricity sector emissions.

The largest sources of emissions from the sector globally[3,4]

26%

Livestock and manure

Animals (mainly ruminants, such as cattle and sheep) produce methane through a digestive process called 'enteric fermentation'. In addition, nitrous oxide and methane can be produced from the decomposition of animal manures under low oxygen conditions.

14%

Agricultural soils

Nitrous oxide is produced when synthetic nitrogen fertilisers are applied to soils. This includes emissions from agricultural soils for agricultural products.

51%

Deforestation

The land use, land use change and forestry (LULUCF) category measures net emissions of carbon dioxide from changes in forestry cover (i.e. the difference between forestry loss and gain) and land use. Emissions are based on lost carbon stores from forests and changes in carbon stores in forest soils. Since vegetation can absorb carbon from the atmosphere, increasing forest cover has the ability to function as a net sink of emissions.

1 IPCC 2022, *Agriculture, Forestry and Other Land Uses (AFOLU) in Climate Change 2022: Mitigation of Climate Change*, WGIII AR6. Cambridge University Press.
2 Ritchie, H. 2021, How much of global greenhouse gas emissions come from food?. Published online at OurWorldInData.org.
3 IPCC 2022, *Agriculture, Forestry and Other Land Uses (AFOLU) in Climate Change 2022: Mitigation of Climate Change*, WGIII AR6. Cambridge University Press.
4 Ritchie, H. 2020, Sector by sector: where do global greenhouse gas emissions come from?. Published online at OurWorldInData.org.

Australian emissions sources

Global agricultural emissions highlight the decarbonisation needs for the sector. Natural capital investments can deliver both abatement and sequestration of emissions, and land use plays a critical role in delivering national net zero targets.

At the CEFC, Natural Capital investments are a strategic priority and our investments target decarbonisation outcomes that are scalable and replicable to address Australia's agricultural emissions.

Australian agriculture activities are the largest source of greenhouse gas emissions outside of electricity, gas and oil use, representing 18 per cent of national emissions (82 Mt CO_2-e) in 2023.[5] Australian forecasts show the sector's emissions are projected to remain flat to 2030 without further action.[6]

In Australia the main sources of emissions from agriculture are: [7]

62Mt CO_2-e

Livestock and manure (80% in 2022)

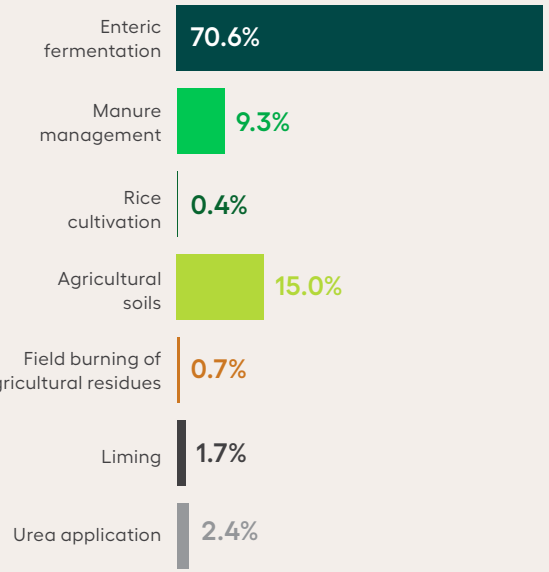
This includes 55 Mt CO_2-e from enteric fermentation and 7 Mt CO_2-e from manure management.

16Mt CO_2-e

Cropping and horticulture (20% in 2022)

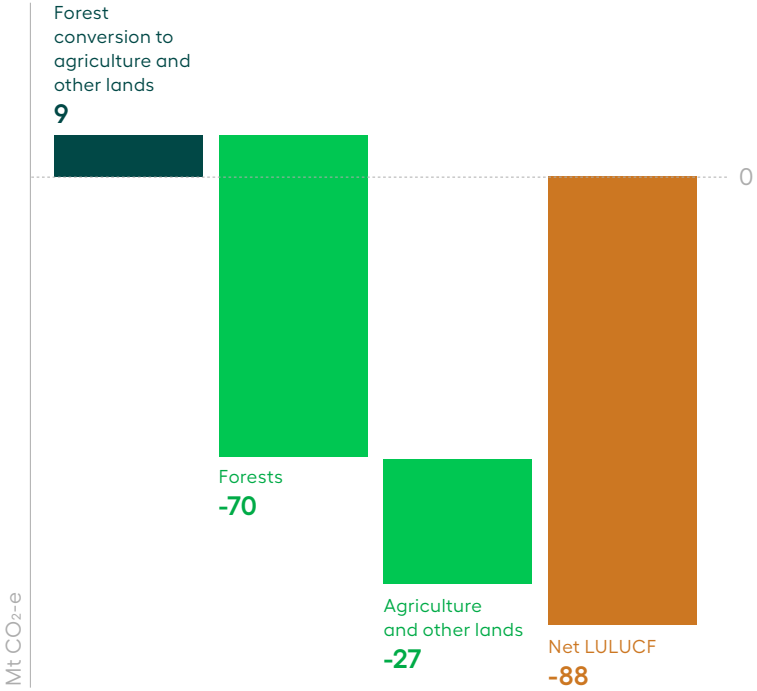
The cropping and horticulture sectors contribute nitrous oxide and carbon dioxide emissions. Most of the emissions from agricultural soils (12 Mt CO_2-e) were from fertiliser application and crop residues, though livestock waste is also responsible for a portion of emissions from agricultural soils.[8] Carbon dioxide equivalent emissions from application of urea and lime accounted for another 3 Mt CO_2-e.

Figure 1: Australia's agricultural greenhouse gas emissions by source 2021-22[9]



5 DCCEEW 2023, Australia's emissions projections 2023, Department of Climate Change, Energy, the Environment and Water, Canberra, November. CC BY 4.0.
6 DCCEEW 2023, Australia's emissions projections 2023, Department of Climate Change, Energy, the Environment and Water, Canberra, November. CC BY 4.0.
7 Australian Government 2024, National Inventory Report 2022, Volume I, Department of Climate Change, Energy, the Environment and Water, Canberra.
8 DAFF 2023, Agriculture, land and emissions: discussion paper, Department of Agriculture, Fisheries and Forestry, Canberra, October. CC BY 4.0.
9 Australian Government 2024, *National Inventory Report 2022 Volume I*, Department of Climate Change, Energy, the Environment and Water, Canberra. Figures have been rounded to the nearest 1 decimal place.

Figure 2: Emissions and removals from LULUCF, 2021-22, Mt CO_2-e[10]



10 Australian Government 2024, ***National Inventory Report 2022, Volume I,*** Department of Climate Change, Energy, the Environment and Water, Canberra.
11 DAFF 2023, ***Agriculture, land and emissions: discussion pape***r, Department of Agriculture, Fisheries and Forestry, Canberra, October. CC BY 4.0.
12 Australian Government 2024, ***National Inventory Report 2022, Volume I,*** Department of Climate Change, Energy, the Environment and Water, Canberra.
13 DCCEEW 2023, ***Australia's emissions projections 2023,*** Department of Climate Change, Energy, the Environment and Water, Canberra, November. CC BY 4.0.

Two other significant sources of emissions are accounted for separately in Australia's national greenhouse gas accounts:

9Mt CO_2-e

Fuel and energy (2021)[11]

Electricity, energy and fuel are needed to run facilities, vehicles and production equipment for agriculture commodities and represent a significant source of greenhouse gas emissions.

9Mt CO_2-e

Deforestation (2022)

Land use, land use change and forestry (LULUCF) emissions are accounted for separately to agricultural emissions in Australia's national accounts and emissions projections, however agricultural activities can contribute to these emissions through primary clearing and maintenance clearing. 'Forest conversion' was a source of 9 Mt of CO_2-e in 2022. However, forests overall were a sink for 70 Mt CO_2-e and 'Agricultural and other lands' were a sink for 27 Mt CO_2-e.[12] As more emissions are taken up by the growth of forests and other sinks than are emitted through forest conversion and other sources, the LULUCF sector was a net sink of 88 Mt CO_2-e in 2022. Most forest conversion activity in Australia is to provide pastures for grazing activities, although some forest conversion occurs to support cropping, settlements, infrastructure, and reservoirs.[13]

Moving towards net zero emissions

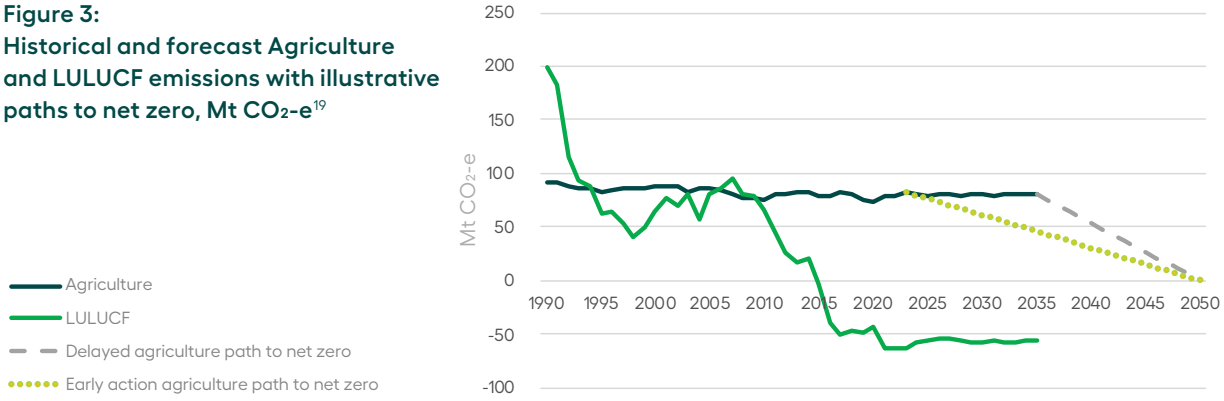
The agriculture and land sectors are already feeling the effects of climate change through more frequent and extreme weather and changing conditions. Producers, land managers and investors have a long-term interest in seeing successful global efforts to combat climate change and Australia's agricultural industry plays a pivotal role.

Australia has committed to achieve net zero emissions by 2050, and over 140 countries and 1,000 corporations have also set net zero emissions targets.[14] This means that all sectors of the Australian economy need to make plans to cut net emissions.

A number of industry groups, such as Meat & Livestock Australia[15] and the National Farmers Federation[16], have also committed to efforts to reduce the trajectory of agricultural emissions. The Commonwealth Government is currently developing a sectoral decarbonisation plan for agriculture and the land sector.[17]

For the agriculture sector to aim for net zero, early action to cut on-site agriculture emissions will mean a smoother transition. Australian government forecasts show the agriculture sector's emissions are projected to stay flat at around 80 Mt CO_2-e from now to 2035 without further action.[18] As an illustrative example (Figure 3), if the sector was to aim for net zero emissions overall by 2050, but waits till after 2035 to move towards this goal, then net emissions would need to fall around 5 Mt CO_2-e a year (7 per cent of 2035 emissions). If the sector starts cutting emissions now, then net emissions would need to fall by only around 3 Mt CO_2-e a year (4 per cent of 2023 emissions).

Figure 3:
Historical and forecast Agriculture and LULUCF emissions with illustrative paths to net zero, Mt CO_2-e[19]



Instruments such as carbon offsets can be used to manage residual emissions in a corporate decarbonisation strategy. Nature based solutions and carbon markets, such as the Australian Carbon Credit Unit (ACCU) Scheme administered by the Clean Energy Regulator, provide a regulated market for carbon sequestration projects. This provides the Natural Capital asset class with opportunities to sequester carbon and generate an economic return through the sale of ACCUs. Often there are additional co-benefits for biodiversity and nature through the development of improved carbon sequestration on farmland.

"Insetting" refers to decarbonisation activities that avoid or sequester carbon on farm and lower the farm's own carbon emissions profile. Insetting does not necessarily mean the creation of ACCUs. However, if an ACCU is created and retired (i.e., not sold as a carbon offset), the sequestration generated remains attributable to the farm and reduces the whole of farm emissions footprint.

14 Net Zero Tracker, accessed 8 June 2024
15 Meat and Livestock Australia, accessed 10 April 2024
16 National Farmers Federation, accessed 10 April 2024
17 DAFF 2023, *Agriculture, land and emissions: discussion paper,* Department of Agriculture, Fisheries and Forestry, Canberra, October. CC BY 4.0.
18 DCCEEW 2023, *Australia's emissions projections 2023,* Department of Climate Change, Energy, the Environment and Water, Canberra, November. CC BY 4.0.
19 DCCEEW 2023, *Australia's emissions projections 2023,* Department of Climate Change, Energy, the Environment and Water, Canberra, November. CC BY 4.0.

Investment potential

Financial and environmental value creation

Australia exports around 72 per cent of the total value of agricultural, fisheries and forestry production.[21] Australia's top export markets include China, Japan, South Korea, Indonesia, Vietnam and the United States. This export orientation links returns on agricultural assets to global demand drivers such as rising populations and incomes.

Australia is a key agricultural market, attractive to global investors, with benefits including opportunities for scalable investments, a stable regulatory environment, proximity to export markets and a southern hemisphere location providing seasons that are counter to US and European markets. Australia's agriculture sector also has deep expertise managing diverse agricultural systems and climatic conditions, volatile commodity prices and considering climate impacts.

As well as investments made to produce agricultural commodities, there is significant value held in Australian agricultural land. Farmland transactions in 2022 equated to a total of 8.8 million hectares of land traded across 6,588 transactions at a combined value of $11.7 billion.[22]

Efficient, responsibly managed agricultural assets are likely to increase in value. Those institutional and family farmers who recognise this now stand to benefit in the future. What's more, the carbon sequestration potential for landowners (including in soils) has the ability to reduce their own emissions ("insetting"), while also creating new revenue streams via carbon credits, alongside broader biodiversity benefits.

"Within the broader natural capital asset class, agriculture continues to be crucial to the Australian economy, with ABARES forecasting the value of production to be ~$80 billion in 2023-24, coming off a record high in 2022-23 due to drier conditions.[20]

20 The nominal gross value of agricultural production is forecast to be $80 billion in 2023– 24, or $86 billion including fisheries and forestry. ABARES 2024, Agricultural Commodities Report: March Quarter 2024, Accessed 10 April 2024
21 ABARES 2024, Snapshot of Australian agriculture 2024, March. Accessed 10 April 2024
22 Rural Bank 2023, Australian Farmland Values. Accessed 10 April 2024

Measurement approach

Benefits for investors

Natural Capital investments are an attractive asset allocation that can deliver appropriate returns for the risk while also targeting environmental benefits over time. Metrics can aid investors and asset managers in the credibility and comparability of sustainability outcomes.

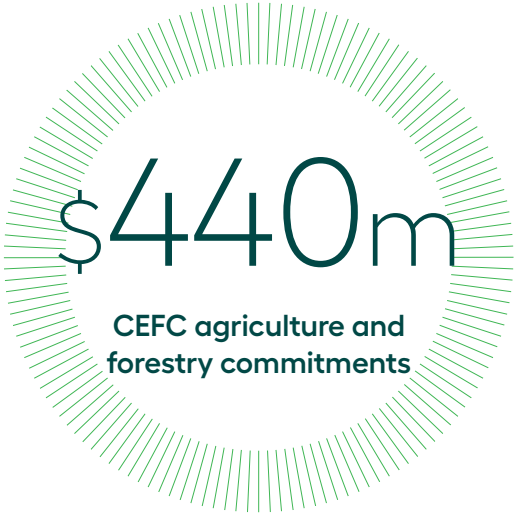
As investors, we focus on identifying investment opportunities that can provide both financial and environmental outcomes. Embedding sustainability targets into natural capital investments provides a contractual mechanism to target priority activities and land management practices for decarbonisation outcomes. By setting targets and adopting a rigorous assessment of land management and emissions profiles, investors are able to direct capital to those investments which demonstrate low emission farming and can assist in determining the highest and best land use.

Natural Capital investors can set metrics relating to the management approach and land activities. This can bring together baselining, targeted emissions outcomes, investment monitoring and reporting schedules. Setting metrics is an important performance management tool for investors and these metrics can be used to compare performance of similar assets and management techniques. Metrics can also underpin a verification process to support the assessment of indicators and progress toward achieving environmental outcomes.

Investors and lenders bring financial expertise to structuring investments which consider investment and asset parameters. Investment decisions are necessarily made on a case-by-case basis. Relevant metrics for an asset will vary depending on the land use activity, the targeted outcomes and the gap to achieve these, among others.

As financial institutions and corporates seek to adopt frameworks such as sustainable finance taxonomies and science-based targets, it will be increasingly important to demonstrate comparability when financing activities that lead to improved environmental outcomes. We consider standardisation and comparability across emerging sustainable finance and natural capital frameworks to be best practice and an enabler for increased capital flow and lower transaction costs with increased investment opportunities.

This report reflects the the CEFC approach to measuring natural capital investments that relate to agriculture and forestry production from landscapes. We focus on activities that deliver productivity, carbon and environmental outcomes, and in defining and grading the metrics outlined we have leveraged the available frameworks listed with a focus on those that are most meaningful and commonly used by institutional investors.



Decarbonisation activities

In assessing potential natural capital investments, the CEFC considers a range of factors influencing financial and environmental outcomes. This includes focusing on identifying activities that target co-benefits of productivity, carbon and environmental outcomes from landscapes and identifying immediate improvements to longer-term sustainability strategies.

Activities that increase productivity, carbon and environmental benefits

Adjust livestock management practices (e.g. genetics, inclusion of pasture legumes, animal feeds/supplements) to lift productivity and reduce enteric methane emissions and/or reduce nitrous oxide emissions	Efficient application of fertilisers, herbicides and pesticides to optimise yield, cut nitrous oxide emissions and pollutant run-off to soils and waterways
Increase organic carbon storage in soils to improve soil health and drought resilience	Optimise water management practices to reduce energy use, surface and ground water use
Increase tree planting to reduce nitrogen and phosphorus load before run-off on soil and water, and/or develop revenue potential via ACCUs	Integrate trees and shrubs into grazing management to improve carbon storage, animal health and welfare and biodiversity
Increase area of protected land under management, to improve biodiversity and habitat connectivity	Consider agroforestry methods, such as shelterbelts, insectaries, riparian zones, wetlands and habitat conservation
Optimise frequency of rotations in crop and pasture to lift carbon storage in biomass	Replace fossil fuel use with renewable energy
Optimise timber land management to lift carbon storage in biomass	Integrate pest management
Fire management practices	Capture and reuse waste

Metric grading matrix

A streamlined guide to grading Natural Capital metrics can support prioritisation of activities, with respect to emissions abatement and sequestration. The gradings are summed to develop an 'overall grade', promoting options that are less complex but provide the most accurate outcomes.

The grading matrix supports the identification of priority metrics, through rating different activities and their subsequent measurement and data sources, across three assessment criteria, namely, feasibility, suitability and maturity. Consider allocating points to produce an overall grading where: Basic = 1-3 points; Good = 4-7 points; Very good = 8-9 points. The gradings are summed to develop an 'overall grade' out of nine, promoting options that are less complex but provide the most accurate outcomes. At the whole-of-farm enterprise level an assessment should be made of all metrics, to consider any interplay between decarbonisation activities that could impact the overall grading.

Table 1: Grading matrix

	What to look for	Relevant considerations	Grading categories		
			Basic	Good	Very good
Feasibility	*Degree to which the metric can be readily measured*	**Viability**: readily available and proven in practice **Useability**: degree of difficulty in capturing data **Efficiency**: relative cost, effort, skills to implement	Substantially restricted data collection	Some barrier to data collection	No barriers to data collection
Suitability	*Quality of data sources, use of scientific protocols*	**Primary data**: identification and tracking of relevant inputs **Science-based protocols**: relevance of data to rigorous scientific requirements **Established**: recognised approach, proven in practice	Not science based and/or rarely used method	Science based protocol and sometimes used method	Science based protocol and established method
Maturity	*Track record of the metric, status of potential innovation*	**Mature**: readily available, commonly used, widely recognised **Innovative**: use of emerging technologies and product innovations to lift accuracy, efficiency **Nascent**: limited use and/or limited availability, suppliers	Metric is nascent or mature with limited opportunity to improve other criteria	Metric is mature with some opportunity to improve in other criteria	Metric is mature with opportunity to improve in other criteria

Sustainable investment metrics and reporting

The CEFC set sustainable investment targets for its natural capital investments. The following tables provide examples of decarbonisation activities and metrics to measure the performance of cropping, grazing production systems and forestry as they relate to management of landscapes. The tables include their expected outcome, data requirements and measurements. For activities and outcomes eligible under the ACCU Scheme, they would be assigned a Very Good metric grade.

What is it	Activities	Outcomes	What to measure	How to measure	Metric grading
Agroecology (the application of ecological principles to land based systems and practices)					
Using site spatial data and emissions modelling to measure reduced ecosystem disturbance and avoided GHG emissions	Protect natural lands Enhance natural lands and connectivity	Increased area protection Emissions avoided from area of land protected or habitat connected, and reduced conversion of land use Emerging practice with methods evolving	Area (ha) and the condition of each protected land type: – productive land – shelterbelt – riparian – habitat conservation, corridor – native, plantation forest	Spatial mapping	☑ **Very good**
		Increased habitat connectivity Emerging practice with methods evolving	Area of and connection between habitat areas to determine condition (including shelterbelt (ha), riparian zones, wetlands, insectaries, biodiversity conservation reserves).	Spatial mapping	☑ **Very good**
		Increased native species	Observed species using visual assessment, surveys, and distribution maps	Field survey	☑ **Basic**
	Decrease carbon and nitrous oxide emissions	Decreased carbon and nitrous oxide emissions from crop, forest stand and harvest rotations Established practice with clear outcomes	Area (ha) of each crop species and number of crop or forest stand and harvest rotations per year	Spatial mapping, crop data, forestry data	☑ **Good**
		Decreased GHG emissions through increased legume planting and frequency	Area (ha) of legume planting, number of crop rotations per year	Spatial mapping, crop data	☑ **Good**
		Decreased GHG emissions through carbon stock held in trees, shrubs, and debris Established practice with clear outcomes	Environmental plantings: (ha) of native trees or mallee eucalypt planted in land that has been cleared of forest cover for over 5 years	Spatial mapping, ha of planting area	☑ **Good**

What is it	Activities	Outcomes	What to measure	How to measure	Metric grading
Soil carbon sequestration					
Using site spatial data, emissions modelling, and soil testing to determine soil surface and sub-surface condition and carbon sequestration	Retention of ground cover and stubble Protect natural lands Planting of legume crop species Enhance natural lands and connectivity	Increased soil organic carbon	Area of each type of land protected or connected to determine avoided emissions (tCO_2-e per ha)	Spatial mapping	☑ Good
			Area of pastures that build carbon stocks	Spatial mapping	☑ Good
			Area of each crop species and rotation frequency	Spatial mapping	☑ Good
		Increased soil infiltration and percolation rate	Area of ground cover and tree thinning frequency to determine soil surface condition	Spatial mapping	☑ **Very good**
			Soil subsurface condition	Agronomic soil testing for each land type including forestry	☑ Basic
Fire management					
Using emissions modelling to determine avoided GHG emissions	Increase fire management practices (e.g. Savanna fire management methods)	Decreased carbon and nitrous oxide emissions Avoided emissions and improved carbon storage Established practice with clear outcomes	Area of each land type, fuel type (e.g. savannah), burning efficiency and patchiness (GHG emission avoidance)	Emissions factor determined by area, fuel type, burning efficiency, and patchiness	☑ Basic

What is it	Activities	Outcomes	What to measure	How to measure	Metric grading
Waste to energy					
Using waste and emissions modelling to measure avoided GHG emissions	Conversion of waste to energy and captured and reused waste	Increased renewable energy Decreased carbon and nitrous oxide emissions	Amount of waste converted from waste to energy (GHG emissions avoided)	Emission factor for asset class waste	☑ Basic
			Amount of waste converted and re-used (GHG emission avoided)	Emission factor for asset class waste	☑ Basic
			Amount of timber water converted from waste to energy (GHG emissions avoided)	Emissions factor for timber waste	☑ Basic
Optimised fertiliser, herbicide and pesticide use					
Using site spatial data, application data and emissions modelling to measure avoided emissions and reduced pollutant run-off	Optimise fertiliser, herbicide and pesticide use	Reduced nitrous oxide emissions from fertiliser use in some pasture and crop production, and forestry land Established practice, clear outcomes	Amount of fertiliser, herbicide and pesticide applied	Spatial mapping Modelled using amount applied and water quality flow meter	☑ Good
Livestock management (including reduction of enteric methane)					
Identifying selective husbandry and genetics practices	Optimise livestock management practices	Increased production efficiency and reduced methane emissions intensity (per kg of production) Established practice with clear outcomes	Modelled using LWG and emissions factor (methane)	Genetic characteristics of livestock	☑ Basic
Amount of livestock supplements used	Optimise livestock management practices	Decreased carbon and methane emissions Emerging practice with targeted decarbonisation outcome.	Modelled using feed intake (kg), LWG proxy and emissions factor (methane)	Dosage of livestock supplements used	☑ Basic
Identifying pasture / feed type (i.e.: legume type and location)	Plant legume (N2 fixing) crop species	Decreased carbon and nitrous oxide emissions Increased soil organic carbon	Modelled using site spatial data (GPS and satellite imagery) and emissions factor Liveweight gain (LWG) applicable for reduced methane emissions	Area of pastures (i.e.: legumes) that reduce methane emissions Area of pastures (i.e.: legumes), woody thickening and dead woody biomass that build carbon stocks	☑ Good

What is it	Activities	Outcomes	What to measure	How to measure	Metric grading
Optimised water use					
Using flow meter / water logger data or site spatial data to measure water use	Optimise water management practices Protect natural lands Enhance natural lands and connectivity	Reduced freshwater withdrawal	Water used for each harvest and rotation frequency	Modelled using flow meters and water level loggers to determine water used per kg yield	☑ Good
				Site spatial data of green, blue and grey water footprints	☑ Good
		Reduced sediment runoff	Amount of sediment discharged to water Water used for each harvest and rotation frequency (forestry)	Modelled using amount applied and water quality flow meter (cropping) Site spatial data or modelling using flow meters and water level loggers to determine water used per kg yield (forestry)	☑ Good
			Change in downstream water quality	Modelled using amount applied and water quality flow meter	☑ Good
Integrated pest control					
Managing pest predation for improved ecosystem outcomes	Integrate pest management	Reduced pest species Reduced crop losses (pre and post harvest)	Area (ha/km2) / land type of each land type impacted by pests	Site spatial data	☑ **Very good**

Emerging technology solutions

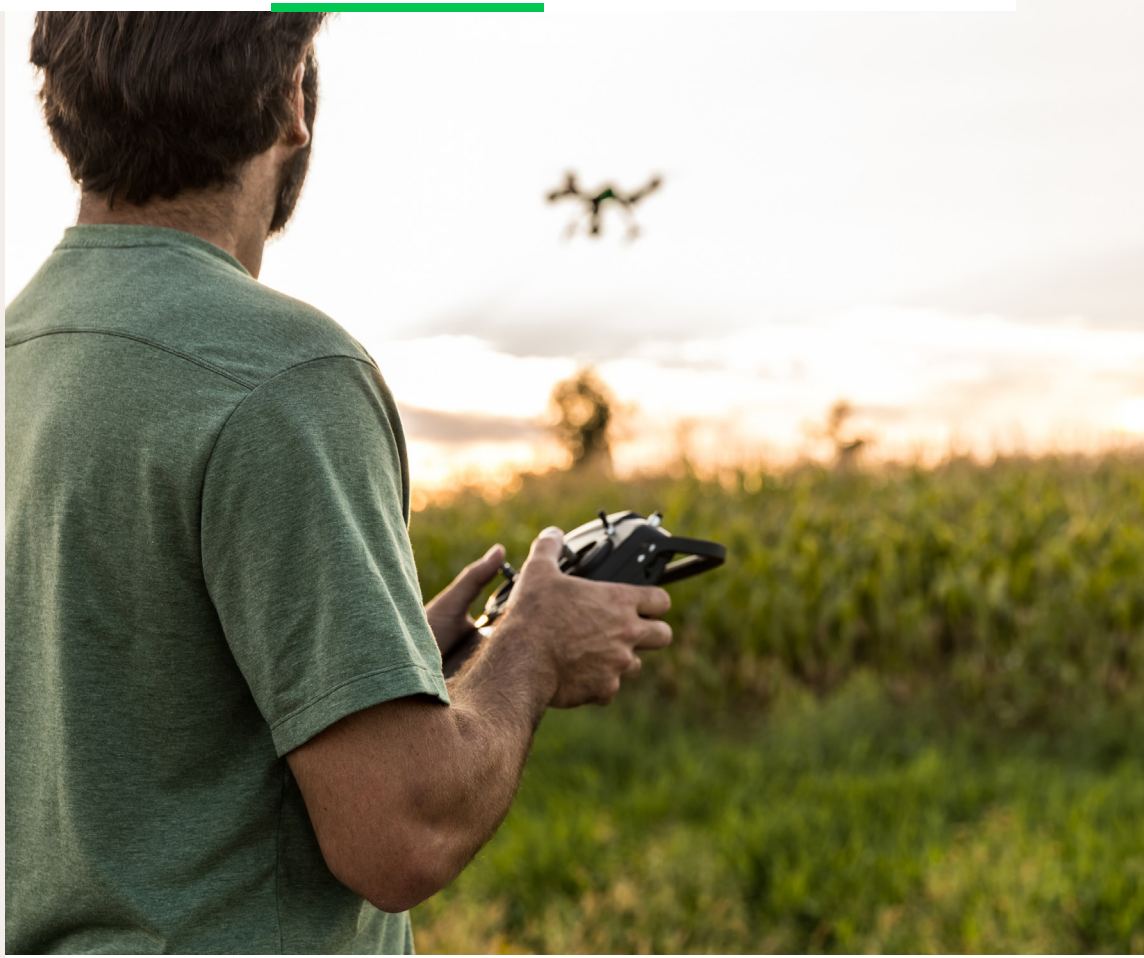
Rapid technology advancements continue to shape the approach to data analytics in natural capital and support land managers to measure and manage their environmental assets. These advancements hold the promise of more effective measurement and verification, are more cost competitive to traditional methods of data collection, have more environmental benefits from improved data and better-timed application and in some cases, have better workplace health and safety outcomes from reduced risks for workers.

During 2022–23 total Australian agricultural research and development funding was $2.32 billion, with 57 per cent contributed from public funding and 43 per cent by the private sector.[22] While the majority of Australian agricultural R&D continues to be public funded, the private sector has increased its share of expenditure over the past few decades.[23]

Globally the agtech industry has faced a major decline in investment in recent years, alongside venture capital more broadly. Venture capital funding has declined by 60 per cent from late 2021 to the end of 2023, due to broader market uncertainty and decreased risk appetite among investors.[24] Despite these funding challenges, McKinsey points to a promising long-term outlook with several tailwinds including the benefits of digitisation and geopolitical focus on food security and sustainability.[25]

This indicates the potential for the measurement of natural capital metrics to become more accurate and cost effective over time through the benefits of emerging technologies, improving the decision-making process for natural capital investments from improved reliability of data for strategic targets and operational goals. As technology develops in support of natural capital activities, and performance of on-farm activities can be measured and reported consistently, agricultural managers can more readily adapt and adopt activities that increase productivity, carbon and environmental benefits.

Accessed 10 April 2024:
22 ABARES 2024, Agricultural research and development investment in Australia - 2022-2023 update.
23 ABARES 2024, Agricultural research and development investment in Australia - 2022-2023 update.
24 Pitchbook data, cited by McKinsey and Co. 2024, Seizing opportunities amid the agtech capital drought.
25 Pitchbook data, cited by McKinsey and Co. 2024, Seizing opportunities amid the agtech capital drought.



Australian agricultural research and development funding in 2022-23[23]

Climate and natural capital frameworks

There is an array of frameworks and tools available to measure emissions and nature-related outcomes. Some are well established and commonly adopted, while others are emerging or in development.

Increasingly, investors and corporates are required to understand natural capital reporting and how to use and apply these frameworks to investments or business operations. The guide below lists some of the commonly referred to frameworks and a snapshot of their key strengths and constraints to assist investors and corporates to select the most appropriate for their purpose. The list is not exhaustive, we note that globally there are other relevant frameworks. With increased adoption of common frameworks, over time financial institutions and corporates will benefit from increased standardisation of approach and comparability of emissions and nature-based reporting. Refer to glossary.

Framework	Description	Strengths	Constraints
GHG Protocol	Comprehensive standardised global framework to measure and manage emissions from private and public sector operations, value chains and mitigation actions Includes measurement methodologies for avoided or sequestered land-based emissions	Standardised, global and well-established	Limited to carbon emissions
SBTN	Resource network to support and drive progress toward nature positive decarbonisation solutions Provides methods and resources for science-based targets for nature, including integrated technical guidance for the assessment and prioritisation of environmental impacts	Guidance extends to freshwater, land, oceans and biodiversity	Related MRV framework under development
SBTi	Particular relevance for land-intensive sectors, including forest, land and agriculture (FLAG) activities Provides framework for emissions reduction based on science-based targets Includes measurement methodologies for avoided or sequestered land- based carbon emissions	Consistent approach supports relevant comparative analysis	Related MRV framework under development
TNFD	Voluntary disclosure framework for organizations to report and act on nature-related risks, with a focus on shifting from nature-negative to nature-positive outcomes	Uses and leverages other existing frameworks providing step by step guidance	Application requires multiple metrics using a range of methodologies and their geo-locational dependencies
CBI	Comprehensive global certification scheme to support the evolving green bond market by promote investment in decarbonisation projects and assets Uses rigorous scientific criteria to enable tracking of the sustainability performance of green bond debt issuances	Increasing global reach by issuers, governments, investors and financial markets Includes sector-specific criteria for agriculture	Limited to climate-related debt products
NCMC	Relevant for organisations that directly or indirectly (e.g. supply chain or customers) own or manage natural assets (e.g. land managers, conservation groups, mining sector, agricultural sector, corporations, finance and investment, government etc.) Supports identification of metrics and methods for use in the management of natural assets (e.g. at the farm level, or along corporate value chains or within defined, managed land areas)	Based on extensive feedback from a broad range of stakeholders Aligned with multiple reporting standards to support external reporting (e.g. against disclosure standards and frameworks) Extends to management of an organisation's nature-related impacts and dependencies, or risks and opportunities (e.g. indirectly through supply chains or directly through business operations)	NCMC is currently a proof of concept version, designed to demonstrate a possible new arrangement of natural capital metrics
FSC	Global certification system to encourage responsible and sustainable practices across forestry sourcing, conservation and restoration Based on 10 principles requiring management planning and reporting across a broad range of relevant areas, including economic, environmental and social policies and objectives	Considered one of the most recognised forest certifications worldwide Standardised, global and well-established Uses satellite mapping and remote sensing technologies to assess sustainability practices Relevant across multiple forest ecosystems and in diverse cultural, political, and legal settings	Certification, compliance and audit processes are subject to fees

Glossary

Term	Definition
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
CBI	Climate Bonds Initiative
CDPQ	Caisse de dépôt et placement du Québec
CEFC	Clean Energy Finance Corporation
CH_4	Methane
CO_2	Carbon Dioxide
FSC	Forest Stewardship Council
GHG	Greenhouse Gas
ISIC	International Standard Industrial Classification
LULUCF	Land Use, Land Use Change and Forestry
LWG	Liveweight Gain
MRV	Monitoring, Reporting and Verification
Mt	Million Tonnes
N_2O	Nitrous Oxide
NCMC	Natural Capital Measurement Catalogue
SBTi	Science-based Targets Initiative
SBTN	Science-based Targets Network
SDG	Sustainable Development Goals
TNFD	Taskforce on Nature-related Financial Disclosures

About the CEFC

The CEFC is an experienced specialist investor with a deep sense of purpose: we're Australia's 'green bank', investing in our transition to net zero emissions by 2050. With access to more than $30 billion from the Australian Government, we're backing economy-wide decarbonisation, from renewable energy and natural capital to energy efficiency, alternative fuels and low carbon materials. In parallel, we're focused on transforming our energy grid, backing sustainable housing and supporting the growth of our climate tech innovators. We collaborate with co-investors, industry and government, recognising the urgency of the decarbonisation task. We also invest with commercial rigour, aiming to deliver a positive return across our portfolio.

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