Climate Risk & Adaptation in Global Food

Executive summary

April 2025

First Sentier MUFG
Sustainable Investment Institute

About the institute and its sponsors and partners

About the Institute

The First Sentier MUFG Sustainable Investment Institute (the Institute) provides research on topics that can advance sustainable investing. As investors, both First Sentier Investors and MUFG recognise our collective responsibility to society and that investment decisions should be made with consideration to our communities both now and in the future.

The Institute commissions research on Environmental, Societal and Governance (ESG) issues, looking in detail at a specific topic from different viewpoints. The Institute recognises that investors are now looking in far greater depth, and with far greater focus, at issues relating to sustainability and sustainable investing. These issues are often complex and require deep analysis to break down the contributing factors. If as investors we can better understand these factors, we will be better placed to consider our investment decisions and use our influence to drive positive change for the benefit of the environment and society.

The Institute is jointly supported by First Sentier Investors (FSI) and Mitsubishi UFJ Trust and Banking Corporation, a consolidated subsidiary of MUFG. Representatives of both organisations will provide input to the activities of the Institute.

An Academic Advisory Board advises the Institute on sustainability and sustainable investment research initiatives. The Academic Advisory Board comprises prominent leaders from academia, industry and nongovernmental organisations in the fields of Responsible Investment, climate science and related ESG endeavours. The Board provides independent oversight to ensure that research output meets the highest standards of academic rigour.

Contact

institute@firstsentier.com
www.firstsentier-mufg-sustainability.com
www.mufg-firstsentier-sustainability.jp

The Institute's sponsors and partners

About First Sentier Investors

First Sentier Investors

First Sentier Investors (formerly First State Investments) is a global asset management group focused on providing high quality, long-term investment capabilities to clients. We bring together independent teams of active, specialist investors who share a common commitment to responsible investment and stewardship principles. These principles are integral to our overall business management and the culture of the firm.

All our investment teams – whether in-house or individually branded – operate with discrete investment autonomy, according to their investment philosophies.

www.firstsentierinvestors.com

About MUFG

MUFG

Mitsubishi UFJ Financial Group, Inc. (MUFG) is one of the world's leading financial groups. Headquartered in Tokyo and with over 360 years of history, MUFG has a global network with approximately 2,000 locations in more than 40 countries. The Group has about 140,000 employees and offers services including commercial banking, trust banking, securities, credit cards, consumer finance, asset management, and leasing. The Group aims to "be the world's most trusted financial group" through close collaboration among our operating companies and flexibly respond to all of the financial needs of our customers, serving society, and fostering shared and sustainable growth for a better world. MUFG's shares trade on the Tokyo, Nagoya, and New York stock exchanges.

www.mufg.jp/english

About the Trust Bank

Mitsubishi UFJ Trust and Banking Corporation, as a core member of MUFG, provides its customers with a wide range of comprehensive financial solutions leveraging unique and highly professional functions as a leading trust bank. Such financial solutions include real estate, stock transfer agency, asset management and investor services, and inheritance related services, in addition to banking operations. We aim to realize our vision to be the trust bank that can create a safe and enriching society and a future alongside the customers through trust (faith and entrustment), and thus created a new key concept: "*Create a Better Tomorrow*".

https://www.tr.mufg.jp/english

Baringa is a global management consultancy focused on creating intelligent and lasting impact for government, industry, finance, and society. Our 2,000 experts operate globally with offices across Europe, North America, Asia, and Australia. We focus on designing and delivering meaningful change, and work across numerous sectors including Agriculture, Consumer Retail, Energy & Resources, Finance, Government, Industry, Pharma, Private Equity, and TMT.

Amongst our accolades include recognition as 'Climate Risk Advisory Firm of the Year' by Energy Risk Asia 2023, 'World's Best Management Firm' by Forbes 2024, and 'Leading Management Consultants' by the Financial Times 2025.

https://www.baringa.com

Baringa were commissioned by the Institute to author this report. It was produced with guidance from Sudip Hazra (Director, the Institute), Yuichi Nakao (Manager, the Institute), Elena Zharikova (Research Analyst, the Institute), Nick Forrest (Partner, Baringa), Darshan Grover (Partner, Baringa), and Jim Fitzgerald (Director, Baringa).

This report was authored by Shuayb Ismail (Director, Baringa) and Zdravko Slavov (Senior Manager, Baringa).

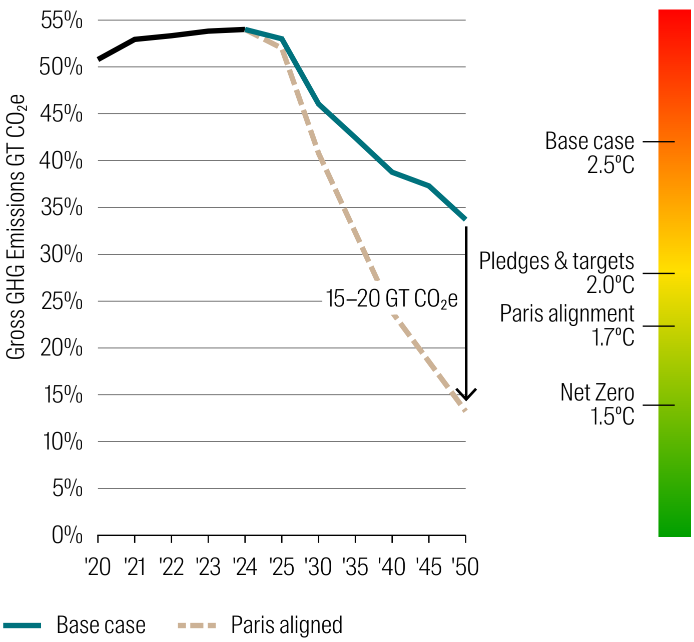
Image caption

Executive summary

1 The purpose of this report is to **highlight the major climate change and extreme weather impacts on global food supply chains** through to 2050 and propose actions which businesses and investors can take to support food security, food system resilience, and commercial returns.

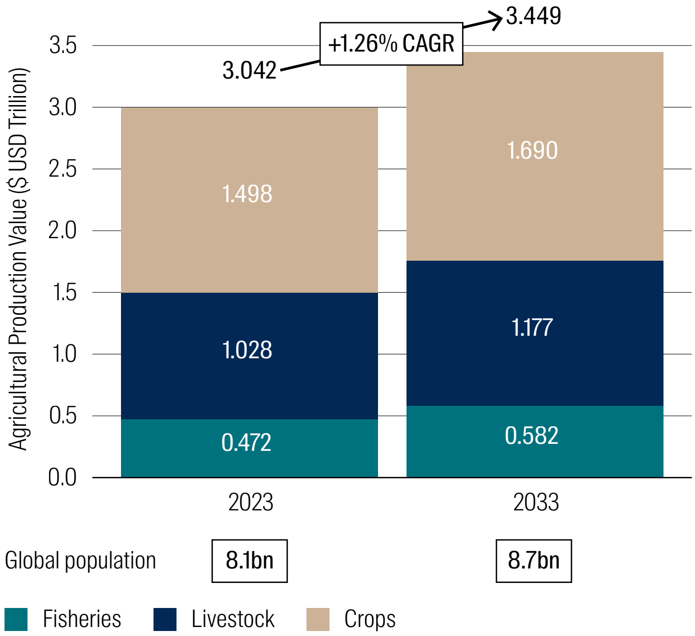
2 The world is **on track for 2.5 degrees global warming by 2050 at the rate of current policies and climate action,**[1] with an expected deficit of 15-20 GT CO2e according to Baringa's modelling. The Intergovernmental Panel on Climate Change (IPCC) has confirmed positive correlations between increased emissions and increased occurrence of extreme weather hazards. This means that both direct and indirect investors across globally integrated supply chains like food will continue to face exponentially increasing climate risks and extreme weather hazards over the next several decades.

Figure 1. Baringa GHG emissions base case (2020–2050)[1]



Source: Baringa analysis based on global energy and industry emissions (2024).

Figure 5. Global agricultural growth (2023-2033)[2]



Source: US Energy Information Agency as at 20 March 2024.

3 Global food **demand is expected to grow at 1.26% CAGR over the next decade, driven by population, economic, and urbanisation growth**. Importantly, agricultural production value is growing in almost every region at a faster rate than the population (0.7% CAGR) especially driven by economic growth and changing diets. Moreover, this demand will happen in a highly integrated global food system where food can travel 1,000s of miles and multiple processing steps before it reaches the table.

4 Supplying this demand will face significant climate risks and extreme weather hazards leading to a higher likelihood of increased insecurity and commercial losses across the food system.

5 **The global food system faces six key extreme weather events** (temperature extremes, heavy precipitation, flooding, droughts, extreme storms, and compound events) which have the potential to cause significant impact against infrastructure, food value chains, and wider natural ecosystems with a projected cost of up to $38 trillion in damages by 2050.[3]

---

1 "Baringa Base Case", Baringa (2024); this considers full Greenhouse Gas Emissions from energy, industry, agriculture, and land use change & forestry, and is informed by the outcome of the latest climate policies, pledges, and their deliverability.
2 "World Population Prospects", United Nations (2024) and "Agricultural Outlook", OECD-FAO (2024).
3 "Emissions Gap Report", UNEP (2024) and "The economic commitment of climate change", Koz et al., Nature (2024).

6 The global food system also has **a range of measures proven to mitigate or adapt to climate change leading to increased climate resilience and protected food system assets**. For example, these include responsible soil management (e.g. through conservation tillage, biochar application, or crop rotations), precision farming to optimise fertiliser usage, and livestock and fishery breeding aimed at ensuring the ability of animals to better withstand climate change impacts (e.g. improved heat resilience or adapted to lower quality feed).

7 Climate risks and extreme weather impacts will continue to be a recurring feature of the changing climatic system leading to a rebalancing of the market. **5 key market shifts will define the new agricultural realities:**

Shift in geographic viability
Changing climate patterns and demand for 'locally sourced' is increasing the commercial viability of higher value and volume products for previously too cold regions (e.g. Northern Europe)

Shift to climate resilient species
Temperature spikes and increasing droughts are changing both crop and livestock farming towards species that are more heat or cold resilient (e.g. from cattle to goat and camel farming)

Shift in technology innovation
Technology innovation is accelerating including the use of data analytics and AI to increase farming yields through up-to-date meteorological data on weather patterns to optimise inputs

Shift in consumer preferences
Dietary choices are changing across markets with a greater emphasis on linkages to health and sustainability in high-income countries, and rising livestock intake in key emerging markets

Shift in agricultural trade
Geopolitical and climate changes can mute agricultural trade in the coming decade compared with previous years requiring corporates to ensure diversified supply chains and markets

8 Ultimately, the world remains on track towards a 2.5° scenario by 2050 unless we can course correct and fast. **Investors can facilitate this by engaging with their portfolio companies, wider sectors, policy makers, and civil society** to shape agricultural value chains towards mitigating the harmful impacts of current practices and adapting to changing weather patterns and consumer demands.

There are three key recommendations for investors to:

8.1 **Incorporate physical climate risk into their investment decision making** including through updating due diligence processes to consider cross-value chain climate impacts (e.g. on upstream commodity input prices).

8.2 **Support companies to consider and disclose (to the board and/or publicly) on 10 areas** that can help them to assess their climate risks and opportunities. These include:

i. **Value chain maps** especially outlining core partners and regions that account for over 20% of either supply or offtake;

ii. **Climate risk scenarios over at least 10 years** across all key extreme weather hazards for themselves and core supply chains;

iii. **Input price scenarios over 5 years** including identifying key drivers for volatility;

iv. **Nutrient density trends across key products** linked to key drivers (e.g. reduction in wheat protein density due to drought);

v. **Emissions trajectories across scope 1–3 for their operations** (including breakdowns between different emission types if possible);

vi. **Natural resource consumption across direct and indirect operations** (e.g. spatial footprint of land controlled, land use change, water consumption) and opportunities to minimise resource usage;

vii. **Priority and material ESG factors impacted or impacting direct and dependent operations** (e.g. water, biodiversity loss, soil health, worker welfare);

viii. **Impacts of current and projected carbon taxes (and other relevant taxes like sugar taxes)** on their operations impacting both economics as well as product mix;

ix. **Market demand trends at the end of their agricultural value chains** that could change customer and consumer demand (e.g. towards health, sustainability, or higher protein foods); and

x. **Operational, product, and investment plans** to decarbonise operations, improve material impacts, and hedge towards future consumer demand.

8.3. **Formulate and pursue an engagement strategy covering portfolio companies, other investors, the wider industry, and civil society** that leverages their influence, convening power, and financial resources to steward their portfolios away from significant climate risk and towards a more resilient future.

Detasseling corn in Illinois, USA.

Designed by the EMEA/US Design Team – SII-PC1267-SII Food and climate exec sum rs1