

STRATEGIES TO ADDRESS CLIMATE RISKS AND CAPTURE OPPORTUNITIES

A guide for agricultural finance institutions

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Environmental Defense Fund, a leading international nonprofit organization, creates transformational solutions to the most serious environmental challenges. EDF links science, economics, law, and innovative private-sector partnerships. EDF’s agricultural finance work includes farm financial analyses, collaborating with finance providers to develop solutions, and agricultural finance policy. To learn more, visit business.edf.org/farm-finance.

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Deloitte is the world’s largest professional services provider and has deep experience working on climate-related goals, plans, and disclosures, with industry leaders in the agriculture, food systems, and finance sectors.

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EXECUTIVE SUMMARY



In 2022, Environmental Defense Fund and Deloitte conducted a global [survey of 167 agricultural finance institutions on risks and opportunities associated with climate change](#). The survey found that 87% of agricultural finance institutions expect climate change to pose a material risk to their business, including negative impacts to the financial situation of their farmer clients (56%). Fifty-nine percent of respondents expressed that climate change will also present opportunities for their institutions. While the vast majority of agricultural finance institutions expect climate change to impact their businesses and clients, only a quarter of responding institutions stated that they currently consider climate change impacts significantly in their decision-making.

Some agricultural finance institutions have taken steps to prepare for climate change impacts by gathering climate-related data, creating climate-related roles and responsibilities within their management structure, setting climate change goals, and partnering with external organizations on climate risk topics. But many agricultural finance institutions face challenges preventing them from taking further action to manage climate risks and opportunities, including a need for more significant resources such as knowledge on climate topics, data to support climate risk assessment and the development of financial products, and educational opportunities for employees and leadership.

This guide provides agricultural finance institutions with strategies to address climate risks and capture climate opportunities

This guide was informed by the [EDF and Deloitte survey](#) of agricultural finance institutions and interviews with agricultural finance providers of different sizes that are approaching the topics of climate risk and opportunity in various ways. This guide aims to provide mid-level and senior-level agricultural finance professionals with an introductory understanding of the risks to agriculture stemming from climate change, the current and potential future effects of those risks on agricultural finance institutions, and a range of approaches for managing and responding to these risks. The strategies outlined in this guide will help agricultural finance institutions navigate the challenges posed by climate change and support their farmer borrowers to sustainably produce food and other agricultural products into the future.

Five strategies to integrate climate risk management at agricultural finance institutions

In particular, this guide is a useful resource for risk, lending and sustainability teams within commercial banks, agricultural banks, financial cooperatives, development banks and government-sponsored financial institutions.

The following five strategies combine to form a holistic approach to understanding and managing climate risk in agricultural finance. They were identified from existing financial sector pre-competitive guidance and publicly disclosed climate strategies from leading banks, governments and climate-modeling companies.



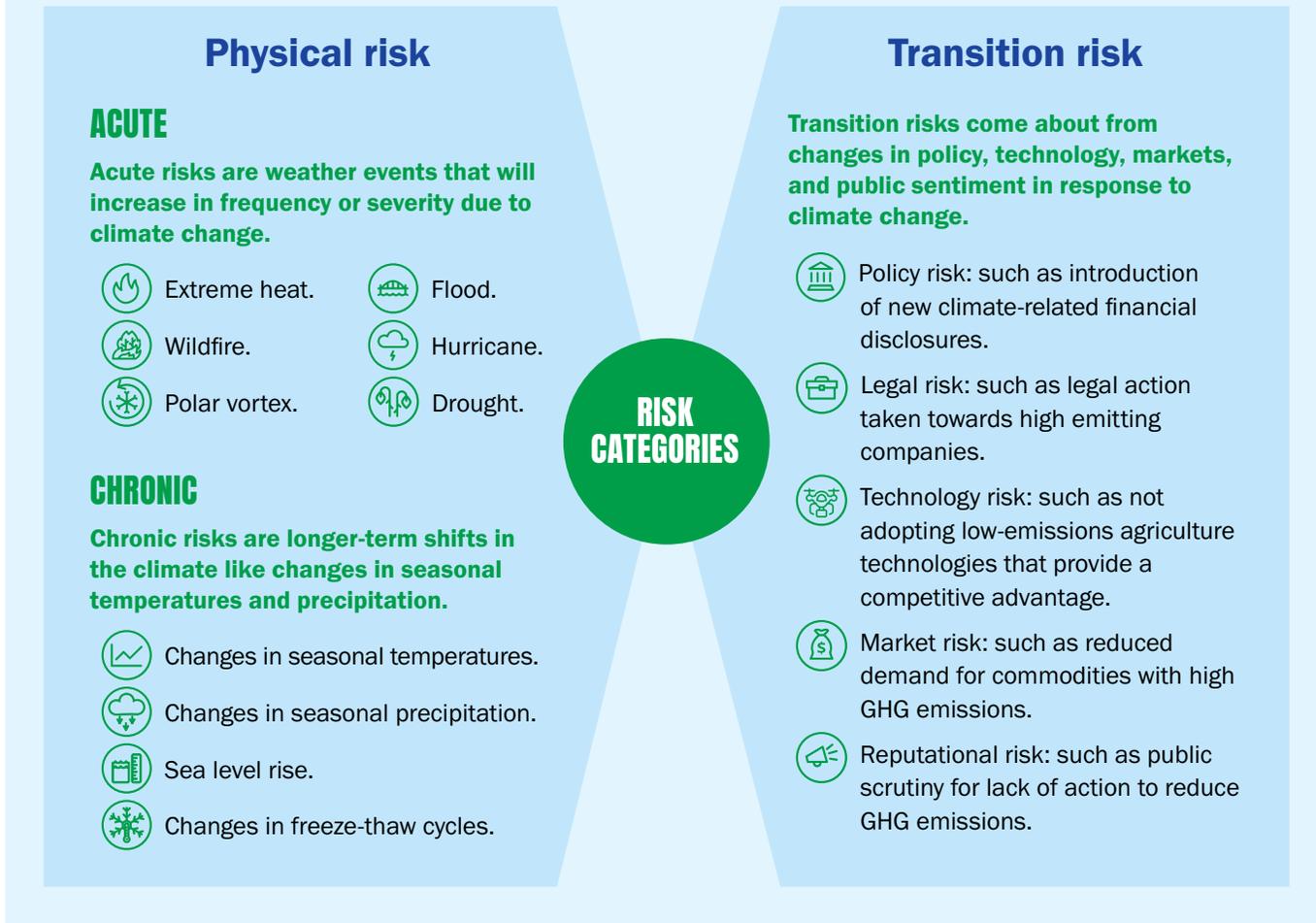
1 Understand the business risks presented by climate change.

The first step to managing climate-related risks is understanding how climate change can impact farmer borrowers and business risks at the finance institution. Climate risk is the vulnerability and exposure to extreme and non-extreme weather, climate, and policy and market events caused by climate change or in response to mitigating climate change.¹

Climate change risks can manifest through physical risks or transition risks. Physical risks are the result of the physical effects of climate change, such as changes in temperature, precipitation patterns, extreme weather events and changes in water availability. Transition risks arise when society takes action to mitigate or adapt to climate change and shift to a low-carbon economy, including risks from policy, market and technology changes.



FIGURE 1
Examples of physical and transition risks for agriculture.



The physical and transition impacts from climate change can lead to financial risks in agricultural loan portfolios through traditional risk categories. Physical and transition impacts of climate change can increase the probability of default and loss given default in agricultural finance institutions’ portfolios. Climate change can create market

risks, such as changes in consumer preference and price volatility for agricultural goods. It can also present policy risks as governments pursue climate policies that could impact agriculture. Agricultural finance institutions can also face liquidity, operational, insurance and reputational risks associated with climate change.

2 Measure and evaluate climate risks in the portfolio.

Agricultural finance institutions should assess climate risks to their agricultural portfolios and integrate that assessment into their Enterprise Risk Management (ERM) framework. Assessing climate risks can help inform portfolio allocation and planning and support borrowers to reduce, adapt to and manage climate risks.

A common approach to assessing climate risks at finance institutions is called “climate change scenario analysis” or “climate risk assessment.” Climate risk assessment is an exercise that explores “what if” questions by modeling changes in climate conditions, climate policy, technology

adoption and GHG mitigation. It allows finance institutions to explore how different future conditions could impact their borrowers and their loan portfolios. The results of climate change risk assessment exercises can inform finance institutions’ risk ratings, client engagement and financial product offerings.

Agricultural finance institutions can complete a climate risk assessment using steps in Figure 2 to integrate climate risks into their existing risk identification and management structures.

FIGURE 2
Steps to complete a climate risk assessment.

- 1 Heat map climate risks to understand and rank the impact of specific climate and weather risks on agricultural lending business.
- 2 Choose a sample of borrowers to conduct a climate risk assessment and gather baseline data about location, production and financial performance.
- 3 Choose a climate model to project the changing probability and severity of climate risks based on how much warming occurs across a defined length of time.
- 4 Input projected climate outcomes into models for crop and livestock productivity to better predict borrowers’ likely yields, costs and production practice changes in the face of a changing climate.
- 5 Use projected productivity and yield changes to better understand the financial performance of individual farms, credit risk ratings and probabilities of default. After that, extrapolate those findings across an entire portfolio.

3 Establish climate risk controls.

Climate risk controls are the overarching structure of rules and processes that a company puts in place to effectively manage the risks and opportunities presented by climate change. Integrating the topic of climate risk into the existing ERM framework and executive-level oversight can help agricultural finance institutions strategically understand, measure and manage climate risks.

Agricultural finance institutions can take three steps to effectively implement climate risk controls and enable the execution of critical climate risk management processes.

- 1 Identify the processes and responsibilities required to manage climate risks.
- 2 Assign the responsibilities to a role or department. (See figure 3 for an example of this.)
- 3 Document results and set up a corresponding reporting structure.

Agricultural finance institutions can integrate climate-related responsibilities into preexisting governance teams and roles or create new ones.

FIGURE 3

Demonstration of how climate change can be added to existing layers of management.



4 Engage customers on the topic of climate change.

Agricultural finance institutions can proactively engage their agricultural customers on climate topics to support them in managing climate risks and opportunities. By engaging customers, relationship management teams will better understand their customers' awareness of climate risks, their specific needs related to climate risk, localized information about physical climate risks, and their level of climate adaptation.

Client engagement can help client relationship managers or loan officers better provide their clients with appropriate financial products and services to help farms and ranches

invest in and adopt climate-resilient practices and technologies.

Agricultural finance institutions can begin by preparing relationship managers and loan officers through climate risk trainings and workshops. They can also make climate risk resources available to relationship managers, including talking points for client engagement. After completing training and developing engagement materials, agricultural finance institutions can identify customers to engage and develop an engagement plan.

5 Develop new offerings to address risks and opportunities.

Agricultural finance institutions can support clients' changing financial needs by offering new or modified financial products that help their agricultural clients manage climate risks or take advantage of climate-related opportunities. Such products may improve the agricultural clients' and portfolios' credit risk profiles, support farmers to transition to climate-smart farming practices, reduce GHG emissions in the agricultural portfolio, and help producers participate in emerging markets for climate-smart products.

Many agricultural finance institutions are already financing farmers who have adopted climate-smart practices and technologies. But some climate risks will require agricultural finance institutions to act more proactively to support more of their clients to adapt to climate change. The approach to developing new or modified financial products should build from the finance institutions' understanding of climate risks and opportunities faced by farmers in their area, the types of practices, technologies or production shifts that can mitigate risks and capture opportunities, and any financial barriers to greater adoption of those solutions. Once an agricultural finance institution has identified the need and demand for a new or modified financial product, there are multiple models they can consider pursuing, these include:

- 1 Green loans:** Green loans are similar to standard loans except for the use of proceeds must be used to fund sustainability projects.
- 2 Sustainability-linked loans:** Sustainability-linked loans are similar to green loans, except they incentivize the borrower to meet sustainability performance targets (i.e., reduction of GHG emissions or energy efficiency improvement) over the loan term. Once the targets are met, the loans' interest rates are ratcheted down.

- 3 Green bonds:** Green bonds are similar to green loans in that funds must be used for sustainable projects. However, green bonds are typically larger in size, have associated transaction costs, and may be privately placed or listed on an exchange.

- 4 Transition loans:** A transition loan has an adjusted repayment structure to support the farmer through adopting new agricultural practices. Some lenders offer transition loans to help farmers work toward organic certification. A similar model can be used to support farmers' transition to climate-smart agriculture practices.

Turn risks into opportunities

The physical and transition impacts of climate change on the agriculture and food systems industry present various risks and opportunities for agricultural lenders. Agricultural finance institutions can implement the five steps presented in this guide to bring climate risk management into business management and client engagement.

The critical takeaway is that new approaches to agricultural finance and client relationships can help turn current and projected climate-related financial risks into opportunities for farmers and agricultural businesses and their lenders. By developing climate strategies, agricultural finance institutions can strategically position themselves as partners to agricultural producers and businesses as they navigate new climate-related challenges and emerging business opportunities.

OVERVIEW: HOW TO INTEGRATE CLIMATE RISK MANAGEMENT AT AGRICULTURAL FINANCE INSTITUTIONS



This guide presents five key strategies that combine to form a holistic approach to understanding and managing climate risk in agricultural finance. These five strategies were identified from existing financial sector pre-competitive guidance and publicly disclosed climate strategies from leading banks, governments and climate-modeling companies. The visual on the left summarizes these topics, which are addressed sequentially in each section.

Strategy one provides information to help agricultural finance professionals understand how climate change and its associated risks translate into financial risks for agricultural finance institutions and their borrowers. This section should support agricultural finance institutions in identifying which climate risks they should include in their risk inventory.

Strategy two covers prioritizing and assessing climate risks as a critical step to integrating climate risk into Enterprise Risk Management (ERM). It will discuss how to complete a heat map of climate risks in agricultural portfolios. It also reviews steps to run those risks in projection models to analyze how future climate changes will impact the severity of these risks, agricultural output, and financial performance of agricultural clients and portfolios.

Strategy three describes opportunities to establish climate risk internal controls to manage these risks properly. It presents potential climate-related roles and responsibilities that financial institutions can embed in their organizational structure, along with how to incorporate climate risks and opportunities into existing processes such as pipeline management and customer relationship management.

Strategy four covers how to engage customers on the topic of climate risks. It presents how information about the impacts of climate change can flow freely between a farm operation and its finance provider so they can identify and address both the risks and opportunities that climate change presents to the parties.

Finally, strategy five discusses the opportunity for agricultural finance institutions to identify and develop new or modified product and service offerings to address the climate-related challenges and opportunities of their portfolios and clients. These opportunities range from new risk management products to help clients manage the short-term impacts of extreme weather to long-term funding for investments in agricultural resiliency and reduced climate impacts, such as GHG emissions reductions.



The five key strategies should be considered in the context of agricultural finance institutions' ERM frameworks. Climate-related risks impact finance institutions' traditional risk categories and should be evaluated within the ERM framework. The guide focuses on risk identification (strategy one), assessment and prioritization (strategy two and three) and response (strategy four and five) steps of the ERM and are framed in that context throughout. Risk responses within the ERM can include accepting, avoiding, pursuing or sharing the risk. The guide specifically focuses on a risk response that pursues opportunities to engage farmer borrowers and develop new or modified financial products that support farmers who build climate resilience

or reduce the climate impacts of their operations. That is not the only response agricultural finance institutions can take, but it is a response in which the agricultural finance industry actively participates in reducing climate risk to the greater agriculture sector.

Additional resources for integrating climate risk topics into enterprise risk management include the [Institute of Risk Management's Climate Change Risk and Management Guidance](#) and [COSO and World Business Council for Sustainable Development's Enterprise Risk Management: Applying Enterprise Risk Management to Environmental, Social and Governance-related Risks](#).

STRATEGY 1: UNDERSTAND THE BUSINESS RISKS PRESENTED BY CLIMATE CHANGE



1

Understand the business risks presented by climate change.

2

Measure and evaluate climate risks in the portfolio.

3

Establish climate risk controls.

4

Engage customers on the topic of climate change.

5

Develop new offerings to address risks and opportunities.

Introduction to climate risk

The first step to managing climate-related risks is understanding how climate change can impact farmer borrowers and business risks at the finance institution.

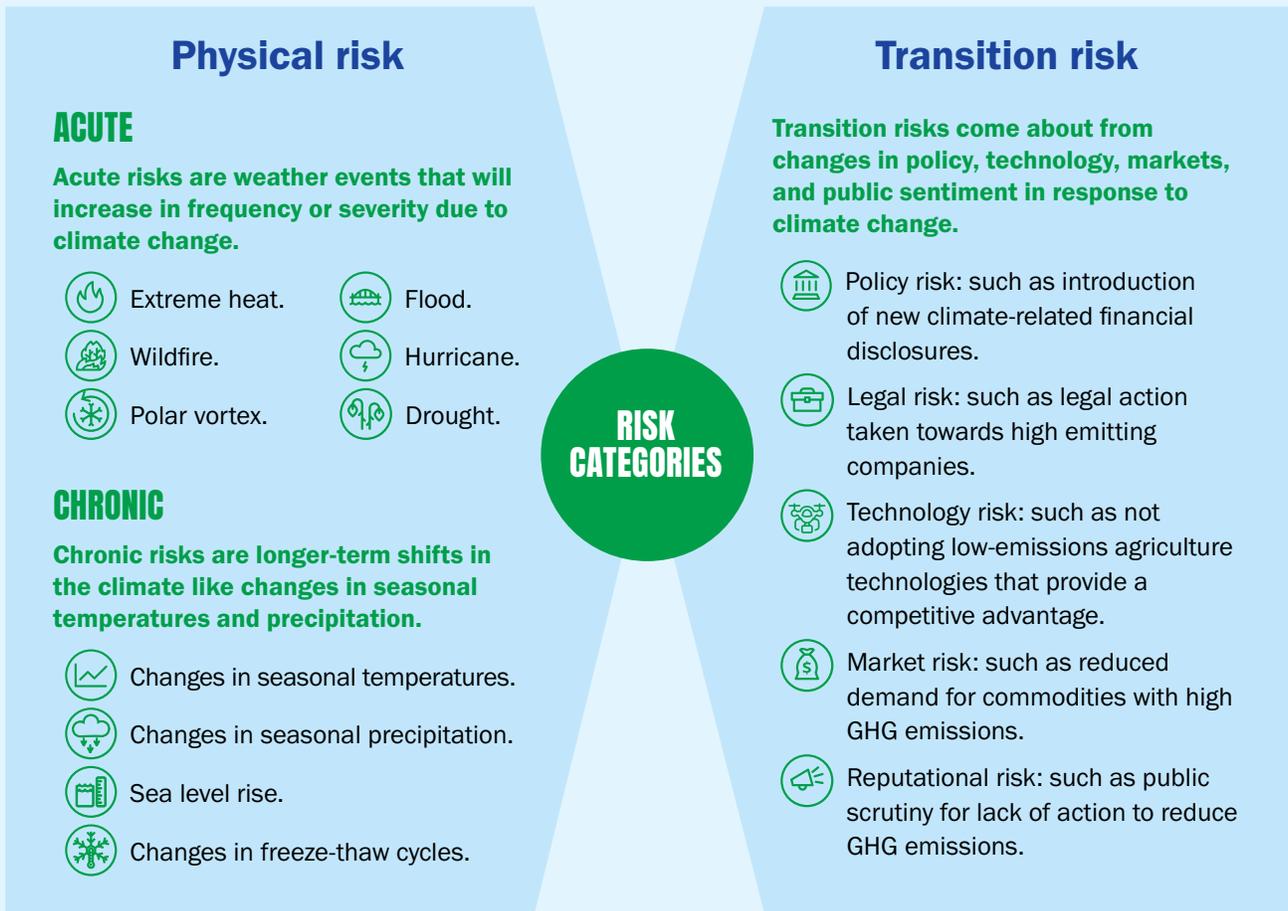
Climate risk is the vulnerability and exposure to extreme and non-extreme weather, climate, and policy and market events caused by climate change or in response to mitigating climate change.⁴ The following sections describe two categories of climate risks: physical risk and transition risk.⁵

Categories of physical and transition climate risks are displayed in Figure 4 below.

What is climate change?

Climate change is the long-term shifts in temperature and weather patterns associated with natural variation and human activity. The Earth's climate naturally fluctuates over long time periods, but since the 1880s, human activity has been the main driver of climate change. Burning fossil fuels and other human activities emit greenhouse gases that act as a blanket around the Earth's atmosphere that traps the sun's heat and raises the temperature in the atmosphere.² This increased atmospheric temperature affects many of Earth's systems, including rising temperatures that result in changing precipitation patterns, rising sea levels, changing frequency, intensity, and duration of extreme weather events, and shifting ecosystem patterns, such as the length of growing seasons and pollination cycles.³ These impacts can affect the agriculture sector in multiple ways described throughout this report. To learn more about climate change, visit the [United Nation's site on climate change science](#).

FIGURE 4
Examples of physical and transition risks for agriculture.



Physical risks

Climate change can present **physical risks** to agriculture which are the result of the physical effects of climate change, such as changes in temperature, precipitation patterns, extreme weather events and changes in water availability. Agricultural finance institutions recognize the potential impact, with 87% of respondents in [EDF and Deloitte's survey of agricultural finance institutions](#) reporting concerns about the impact of weather on their agricultural clients and anticipating material^A risk from short-term and/or long-term physical risks.⁶

A Material risk is defined as a certain risk that is sufficiently significant to be managed to a certain minimum standard.

Climate change has already impacted crop productivity positively in some cases and negatively in others. Figure 5 below from the Intergovernmental Panel on Climate Change demonstrates the researched impacts climate change has already had on crops. Climate change has positively impacted yields in certain regions and negatively impacted others. Physical climate changes in the future are likely to reduce agricultural productivity in certain regions unless the pace of agricultural adaptation increases significantly. These changes could also increase productivity in other regions that may see longer crop production seasons.

FIGURE 5

Observed climate change impacts on crop yields and productivity.

(from the Intergovernmental Panel on Climate Change AR 6 report)⁷

Synthesis of observed impacts on crop yields and productivity



Figure 5.3 | Synthesis of literature on observed impacts of climate change on productivity by crop type and region. The figure draws on >150 articles categorized by: agriculture total factor productivity including literature estimating all agricultural outputs in a region; major crop species including literature assessing yield changes in the four major crops; crop categories including productivity changes (yield, quality and other perceived changes) in a range of crops with different growth habits. The assessment uses literature published since AR5, although the timespan often extends prior to 2014. The direction of the effect and the confidence are based on the reported impacts and attribution, and on the number of articles. See SM5.1 and SM5.2 for details.

Physical risks from climate change can manifest through **acute** or **chronic** impacts.

Acute physical impacts

Acute physical climate impacts are those that occur as distinct events, such as droughts, hurricanes, or severe precipitation events that cause flooding. Although no single extreme weather event is caused by climate change, climate change increases the likelihood, frequency and severity of weather extremes.⁸ Acute physical impacts on agriculture can cause crop productivity decline or livestock loss, decreased farm income and supply chain disruptions.⁹ For example, during the summer of 2022, floods in Pakistan destroyed half the country’s crops, valued at over \$2 billion USD.¹⁰ This caused local vegetable sellers to increase prices by over 200% in a week.¹¹ Risks

to farmer borrowers and other agricultural businesses in a region affected by an acute physical climate impact creates risk for finance providers, particularly those who are concentrated in the affected region and/or the type of agricultural production impacted. Figure 6 below shows examples of how acute physical impacts can manifest into financial risk.¹²

Many agricultural lenders require their borrowers to hold crop insurance or other forms of insurance. While crop insurance can absorb the majority of financial losses from an acute weather event, it does not make up for all losses. Furthermore, not all crops are covered in many national crop insurance programs, leaving some borrowers unprotected by these policies. Crop insurance and other forms of insurance are important forms of protection against losses from extreme events – but they do not fully protect farmers or their finance providers – particularly if more than one event occurs in succession.

FIGURE 6
Examples of the acute physical impacts of climate change on agriculture and the associated financial risk.

ACUTE PHYSICAL RISKS



Floods.



Droughts.



Fires.



Heatwaves.



Hurricanes.



Storms.



Arctic vortex.



Recurring wildfires in California cause abandonment of...



...farms and evacuation of livestock as well...



...as power outages impeding harvesting and watering...



...affecting an entire region and triggering costly restoration efforts.^{11.1}



Intense thunderstorms and lightning in India...



...are destroying crops and killing livestock...



...as well as causing sharp changes in temperatures...



...leading to further crop loss and financial loss.^{11.2}

Chronic physical impacts

Chronic physical impacts are gradual changes in the climate that progressively affect a region's weather conditions over time. Chronic physical climate risks to agriculture are shifts in seasonal rainfall patterns, average temperatures, freeze and thaw patterns and indirect effects of climate change (e.g., loss of ecosystem services such as pollination and degradation of soil quality).¹³ Several examples of chronic physical impacts include:

- Shifting temperatures and more frequent extremes can damage crops and create conditions for weeds and pests to further damage crops.¹⁴
- Persistent droughts and floods increase soil degradation, which impedes soils' ability to grow crops.¹⁵

Figure 7 shows examples of how chronic physical impacts can manifest into financial risk.¹⁶

These chronic climate impacts on agriculture can have adverse outcomes that crop insurance may not be able to buffer. For example, more consistent drought can reduce land value growth, which impacts farmers' balance sheets and the value of the collateral used to secure a loan.

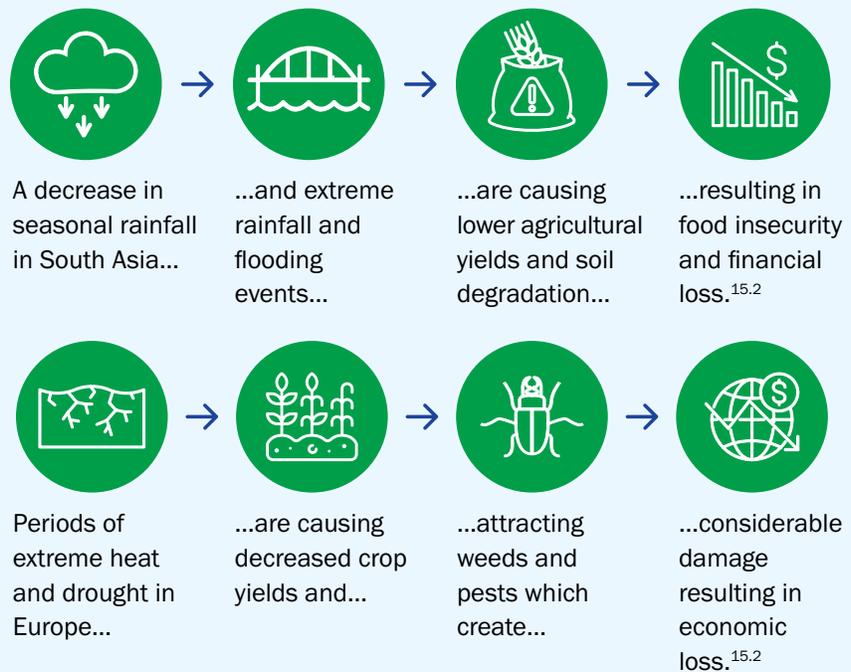
As agricultural finance institutions consider which physical risks are important to their business and how to address them, it is important to remember that these physical risks are not evenly distributed across geographies. Finance institutions will experience different impacts from climate change depending on the prevailing climate changes and agricultural production in their region. For this reason, it is important to identify where lenders' investments and assets are precisely located. Once the geographic locations of the investments are identified, finance institutions can determine which climate risks could impact their portfolios. Agricultural finance institutions whose portfolios are regionally concentrated may face greater risks from regional chronic climate risks than regionally diversified banks.

FIGURE 7

Examples of the chronic physical impacts of climate change on agriculture and the associated financial risk.

CHRONIC PHYSICAL RISKS

-  Temperature changes.
-  Shifting rainfall patterns.
-  Rising sea level.
-  New pests and diseases.
-  Desertification.



Transition risks

Transition risks arise when society takes action to mitigate or adapt to climate change and shift to a low-carbon economy. This transition may present risks to agricultural finance institutions if the transition needs to be properly anticipated or followed by a quick response. A sudden or disorderly shift in climate policy or technology may impact the value of a finance institution's assets or liabilities.¹⁷ A specific agricultural transition risk example is the "Dutch nitrogen crisis," which was triggered by the government announcement of nitrogen emissions reduction targets and plans to buy out livestock farms in response to high nitrogen pollution from animal manure.¹⁸

Climate risk management within an agricultural lending portfolio should include various transition risks, including major policy, legal, technology, market and public sentiment shifts as society and the economy respond to climate change. Each of these transition risks has the potential to disrupt the operational and financial performance of agricultural businesses.¹⁹ Sixty-five percent of agricultural finance institutions in [EDF and Deloitte's survey](#) anticipate significant risk from short-term and/or long-term transition risks.²⁰

FIGURE 8

Examples of transition risk categories.

TRANSITION RISKS



Policy.



Market.



Legal.



Public/
Consumer
sentiment.



Technology.

Governments may institute **new policy** measures to foster a low-carbon economy, **new agricultural technologies** may be developed that, if not adopted, could make a producer less competitive, and **consumer preferences** may change demand for food products. These developments all have the potential to cause competitive advantages or disadvantages for agricultural finance institutions based on their level of foresight and preparation.



Policy transition risks can include the introduction of new climate policies, such as carbon pricing, which may reduce the profitability of more carbon-intensive commodities. Policy risks also include the introduction of new climate risk disclosure policies that require companies to measure and report GHG emissions.²¹ The introduction of climate risk disclosure rules in some jurisdictions is an example of a transition risk that is materializing. Publicly traded companies, including some banks, in jurisdictions that have set climate disclosure rules are spending resources to gather, analyze and disclose climate data to their regulators. Those already disclosing climate risks under voluntary frameworks are better prepared to respond to the new requirements and may have a competitive advantage. Table 1 below shows recent developments in climate risk disclosure rules in the United States and the European Union.

TABLE 1
Recent development in climate-related disclosures.

Jurisdiction	Year	Agency or Directive	Details
U.S.	2022	Securities and Exchange Commission	Published a proposed rule that would require publicly registered companies to disclose information about certain climate change-related risks, including their GHG emissions.
	2021	Financial Stability Oversight Council	Published a report that provided recommendations for financial regulators to assess climate-related financial risk and enhance climate-related disclosures.
	2020 and 2021	Commodity Futures Trading Commission	Published a report on Managing Climate Risk in the U.S. Financial System and established a Climate Risk Unit .
European Union	2023	Corporate Sustainability Reporting Directive	Expands reporting requirements of Non-financial Reporting Directive (below) to all large companies, require an audit of the information, and new information requirements.
	2020	Sustainable Finance Disclosure Regulation	Establishes rules for financial market participants and financial advisers on: i) transparency with regard to the integration of sustainability risks; ii) the consideration of adverse sustainability impacts in their processes; and iii) the provision of sustainability-related information with respect to financial products.
	Base legislation 2019 Implementing rules 2021-2	‘Banking rulebook’ comprising Capital Requirements Regulation and Capital Requirements Directive	Establishes prudential framework for banks and investment firms, also implements Basel Framework. 2021 and 2022 implementing (executive) acts introduce requirements for banks to report on transition and physical climate risk exposure, plus actions taken to mitigate risks (in force from 2024). The Capital Requirements Regulation and Capital Requirements Directive base legislation is also in the process of being revised. The proposal on the table would enlarge the scope for ESG risk disclosure from large institutions with listed securities to all institutions (with some concessions for ‘small and non-complex’ institutions); it also introduces requirements for ESG stress-testing, starting with climate risk.

Technology risks may arise as later adopters of climate-smart technologies lose out on early competitive advantage and even grants to support early technology adoptions. Technology risks also present equity concerns as emerging climate-smart farm technologies are created for — and affordable only to — large farms, further exacerbating challenges to small farms.²²

Consumers and investors are becoming increasingly aware of the importance of climate change action, which may cause shifts in demand and investment toward more climate-friendly products. Investors are increasing the demand for sustainable agriculture investments. Banks, food and agriculture companies and farmers not adapting to this demand could lose financial opportunities to their competitors.²³ These shifts present a **market** risk to agricultural producers if they cannot act fast enough to meet these changing demands.²⁴

It is increasingly important for agricultural finance institutions to assess their vulnerability and the necessary strategies to manage these transition risks.²⁵



Climate change opportunities

Climate change may also create opportunities for agricultural finance institutions. In [EDF and Deloitte's survey of agricultural finance institutions](#), 59% of institutions in North America, the European Union and India identified opportunities presented by climate change. The survey respondents identified opportunities, including increased demand for new extreme weather-specific financial products and services, increased credit needs, and the development of carbon and ecosystem markets.²⁶ The global uncertainty and disruption caused by climate change will drive innovation, new agricultural technologies, and demand for low GHG emissions products. Government transitions to low GHG policies can also present opportunities to lenders participating in emission-reduction projects. For example, in 2022, the USDA invested \$2.8 billion in projects that will create markets for climate-smart agriculture commodities.²⁷

Farmers and agricultural businesses may demand new and different financing to help them reduce GHG emissions and adapt to climate change, utilizing innovative farming approaches and technologies in some cases.²⁸ There are opportunities for farmers to invest in agricultural practices and technologies that mitigate risk, which may create more resilient borrowers where new farm input technologies and agro-economic practices increase yields and reduce the risk of crop failure.²⁹

Such climate-smart practices may also create opportunities in carbon and other ecosystem services markets for farmers and agricultural finance providers. For example, the advisory services part of the agricultural finance business could offer consultation to its clients on how to invest in sustainable or regenerative agricultural practices, which may generate additional income through incentives and markets rewarding the climate — and wider environmental — benefits these practices deliver. Agricultural finance institutions that do not have an advisory services business can still provide borrowers with education and training on ecosystem services market opportunities which could increase revenue opportunities for their borrowers.

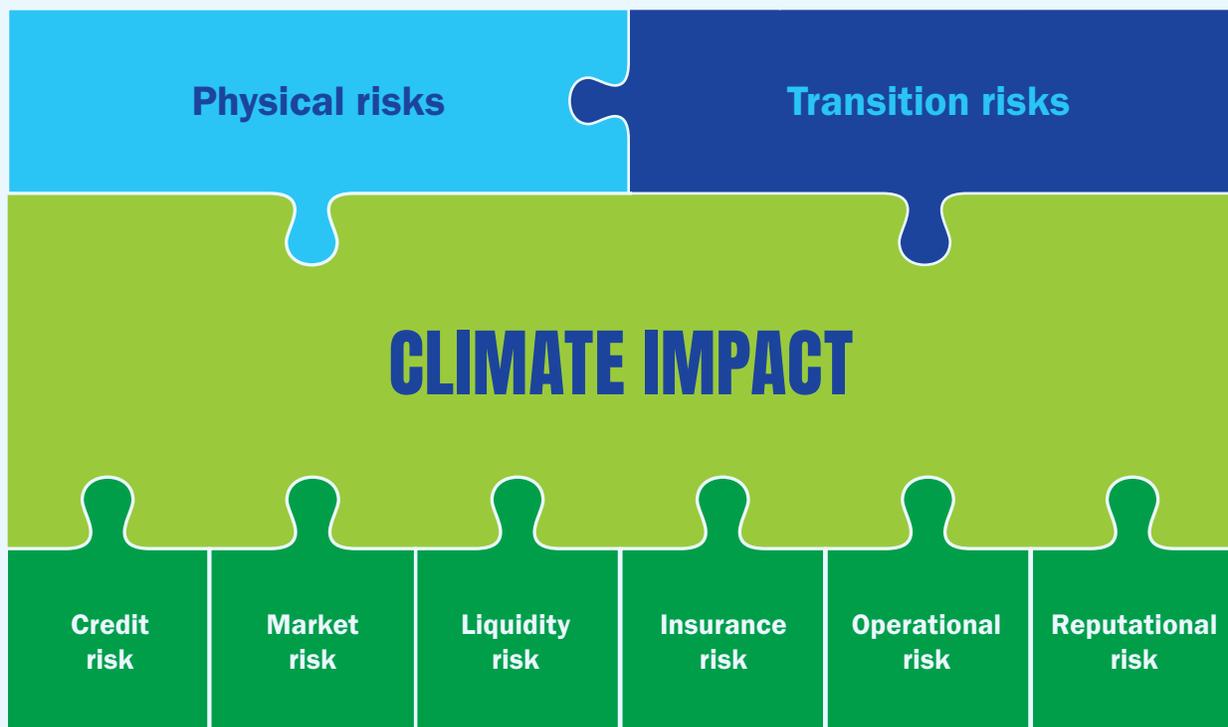
Climate-related financial risks for agricultural finance institutions

The physical and transition impacts from climate change can lead to financial risks in agricultural loan portfolios. Agricultural finance institutions should identify which climate risks are already included in their risk inventories and which ones should be added. They can identify which climate risks are relevant to them using their ERM's risk identification process, which could include conducting surveys, workshops and interviews with external stakeholders and internal teams.³⁰ Agricultural finance institutions can then include the identified climate risks

and the way they can impact the traditional risk categories in the risk inventory.

This section explains the traditional risk categories and how they could be affected by climate risks in agriculture, covered in the previous section. These traditional risks include credit, market, liquidity, insurance, operational and reputational risks.³¹ Each of these risks is interconnected and can have reinforcing effects that further increase the impact of climate risks on agricultural lenders.

FIGURE 9
Linking climate risks with financial risks.



Credit risk

Credit risk occurs when there is the potential for the borrower to fail to repay part of or all the interest or principal of a loan.

Borrowers' credit risk profiles and finance institutions' portfolio risk levels may rise due to climate change impacts. Acute physical risks like natural disasters that damage or destroy crops or other valuable farm assets (e.g., collateral and productive land or equipment) may tighten the borrower's cash flows, leading to a higher probability of default, and may diminish collateral value leading to higher loss given default. In **EDF and Deloitte's survey of agricultural finance institutions**, 42% of agricultural finance firms expect a higher probability of default in their portfolio, 32% expect higher loss given default, and 28% expect diminished collateral value due to the impacts of climate change.³²

Long-term, chronic physical risks from changing weather patterns can also impact borrowers' credit risk profiles and risk at the portfolio level. Reduced rainfall or higher temperatures may increase crop stress, leading to higher losses and tighter cash flows.³³ This may result in a higher amount of non-performing loans in the agricultural portfolio. Changes in temperatures and precipitation may also diminish the value of farmland in specific regions leading to lower collateral values and higher loss-given defaults for agricultural portfolios. For example, farmland in the Southeast U.S. could lose 2.5-5% in aggregate value, and Florida could lose approximately 40% of its farmland value by 2100 because of increased summer temperatures caused by climate change.³⁴ In the Southern regions of the European Union, farmland value is predicted to decrease by up to 80% by the end of this century due to changing temperatures and precipitation patterns.³⁵

Market risk

Market risk is the risk that the market value of an asset will fall (or the value of a liability increase) in a portfolio. Climate change-related market risks to agricultural finance institutions may result from changes in consumer demand, price volatility, climate policy and other factors.

- ➔ **Consumer preferences:** Changing consumer preferences for climate reporting/disclosures and low-carbon products may reduce the value of certain agricultural products that are not produced using climate-smart practices and increase the value of others that have a lower climate impact.
- ➔ **Price volatility:** Amplified price volatility of agricultural commodities from climate and weather events may impact agricultural lenders' ability to recoup expected values. Severe weather events affected by climate change have already impacted price volatility.³⁶ For example, India received 500% more rainfall in October 2022 than the average year, damaging crops and increasing rice prices.³⁷ Price volatility risk may differ across regions based on the maturity of the futures markets. If climate change impacts increase price volatility, it could impact a finance institution's ability to accurately predict farmers' cash flow, the probability of default and loss given default from changing collateral values.
- ➔ **Climate policy:** Climate policy could result in a rapid re-pricing of agricultural assets according to their relative GHG emissions intensity and depending on whether agricultural production is included in the climate policy. In situations where agricultural production is included in the climate policy, producing carbon-intensive agricultural commodities will increase in cost and producing less carbon-intensive agricultural commodities will decrease in price. In situations where agricultural production is not included in the climate policy, more carbon-intensive agricultural commodities may have the opportunity to sell GHG emissions reductions to regulated entities.

Liquidity risk

Liquidity risk is the risk that a lender may not have enough stable funding sources to meet its financial obligations on time. The impacts of physical risks on farms may lead to farmers drawing down on deposits and credit lines and ultimately lead to tighter liquidity for agricultural lenders.³⁸ For example, farmers in the same region impacted by flooding may draw down their credit lines immediately after a storm to make necessary repairs and buy new inputs, putting stress on the lender's liquidity.

Insurance risk

Insurance risk is the risk brought on by higher costs for farmers due to higher insurance premiums and, for insurance companies, due to more frequent insurance payments caused by more frequent and intense disasters. In the U.S., insurance payments to farmers increased more than 400% due to drought and 300% due to flooding and excess moisture from 1995 to 2020.³⁹

Climate risks could cause crop and weather insurance premiums to rise over time. In the U.S., the USDA's Economic Research Service estimates that without sufficient adaptation to climate change, the cost of the Federal Crop Insurance Program that producers and taxpayers pay could increase by over a third in the second half of this century.⁴⁰ There is a risk that government subsidization of crop insurance premiums could go down as taxpayers and policymakers may not want to pay for the increased cost of crop losses. This could increase the cost of crop insurance to farmers and could cause some to be unable to pay for insurance. There may also be an opportunity to partially reduce relative insurance premiums for producers that adopt climate-smart agriculture and farm adaptation measures that reduce risk.⁴¹

Operational risk

Operational risk is the risk of loss due to inadequate internal processes, people, and systems or external events interrupting existing business operations.⁴² Finance institutions can face operational risks if their offices or power sources are in areas at risk of extreme weather events. Agricultural finance institutions can also face operational risks from climate change if they do not have adequate processes or technology to support their borrowers during or after a severe weather event.

Reputational risk

Reputational risk is the risk of threats that can tarnish the company's public perception. Reputational risk can arise from changes in public sentiment, driving negative perceptions about specific commodities and scrutiny from stakeholders. For example, if agricultural financing is connected to deforestation or unsustainable agricultural practices, agricultural finance institutions may face reputational risk, resulting in reduced support from investors. On the other hand, agricultural lenders developing climate strategies must also consider the reputational risk if their borrowers become concerned that the institution is being too prescriptive of the borrowers' agricultural practices.

Summary

Climate change can pose risks to agricultural production through the physical impacts of changing and extreme weather and the transition impacts of moving toward a low GHG emissions economy. These physical and transition risks pose financial risks to agricultural finance institutions through traditional financial risks like credit and insurance risks. Understanding how climate change can lead to risks to agriculture and translate into financial risks is important for agricultural finance professionals to identify, measure and manage climate risks to their institutions.

For more information on business risks presented by climate change, please refer to [WBCSD's Food, Agriculture and Forest Products TCFD Preparer Forum](#) and [BIS' Climate-related risk drivers and their transmission channels](#).

Potential partnerships to better understand risks from climate change:

- Partnering with university scientists and researchers that can inform the institutions about climate change impacts on agriculture in their region.
- Partnering with non-profit organizations with expertise in agriculture finance and climate risks that have measured how climate change could impact agricultural production in the region of interest.



STRATEGY 2: MEASURE AND EVALUATE CLIMATE RISKS IN THE PORTFOLIO



1

Understand the business risks presented by climate change.

2

Measure and evaluate climate risks in the portfolio.

3

Establish climate risk controls.

4

Engage customers on the topic of climate change.

5

Develop new offerings to address risks and opportunities.

Once relevant climate risks are identified, agricultural finance institutions should assess climate risks to their agricultural portfolios and integrate that assessment into their ERM framework. Assessing climate risks can help inform portfolio allocation and planning and support borrowers to reduce, adapt to and manage climate risks.

A common approach to assessing climate risks at finance institutions is called “climate change scenario analysis” or “climate risk assessment.” Climate risk assessment is an exercise that explores “what if” questions by modeling changes in climate conditions, climate policy, technology adoption and GHG mitigation. It allows finance institutions to explore how different future conditions could impact their borrowers and their loan portfolios.⁴³ It can also assess how adaptation strategies could reduce climate risks for producers and the lending institution. The results of climate change risk assessment exercises can inform finance institutions’ risk ratings, client engagement and financial product offerings.

This section outlines five steps agricultural finance institutions can take to identify important risks and conduct a climate risk assessment that includes:

Step 1: Heat map climate risks.



Heat mapping is a formal exercise that helps agricultural finance institutions understand and rank the impact of specific climate and weather risks on their agriculture lending business. This can be integrated into the risk prioritization section of the finance institution's ERM.

Step 2: Choose a sample of borrowers and gather baseline data for the climate risk assessment.



Conducting a climate change risk assessment on a segment or the entirety of the agriculture loan portfolio requires a sample of borrowers and their baseline location, production and financial data. This baseline data is evaluated against the projected change in production and financial outcomes under a future climate scenario.

Step 3: Choose a climate model and timeframe.



The most important risks identified in step one can be estimated for the sample of borrowers using climate models that project the changing probability and severity of the risks according to the degree of atmospheric warming that occurs (i.e., 2, 3, or 4 °C of global atmospheric warming) over a specified time horizon. Agricultural finance institutions can choose the right climate model and time horizon for their business decisions.

Step 4: Project the impacts on agricultural yield.



The yearly weather outcomes of the climate models (including temperature, precipitation, and thousands of other weather variables) can be used as inputs to crop and livestock models that measure crop and livestock productivity changes based on weather and input variables. These models can help agricultural finance institutions understand how their borrowers' yields, costs and production practices could change based on the modeled climate changes.

Step 5: Project the impacts on financial performance.



The changes in agricultural productivity and yield can then be used to understand the projected financial performance of agricultural clients' individual farms, credit risk ratings and probabilities of default. These impacts can be extrapolated across an agricultural finance institution's portfolio to measure changes in probability of default and loss given default. Agricultural finance institutions can use the outcomes of this modeling exercise to discuss their risk appetite, ways to manage or share the risks, and opportunities to work with borrowers to reduce the underlying risk at the farm level.

The sections below describe how to conduct these five climate risk assessment steps and share helpful examples and tools.

Step 1: Complete heat map of climate risks

To effectively evaluate the climate risks identified in section one, agricultural finance professionals should consider completing a “heat map” of climate risks. Heat mapping is a critical first step for finance professionals to evaluate a set of climate impacts and segments of the portfolio to identify which are most important to assess in further detail using climate change risk assessment.

Heat mapping is an exercise that can help agricultural finance institutions identify the segments of their portfolio at greatest risk from climate change impacts. The relative risk of different segments of the agriculture loan portfolio (types of production systems and regions) is evaluated across three key variables: vulnerability, hazard and exposure.⁴⁴

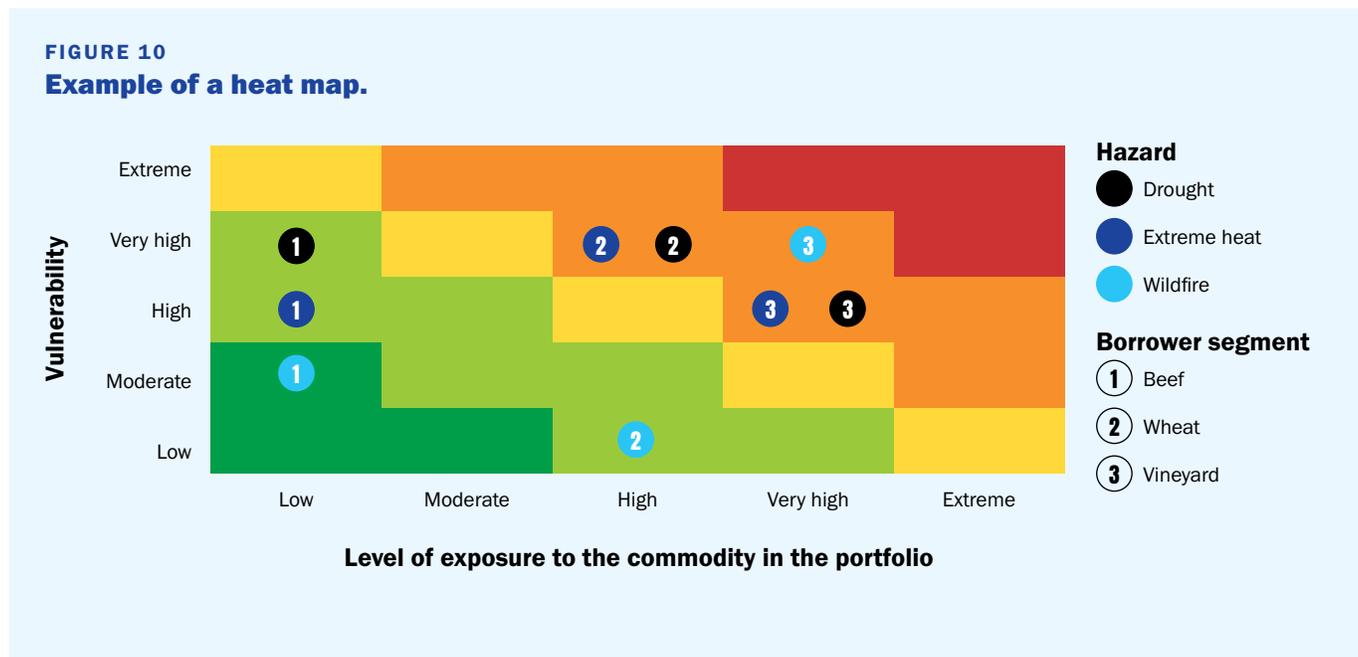
- ➔ **Vulnerability** is the likelihood of being adversely affected by changes in the climate, severe weather events, changes in policy, or weather impacts on other parts of the value chain. Agricultural finance institutions can assess the vulnerability of different segments of borrowers based on their reliance on consistent weather, high GHG emitting inputs or products, climate-sensitive input supplies, transportation routes, and other attributes that could be affected by climate change.
- ➔ **Hazard** is the type of climate-related event or trend that could impact borrowers. These include increased seasonal temperature, precipitation, wildfire frequency and drought intensity. Agricultural finance institutions can assess the hazards that are likely to impact their borrowers in different regions.
- ➔ **Exposure** is the presence of borrowers in areas that hazards will impact. Agricultural finance institutions can assess the relative presence of their borrowers in areas projected to be affected by climate hazards.



Agricultural finance institutions can inform their heat map by conducting surveys, interviews and workshops with external and internal stakeholders.

Figure 10 below is an example of a heat map demonstrating the vulnerability, exposure and hazards of an agricultural loan portfolio consisting of beef, wheat and vineyard borrowers. The three borrower segments

(distinguished using numbers) are evaluated by their vulnerability (vertical axis) and exposure (horizontal axis) to climate hazards (distinguished using colored circles). The red and orange cells in the top right of the map should be the risks and borrower segments facing the greatest climate-related risks that could be evaluated using a climate change risk assessment described in steps two through five.



Step 2: Choose a sample of borrowers and gather baseline data

The first step to modeling the impacts of climate risks identified in the heat map in step one is to identify borrowers to evaluate. A sample of borrowers can be selected that is representative of the portfolio segment the institution aims to evaluate. It can be beneficial to select borrowers interested in learning from the results of the risk assessment since they are more likely to provide the data required to conduct a robust assessment and share how the assessment’s results have informed their decision-making.

After selecting a set of borrowers for the assessment, the project leads should gather baseline borrower characteristics that will be used to evaluate how the financial conditions of the farms could change when impacted by climate stressors. The finance institution may already have some of this data, but additional data categories may need to be gathered directly from producers.

Borrower information to collect can include:

- ➔ **General characteristics:** Location, production system, number of crop or pasture acres.
- ➔ **Production characteristics:** Planting and harvest date, fertilization rate, seeding rate, irrigation, livestock stocking rate, purchased feed, grown feed, and yield averages.
- ➔ **Financial characteristics:** Revenue, gross profit, earnings before interest and taxes (EBIT), earnings before interest, taxes, depreciation, and amortization (EBITDA), interest expense, net income, liabilities, assets, and capital expenses (CAPEX).

Step 3: Select a climate model

The next step for evaluating the impacts of climate change on the agricultural loan portfolio is to choose the future climate scenario the project team wants to measure and the model (or set of models) that can best represent that scenario. The project team can work with internal climate-modeling experts or an external climate-modeling firm to choose the characteristics of the future climate scenario they want to evaluate. These characteristics include:

- ➔ **Degree of atmospheric warming:** The project team can choose between several scenarios associated with different levels of progress toward mitigating climate change and, therefore, degrees of atmospheric warming and climate impacts. The project team can choose between Representative Concentration Pathways, or RCPs, that are representative of economic and social conditions that lead to a certain amount of GHGs in the atmosphere and, therefore, global atmospheric temperature. For example, RCP 2.6 is associated with 1.0 °C of warming by 2100, RCP 4.5 is associated with 1.8 °C of warming, RCP 6.0 is associated with 2.2 °C of warming, and RCP 8.5 is associated with 3.7 °C of warming.⁴⁵ Alongside RCPs, the project team can also use shared socioeconomic pathways that measure how much climate mitigation could occur under different population growth, economic growth, education, urbanization and technological development rates.⁴⁶
- ➔ **Time period:** The project team can focus the evaluations on the most important time period for the finance institution's strategy. It is important to keep in mind that changes in the climate in the short term are more certain than changes in the long term that mitigation efforts could influence. It can be expected that models will show less deviation from current conditions in the short term and greater deviation in the long term.
- ➔ **Hazards:** It is critical for the project team to specify which climate hazards (e.g., drought, heat, wildfire) they find most important to model. Identifying these priority hazards will help the crop modeling team capture the climate model outputs needed to measure the impacts of those future hazard conditions on the sample of borrowers.

Working with climate and crop modeling experts

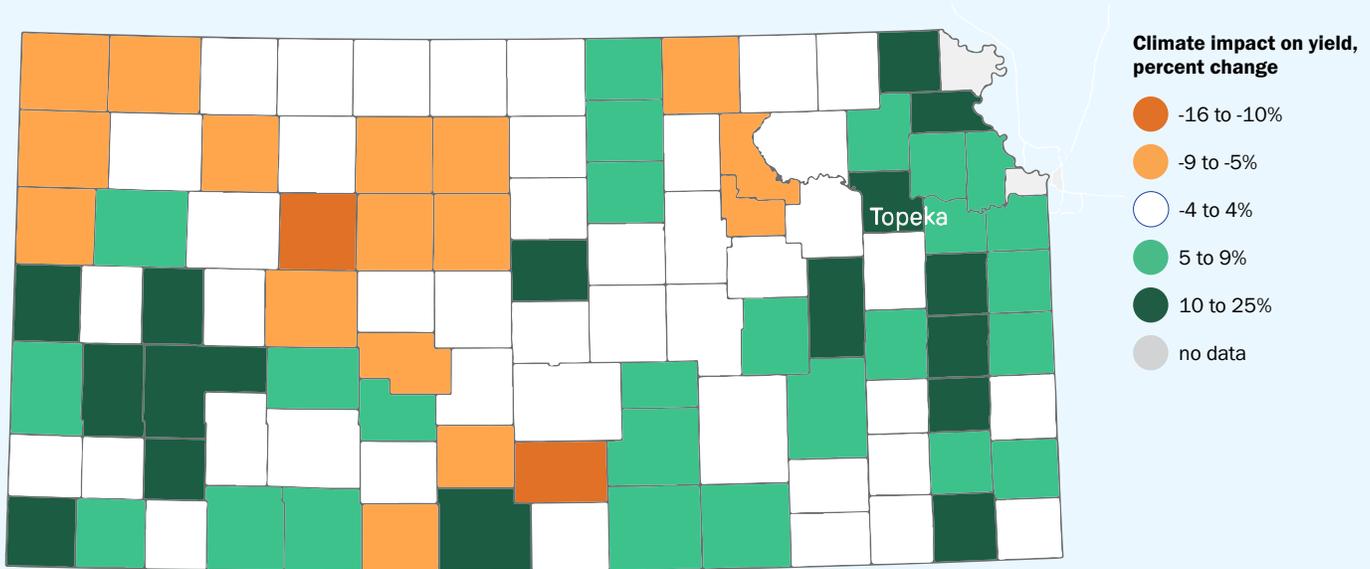
Undertaking robust climate change risk assessments requires climate and crop modeling expertise that most agricultural finance institutions do not have in-house. Agricultural finance institutions can build this expertise internally or work with external consultants specialized in climate and crop modeling. Smaller institutions lacking the resources to create climate risk teams should consider partnering with modeling consultants that can support their climate risk assessments. Collaborating with a crop modeling consultant and a financial modeling consultant on the same project can be especially successful so that the models and data can be built to operate well together.

- ➔ **Local context:** Regions may be impacted differently by varying climate risks due to their current climate. Looking only at average outcomes for an entire region or state can hide or dampen the more significant effects in local areas. This is especially important when the main concerns are downside risks and if such risks might not be balanced out in reality by gains elsewhere. Therefore, teams will want to choose the scale of assessment (e.g., farm, entity, township) that best relates to decision-making on the part of the institution. Finance professionals can speak to local and regional experts and review the literature on the local impacts of climate change to inform their projection inputs. Figure 11 demonstrates the variability climate change can have on local production outcomes, as demonstrated by climate-modeling of wheat yields in Kansas.

FIGURE 11

Climate impacts on winter wheat yields in Kansas counties in 2050.

Counties with dark and light shades of green may receive a climate boost. Counties in white might experience less than +/-5% change in yield as a result of climate change. Counties in dark and light orange may experience a climate burden.⁴⁷



After identifying the future scenario characteristics the project team wants to evaluate, the modeling team should select a climate model that best represents that scenario. Modeling teams can select models evaluated by the [Agriculture Model Intercomparison and Improvement Program](#) (a consortium of agricultural modelers that aim to advance agricultural systems data and models). The climate models selected by the modeling team are already run models that project future climate, atmospheric and ocean conditions, including temperature, precipitation, snowfall, windspeeds and other variables. Depending on the model, thousands of variables can be generated on hourly, daily or monthly timeframes. Some of these outputs can be used as inputs to crop and livestock models to assess the productivity impacts of changing climate conditions.

Additional examples and resources for climate scenario analysis can be found at [IIASA's Scenario Services](#) and [Moody's Analytics Climate Change Models](#).



Step 4: Project the impacts on agricultural yield

After selecting the best climate model to evaluate the future climate scenario of interest, the project team can use the model outputs to measure the crop yield and livestock production of their borrowers in the future using crop models. Crop models use biological and physical principles of plant growth to measure how a crop will grow under different weather, management and nutrient input conditions. The models require information on the crop variety, weather conditions, precipitation, soil conditions, management practices and inputs to estimate the crop yield. Assessing impacts on livestock could include using crop models to assess feed and forage productivity changes. It can also involve evaluating impacts of heat stress on livestock growth, milk production, morbidity and mortality.

The sample borrower data gathered in step two can be used to inform the location, management practices, soil conditions and inputs of the model. And the outputs of the climate model can inform the future temperature, precipitation and other weather conditions. For instance,

a change in precipitation projected by the climate model in step three is used to project how crop productivity and yields change in the crop model. Then the percent change in crop yield during a period under one climate scenario (i.e., 2°C) is projected. Crop modeling can also be conducted on key production inputs such as livestock feed that can eventually be assessed as changes to costs of goods sold, or COGS, in step five below.

The project team can select a crop model that best suits the crops, region and timescale of the project in collaboration with their crop modeling expert partner. Some models they can choose from include:

- [Decision Support System for Agrotechnology Transfer \(DSSAT\).](#)
- [Agricultural Production System Simulator \(APSIM\).](#)
- [System Approach to Land Use Sustainability \(SALUS\).](#)
- [World Food Studies \(WOFOST\).](#)
- [Modeling System for Agricultural Impacts of Climate Change \(FAO-MOSAICC\).](#)



Step 5: Project the impacts on financial performance

After modeling the impacts of changing climate risks on farm productivity, portfolio managers can integrate changes in borrowers' revenue and/or COGS to evaluate changes in those borrowers' credit risk. The crop yield and livestock production impacts assessed using crop models in step four can be used to assess future revenues for the sample borrowers and the borrower segment they represent. For example, if wheat yields are projected to decline due to lower precipitation and longer droughts, the project team can estimate the percentage of revenue decrease as the farm will have fewer crops to sell. Prices can be assumed to remain stable for simplicity, or price fluctuation modeling can be incorporated into the model based on knowledge of current and future market activity. The crop modeling can also assess changes in COGS for livestock borrowers.

The project team can work with portfolio managers and risk teams to stress the borrower's and portfolio's credit risk models with the climate-driven changes in revenue and COGS. All other factors in the risk models can be held constant to evaluate how the climate-driven shifts in revenue and COGS impact the borrower's risk ratings and the portfolio's projected probability of default, or PD. Another important variable like commodity prices can be modeled to evaluate the climate impact under different market conditions. This exercise can be productively completed by holding a workshop with the project team, modeling partners, portfolio managers and risk teams to evaluate assumptions and drivers leading to changes in borrower revenue, COGS, risk ratings and PD. During this exercise, the project team can develop ways to extrapolate the results from the sample of borrowers to the entire portfolio segment.

The results of the climate change risk assessment, including the crop modeling and the risk rating and PD review can inform financial institutions' risk rating methodologies, client engagement and financial offerings. The risk team could update their risk rating methodologies to include climate adaptation practices or technology factors if a particular portfolio segment is at risk from climate impacts. The client relationship managers and loan officers can focus client engagement with borrowers identified to face climate risks by the assessment. Finally, the lending team can develop financial offerings that support their borrowers to adopt climate adaptation practices if specific borrower segments are projected to face significant financial risks from climate impacts.

For additional information on climate change risk assessment, refer to agriculture portfolio assessments in [United Nations Environment Programme - Finance Initiative "Navigating a New Climate" report](#) (page 29, bank #1 case study: agriculture). Also, refer to [Baringa & BlackRock's Climate Change Scenario Model](#) and [United Nations Environment Programme - Finance Initiative Climate Risk Tool Landscape](#).

Partnerships:

- 1 Climate-modeling experts can advise on climate model choice.
- 2 Crop modeling firms can integrate the climate model outputs into crop models and project changes in crop yield.
- 3 Environmental nonprofits and university experts can advise on alternative management scenarios that can measure the impact of adaptation measures.

STRATEGY 3: ESTABLISH CLIMATE RISK CONTROLS



Integrating the topic of climate risk into the existing ERM framework and executive-level oversight can help agricultural finance institutions strategically understand, measure and manage climate risks. Climate risk controls are the overarching structure of rules and processes a company puts in place to effectively manage the risks and opportunities presented by climate change.

Figure 12 below outlines steps an agricultural finance institution can take to effectively implement climate risk controls and enable the execution of critical climate risk management processes.

FIGURE 12
How to embed climate-related responsibilities into agricultural finance institutions.⁴⁸



Step 1: Identify the processes and responsibilities required to manage climate risk

Agricultural finance institutions should assess existing ERM processes and consider which process modifications or additions may be required to effectively manage climate risk. All newly identified processes and responsibilities should be assigned to specific teams and employees. Agricultural finance institutions can create an internal planning group to help identify these processes and responsibilities.

Farm Credit Services of America's / Frontier Farm Credit's Path to Sustainability Involvement

Farm Credit Services of America/Frontier Farm Credit (Associations) are financial services cooperatives that provide credit and insurance services for farmers, ranchers, agribusinesses, and rural residents. As a cooperative, they are 100% owned by their customers. The Associations are also a part of the U.S. Farm Credit System. Farm Credit Services of America/Frontier Farm Credit has 48 offices serving Iowa, Nebraska, South Dakota, Kansas, and Wyoming. Their portfolio includes grain, beef cattle feedlots, cow/calf, swine, dairy, poultry/eggs, fruits/vegetables, forest products, and telecommunications, as well as many other commodities.

In 2021, the Associations began receiving customer questions regarding carbon markets and, more generally, environmental sustainability. Operating sustainably has long been a focus of the Associations' customer-owners, particularly the topics of economic, generational, and social well-being for agricultural producers. But over the past three to five years, the focus on environmental sustainability has grown exponentially. Interest in environmental sustainability has been elevated to the point that consumers and shareholders are incorporating it into their purchasing decisions. Many businesses, including major agriculture corporations, have implemented sustainability strategies in their business activities.

Over the last few years, new companies entered the environmental sustainability space and have begun engaging with the Associations' customers. Customer-owners did not know whom to trust when approached by these companies and turned to the Associations as their trusted advisers to help them identify the right opportunities.

As inquiries increased, the Associations responded by forming a cross-functional workgroup to gain broad awareness and understanding of the rising sustainability opportunities and challenges facing the Associations and the agricultural

borrowers they serve. The workgroup reviewed existing policies, programs, and regulations related to sustainable agriculture. The workgroup recommended that the Associations' leadership create a position statement and related strategies to guide and direct the Associations' role and response regarding sustainable agriculture.

The workgroup also recommended that a new position be created to hire a sustainability expert to coordinate and lead the Associations' sustainability work. The workgroup and the Associations also affirmed that as a financial services cooperative, the Associations' job is to finance and insure agriculture as it comes. To that end, they do not and will not prescribe production methods to their customer-owners – those are individual choices best made by each producer. However, the Associations are committed to the following:

- Educate customers about opportunities, trends and challenges in sustainable agriculture.
- Enable customers who choose to participate in sustainable practices through specialized products and programs.
- Engage with third-party organizations to collaborate on partnerships and new opportunities that bring value to customers, associations, communities and agriculture more broadly.

The new role of Vice President, Corporate Sustainability was hired in 2022 and is supported by the associations' Sustainable Ag Committee— a standing cross-functional group that helps define and implement strategies to educate, enable and engage on behalf of customers. Group members represent a variety of areas within the business, from Portfolio Analysis & Reporting to Education, Communications, Lending and beyond. The Associations recognize that agriculture, as well as sustainability, are constantly evolving. Their efforts in this area will continue to evolve and expand, but their dedication to helping their customer-owners succeed and thrive in changing times will remain constant.

Executive level oversight: An executive could be accountable for setting and reporting on climate-related targets, adequately responding to external stakeholders about growing public concern about climate change and defining the processes for making strategic decisions related to climate risks and opportunities. When an executive is accountable, he, she or they can engage teams with the necessary skills to complete each discrete task.

Middle management level responsibility: Employees at middle management levels may have climate-related responsibilities like measuring and evaluating climate risks in the portfolio, engaging customers on the topic of climate change, or developing new product offerings to address climate impacts. These responsibilities are further broken down in sections three, four and five, which may assist in assigning distinct tasks to appropriate roles or teams.

Step 2: Assign responsibilities to a role or department

The responsibilities identified in step one can be assigned to existing roles, such as a Chief Risk Officer, or newly created climate roles, such as a Chief Sustainability Officer. Seventy-five percent of agricultural finance institutions in [EDF and Deloitte's survey](#) had at least one employee

dedicated to Environmental, Social and Governance, or known as ESG (46% of firms), weather-related agriculture risk (34%), and/or climate change (34%).⁴⁹ Figure 13 below breaks down positions where climate risk management can be integrated into existing roles or newly created roles across varying management levels at a finance institution.

Finance institutions may make the Chief Risk Officer responsible for climate risk management in collaboration with the broader executive team.⁵⁰ At other levels, finance institutions might train risk professionals at the management level to add climate expertise to their roles and create steering groups focused on integrating climate risk into the institution.

Agricultural finance institutions may face resource constraints to hire new climate-specific roles. These institutions should incorporate climate risk management responsibilities into existing teams and roles (displayed in the left column of Figure 13) and partner with organizations to support their climate risk management, such as trade associations and agriculture or environmental organizations. These organizations can also collaborate. For example, small banks could collectively pursue the development of common climate risk assessment methodologies that various finance institutions could use.

POTENTIAL PREEXISTING GOVERNANCE TEAMS AND ROLES

Board of Directors Public affairs focus, strategy focus
Executive Management Team CEO, CFO, CRO, CIO, etc.
Management VP Agriculture Lending, Agriculture Markets Team
Steering Groups Credit Committee, Compliance Risk Working Group

CLIMATE-SPECIFIC GOVERNANCE TEAMS AND ROLES

- Risk management committee
- Chief Sustainability Officer - Chief Risk Officer
- Head of Risk - Risk Manager
- Climate Risk Working Group: New group to focus on integrating climate risk - Climate Opportunities Working Group: New group to identify climate-related opportunities



Step 3: Document results and set up a corresponding reporting structure

Documenting the results of steps one and two and formalizing a climate risk reporting structure can help institutionalize the climate risk management responsibilities. Agricultural finance institutions can create an organizational tree diagram that displays the climate risk management structure across the organization. The diagram will map out the reporting structure of each climate risk management role. A clear reporting structure will link all climate-related information and strategies to an owner on climate risk or a broader executive or management team that can ultimately make decisions based on climate risk information gathered across different departments.

Agricultural finance institutions can support the employees they are tasking with new climate risk responsibilities by providing them with training, adequate resources, and access to experts to equip them with the appropriate knowledge and skills. Further examples of how to support employees in managing their climate risk-related tasks are shared in section four.

Refer to [Bank of America's 2022 Task Force on Climate-related Financial Disclosures \(TCFD\) Report](#) or [Citi's 2020 TCFD Report](#) to see their climate management roles, committees, reporting structures and policies.

Potential partnerships to support building climate risk internal controls:

- Banking associations can help institutions develop best practices for climate risk internal controls and assigning team responsibilities.
- Risk professionals' organizations can support employee training on climate risk issues and skills.
- Partnering with other agricultural finance institutions to identify the right roles to manage climate topics can reduce the cost of this process and encourage knowledge sharing.

STRATEGY 4: ENGAGE CUSTOMERS ON THE TOPIC OF CLIMATE CHANGE



Engaging agricultural clients on climate topics can help financial institutions reduce risk and support adaptation

Agricultural finance institutions can proactively engage their agricultural clients on climate topics to support them in managing climate risks and opportunities. By engaging customers, relationship management teams will better understand their customers' awareness of climate risks, their specific needs related to climate risks, localized information about the physical risks of that area, and their level of climate adaptation. With an understanding of the localized climate risks and the specific financial needs required to address them, client relationship managers or loan officers can provide appropriate financial products and services to their clients. As a result, agricultural clients will receive the support they need to manage their operations and cash flows as they face climate risks. As a result, they will be better positioned to repay their loans to financial institutions, lowering overall portfolio risk. These conversations can also contribute to a strong relationship between loan officers and their farmer clients, as they demonstrate their ability to support their clients in navigating their challenges.

Prepare relationship managers to engage agricultural clients on climate topics

To properly engage with agricultural clients, the employees of finance institutions — with an emphasis on relationship managers — must understand climate risks in agriculture relevant to the region and production systems in the portfolio.

Offer climate risk trainings and workshops

Education teams and employees tasked with climate risk responsibilities can educate relationship managers about these topics by providing training on climate change and climate risk fundamentals. This could include seminars by external experts such as university researchers or cooperative extension. It could also include encouraging employees to earn certificates like the Sustainability and Climate Risk Certificate offered by the Global Association of Risk Professionals.⁵¹ Agricultural finance institutions can also consider partnering with external organizations, such as universities, climate-related organizations, or trade associations to develop educational materials and educate their employees.



Offer climate risk resources

Agricultural finance institutions should create or compile resources that are useful to employees in engaging clients on climate risk. Establishing and directing employees to a single internal or online site where they can access all the resources may be useful.⁵² An example of a resource that may be included is a quick reference guide that employees can review before or during a client conversation. The guide may be tailored to a specific type of client and include the information employees are most likely to need, such as:

- ➔ Talking points employees could use to educate clients on the basics of climate change and climate risk in a way that is likely to resonate with the client base.
- ➔ Climate risks that are likely to impact the client based on their location and the types of crops or livestock they produce.
- ➔ Practices, technologies and other management strategies that similar farmers are undertaking to manage these risks or that have been recommended by experts such as university researchers, and information on the costs, benefits and risks of those practices or technologies.
- ➔ Funding programs and financial products that can help them manage each identified climate risk or adopt practices or technologies to reduce risk.
- ➔ Questions clients frequently ask and the corresponding answers.

Many agricultural lenders are precluded from directly recommending practice changes to their farmer clients by laws restricting the lenders' direct engagement in the farming decisions of their clients. However, lenders are still a valuable source of information to their clients and are considered a trusted adviser. For example, lenders could conduct a financial analysis of climate adaptation practices and share them with their borrowers. They can facilitate peer-to-peer farmer training sessions that allow borrowers to learn about the climate adaptation practices their peers are implementing.

Regularly communicate with employees on climate topics

To increase the success of an educational campaign, finance institutions can regularly communicate and disseminate information on climate risk topics to their employees. These communications can show how to access the training and resources and how employees will benefit from understanding climate risks. Messaging can be disseminated through multiple channels, including emails, town halls, and newsletters. Champions in each part of the business can be designated to point people to the resources and reinforce the importance of

understanding climate risk.⁵³ For example, Bank of America has created an online training portal that includes training on Net Zero emissions to help employees support their clients in reaching Net Zero goals.⁵⁴ In 2019, Morgan Stanley created an internal Climate Change University that trained thousands of employees on climate change fundamentals, risks and opportunities and other climate change topics.⁵⁵

Once employees understand climate risks, they can proactively initiate the appropriate discussions with customers. These employees will have the knowledge to understand customers' needs and offer support in mitigating climate risks and transitioning to climate-smart practices.



Engage agricultural clients on climate topics

There are a variety of approaches to engage agricultural clients on climate change topics. Below is an example of one approach that can be considered and adapted to meet the clients' needs and integrated into existing client engagement processes.

Identify customers

To begin the client engagement process, relationship managers should first identify agricultural customers to engage with on climate topics. Relationship managers can prioritize those likely to face the most significant climate risks or opportunities based on the results of climate risk assessments described in section four, the farm's location, types of crops or livestock, and relationship managers' knowledge of the client's interests.

Develop an engagement plan

Before engaging with customers, relationship teams can develop a plan to approach each customer segment and consider the following:

Channel: Discuss with clients the best channels to reach and educate them on climate topics (i.e., email, phone calls, farm visits, or group events).

Frequency: Set the frequency of communications on climate risks based on existing rapport with the client.

Communication topics: Plan specific topics for communication with clients. Some examples include:

- 1 Impacts of climate change:** Discuss with agricultural clients the potential impacts of climate change on their agricultural production and financial performance, informed by the institution's risk assessment process and input from local experts.
- 2 Information sources:** Share analysis and research reports conducted by the portfolio management team and other reputable organizations. Relationship managers can also share a flyer with the key takeaways so clients better understand climate change impacts, what can be done to

address them and how their financial institution is there to support them.

- 3 Climate-smart practices, technologies, and other risk mitigation strategies:** Share information with clients on practices that improve soil health and yield resilience (i.e., cover cropping or conservation tillage), utilize climate-smart technologies (i.e., efficient irrigation technologies, efficient nitrogen application), or mitigate risks through actions (i.e., planting more drought-resistant crops).
- 4 Products and services:** Relationship managers can ask clients what financial products and services can best support them in adapting to climate risks or achieving climate opportunities.⁵⁶ Client teams can share the currently offered products and service offerings that may help them transition to climate-smart products and address some of the climate risks they face (further explained in section five).
- 5 Partnership resources:** Relationship managers can share about partnership programs that offer clients additional services such as educational or technical support, subsidies and farm management software.





Implement the customer engagement plan, track results, and revise based on client feedback

Agricultural finance institutions should implement the customer engagement plan to understand agricultural clients' awareness of the impacts of climate change and to equip clients with the education and financial services they need to adapt to and mitigate the effects of climate change.

Agricultural finance institutions can implement client outreach on climate topics through existing channels, whether through relationship manager communications, email distributions or other channels. Working through existing channels can be especially helpful for smaller institutions with less capacity. These institutions can set recurring check-in points with relationship managers to see if different strategies in the customer engagement plan are working or not, measured by client interest in new climate products and educational resources. Larger finance institutions can consider using software and technology platforms to automate communication processes to simplify the process and track results.⁵⁷

For additional resources on engaging clients, refer to [Let's Discuss Climate: The essential guide to bank-client engagement from the Cambridge Institute for Sustainability Leadership](#) and [The Ultimate Customer Engagement Playbook in Banking from The Financial Brand](#).

Potential partnerships to support client engagement efforts:

- University or local experts that support farmers on agronomics and risk management can help deliver training and advisory services to farmers.
- Environmental education organizations can help develop climate change information for the client engagement process.
- Banking associations could help develop common climate change information and resources to support their members' client engagement.

STRATEGY 5: DEVELOP NEW OFFERINGS TO ADDRESS RISKS AND OPPORTUNITIES



1

Understand the business risks presented by climate change.

2

Measure and evaluate climate risks in the portfolio

3

Establish climate risk controls.

4

Engage customers on the topic of climate change.

5

Develop new offerings to address risks and opportunities.

Eighty-eight percent of respondents to EDF and Deloitte's survey of agricultural finance institutions expect their agricultural clients' financial needs will change due to climate change.⁵⁸ Agricultural finance institutions can support clients, changing financial needs by offering new or modified financial products that help their agricultural clients manage climate risks or take advantage of climate-related opportunities. Such products may improve the agricultural clients' and portfolios' credit risk profiles, support farmers to transition to climate-smart farming practices, reduce GHG emissions in the agricultural portfolio, and help producers participate in emerging markets for climate-smart products.

The approach to developing new or modified financial products should build from the finance institutions' understanding of climate risks and opportunities faced by farmers in their area, the types of practices, technologies, or production shifts that can mitigate risks and capture opportunities, and any financial barriers to greater adoption of those solutions. To develop this understanding, lenders should learn from the expertise of agricultural scientists and economists, as well as farmer leaders in their area.

Financial analysis of climate-smart practices can inform lending solutions.

Conducting financial analysis of farming practices that reduce GHG emissions or improve farm resilience to climate change hazards can help inform agricultural finance institutions, their borrowers, and their partners about their financial costs, benefits, and implementation time horizons. EDF has conducted these financial analyses in multiple U.S. regions in collaboration with farmer organizations, agricultural accountants and agricultural finance institutions. These projects typically involve:

- 1 Selecting partners.
- 2 Choosing practices, technologies or other management shifts to evaluate.
- 3 Choosing financial data gathering process and comparison groups.
- 4 Gathering farm, management and financial data.
- 5 Conducting a comparative analysis of practice adopters and non-adopters.
- 6 Communicating the results to internal and external stakeholders, including borrowers.

Learn more about how to conduct a financial analysis of climate-smart agriculture practices in EDF's [Practitioner's Guide To Conducting Budget Analyses of Conservation Agriculture](#).

For examples of financial analysis projects and results, visit EDF's analyses: [Financial Impacts Of Climate-Resilient Agriculture In North Carolina](#), [Conservation's Impact On The Farm Bottom Line](#), [How Conservation Makes Dairy Farms More Resilient](#), and [Farm Finance And Conservation](#).

Many agricultural finance institutions are already financing farmer clients who are early adopters of climate-smart practices and technologies. Lenders are important allies in understanding what kinds of financial support other farmers may need to make the transition. Agricultural finance institutions should consider engaging some of these early adopters as advisers, individually or as a group, as the finance institution develops financial offerings to support more producers interested in pursuing climate-smart agriculture.

New or modified financial products should be designed to meet the needs of farmers attempting to transition to climate-smart agriculture or to incorporate the risk reduction value generated by the long-term use of climate-smart practices. For instance, longer term, lower interest rates and more flexible repayment arrangements (i.e., interest-only periods) may help agricultural producers manage tighter cash flows associated with the initial periods of transitioning to a new climate-smart agriculture practice. For successful long-term adopters of climate-smart agriculture, lenders should incorporate long-term financial projections of climate-smart practices in credit models when evaluating loan opportunities to ensure the value of these practices is accurately reflected.

In scoping a financial offering, market research can help agricultural finance institutions identify the most desirable features for their farmer clients. For example, a 2021 market research study of 100 farmers in the U.S. State of Iowa tested farmer interest in a model soil health transition loan with various additional attributes, from technical assistance to an interest rate reduction. Notably, 50% of farmers surveyed were interested in participating when either a 1% reduction in their current operating loan interest rate or a \$10 per acre cost-share incentive was included in the package.

Read more about market research on soil health transition loans: [Banking on Soil Health](#).

Once an agricultural finance institution has identified the need and demand for a new or modified financial product, there are multiple models they can consider pursuing. Some of these models are summarized in the table below; lenders may also adapt other models to meet the needs of their clients.

TABLE 2
New or modified financial products to support borrowers' climate adaptation or mitigation.

Debt products	Description	Examples
Green loans	Green loans are similar to standard loans except for the use of proceeds must be used to fund sustainability projects. ⁵⁹ Green loan principles can be found here: Green Loan Principles .	Bank of China (Hong Kong)'s Green Loan Green bonds and loans in Mexico including sustainable agriculture
Sustainability-linked loans	Sustainability-linked loans are similar to green loans, except they incentivize the borrower to meet sustainability performance targets (i.e., reduction of GHG emissions or energy efficiency improvement) over the loan term. Once the targets are met, the loans' interest rates are ratcheted down. Sustainability-linked loan principles can be found here: Sustainability Linked Loan Principles .	Farmers Business Network® Regenerative Agriculture Finance Operating Line
Green bonds	Green bonds are similar to green loans in that funds must be used for sustainable projects. However, green bonds are typically larger in size, have associated transaction costs, and may be privately placed or listed on an exchange. ⁶⁰	HSBC Green Bonds
Transition loans	A transition loan has an adjusted repayment structure to support the farmer through adopting new agricultural practices. Some lenders offer transition loans to help farmers work toward organic certification. A similar model can be used to support farmers' transition to climate-smart agriculture practices. ⁶¹	Compeer Financial Organic Bridge Loan

Additional considerations for agricultural finance institutions should include:

- **Collecting data to show results.** Depending on the requirements of the loan, the lender may need to collect new types of data to show that farmers are meeting those requirements. If the requirements are practice-based, the lender may need to confirm that the farmer did the intended practice. If the requirements are environmental outcomes-based, the lender may need to verify that farmers achieved the relevant outcomes. Partnerships with technical advisers or data companies are likely to be critical here, as lenders often lack the in-house capacity to collect this data.
- **Consider the financing needs of farmers historically underserved by agricultural credit.** In any new program or product for resilient agriculture, assess opportunities to improve access to loans for small farmers and historically underserved farmers. Consider low-interest loans and microloans, as well as loans not requiring collateral or other alternative financing options.
- **Explore lending solutions that can support both farmers and food companies.** For lending institutions with farmer and corporate supply chain clients, develop lending solutions that can support corporate clients in achieving sustainability goals while offering farmer clients opportunities to enhance the resilience of their operations.

Potential partnerships to support financial offering efforts:

- Food and agriculture companies that purchase crops or livestock in your region could collaborate on financial incentives.
- National or regional government programs could partner on grants or blended finance solutions to support pilots of new financial offerings.
- Impact investors could partner on blended finance solutions to support pilots of new financial products.



CONCLUSION

The physical and transition impacts of climate change on the agriculture and food systems industry present various risks and opportunities for agricultural lenders. Agricultural finance institutions can implement the five steps presented in this guide involving risk management processes, financial products, and adopting principles that bring climate risk management into overall business management and client engagement.

To begin addressing climate risk in agricultural portfolios, finance institutions can consider the following:

- 1 Understand the business risks of climate change by reading this report and other referenced sources.**
 - 2 Work with experts and partners to incorporate climate modeling and scenario analysis to evaluate climate risks in the portfolio.**
 - 3 Determine if climate risk responsibility has a defined leader and management team, from middle management to board-level governance positions.**
 - 4 Engage with and educate agricultural customers on climate risk topics.**
 - 5 Develop and adapt product offerings to better support customers in managing climate risks.**
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The critical takeaway of this guide is that new approaches to agricultural finance and client relationships can help turn current and projected climate-related financial risks into opportunities for farmers and their lenders. By developing climate strategies, agricultural finance institutions can strategically position themselves as partners to farmers and ranchers as they navigate new climate-related challenges and emerging business opportunities.

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