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BUSINESS

Climate Change: Implications for Agriculture

Key Findings from the Intergovernmental Panel on Climate Change Fifth Assessment Report

UNIVERSITY OF CAMBRIDGE
Cambridge Judge Business School
Cambridge Institute for Sustainability Leadership

BSR

The **Physical Science** of Climate Change

Rising temperatures:

The Intergovernmental Panel on Climate Change (IPCC) Fifth Assessment Report (AR5) concludes that climate change is unequivocal, and that human activities, particularly emissions of carbon dioxide, are very likely to be the dominant cause. Changes are observed in all geographical regions: the atmosphere and oceans are warming, the extent and volume of snow and ice are diminishing, sea levels are rising and weather patterns are changing.

Projections:

Computer models of the climate used by the IPCC indicate that changes will continue under a range of possible greenhouse gas emission scenarios over the 21st century. If emissions continue to rise at the current rate, impacts by the end of this century are projected to include a global average temperature 2.6–4.8 degrees Celsius (°C) higher than present, and sea levels 0.45–0.82 metres higher than present.

To prevent the most severe impacts of climate change, parties to the UN Framework Convention on Climate Change (UNFCCC) agreed a target of keeping the rise in average global temperature since pre-industrial times below 2°C, and to consider lowering the target to 1.5°C in the near future.

The first instalment of AR5 in 2013 (Working Group I on the physical science basis of climate change) concluded that by 2011, we had already emitted about two-thirds of the maximum cumulative amount of carbon dioxide that we can emit if we are to have a better than two-thirds chance of meeting the 2°C target.

Impact of past emissions:

Even if emissions are stopped immediately, temperatures will remain elevated for centuries due to the effect of greenhouse gases from past human emissions already present in the atmosphere. Limiting temperature rise will require substantial and sustained reductions of greenhouse gas emissions.

About this document

The Fifth Assessment Report from the Intergovernmental Panel on Climate Change is the most comprehensive and relevant analysis of our changing climate. It provides the scientific fact base that will be used around the world to formulate climate policies in the coming years.

This document is one of a series synthesizing the most pertinent findings of AR5 for specific economic and business sectors. It was born of the belief that the agriculture sector could make more use of AR5, which is long and highly technical, if it were distilled into an accurate, accessible, timely, relevant and readable summary.

Although the information presented here is a 'translation' of the key content relevant to this sector from AR5, this summary report adheres to the rigorous scientific basis of the original source material.

Grateful thanks are extended to all reviewers from both the science and business communities for their time, effort and invaluable feedback on this document.

The basis for information presented in this overview report can be found in the fully-referenced and peer-reviewed IPCC technical and scientific background reports at: **www.ipcc.ch**

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Key Findings

1. **Climate-related impacts are already reducing crop yields in some parts of the world**, a trend that is projected to continue as temperatures rise further. Crops affected include staples such as wheat, maize and rice. Climate change is projected to increase price volatility for agricultural commodities, and reduce food quality.

2. **Farmers can adapt to some changes, but there is a limit to what can be managed.** Adaptive capacity is projected to be exceeded in regions closest to the equator if temperatures increase by 3°C or more. The agricultural industry's own interests are best served by ambitious approaches to adaptation and to cutting emissions.

3. **Greenhouse gas (GHG) emissions from agriculture comprised about 10–12% of man-made GHG emissions in 2010.** The sector is the largest contributor of non-carbon dioxide (non-CO_2) GHGs such as methane.

4. **Opportunities for mitigation include reducing emissions** from land use change, land management and livestock management. Carbon can be captured and stored in soil and biomass. Economy-wide emissions from energy use can be reduced, under certain conditions, by replacing fossil fuels with biofuels.

5. **The potential for reducing GHG emissions from agriculture through changes in consumption could be substantially higher than technical mitigation options.** Approaches include reducing food waste, changing diets towards less GHG-intensive food (e.g. substitution of animal products with plant-based food), and reducing overconsumption in regions where this is prevalent.

Executive Summary

This summary looks at climate risk, resilience and GHG mitigation potential relevant for the agricultural sector and not for the broader AFOLU (Agriculture, Forestry and Other Land Use) landscape.

The effects of climate change on crop and food production are already evident in several regions of the world, with negative impacts more common than positive ones. Without adaptation, climate change is projected to reduce production for local temperature increases of 2°C or more (above late-20th-century levels) up to 2050, although individual locations may benefit. After 2050, the risk of more severe yield impacts increases and depends on the level of warming. Climate change will be particularly hard on agricultural production in Africa and Asia. Global temperature increases of 4°C or more, combined with increasing food demand, would pose large risks to food security globally and regionally.

Greenhouse gas emissions from agriculture comprised about 10–12% of global GHG emissions in 2010. The sector is the largest contributor of non-CO_2 GHGs (including methane), accounting for 56% of non-CO_2 emissions in 2005. Opportunities for mitigation include so-called 'supply' and 'demand' side options.

On the supply side, emissions from land use change, land management and livestock management can be reduced, and terrestrial carbon stocks can be increased by sequestration in soils and biomass. Emissions from energy use across the entire economy can be reduced through the substitution of fossil fuels by biomass providing certain conditions are met. On the demand side, GHG emissions could be cut by reducing losses and waste of food, and by encouraging changes in diet.

The agricultural industry's own interests are best served by implementing ambitious approaches to mitigation to ensure that key temperature thresholds are not crossed, while also working to enhance resilience in the face of inevitable temperature rises and associated climate events. While adaptation to climate impacts is possible, largely by extending techniques already in existence, there is a limit to what can be managed. Adaptive capacity is projected to be exceeded if temperature increases by 3°C or more, especially in regions close to the equator.

Impacts of Climate Change

Major impacts are projected on water availability and supply, food security, and agricultural incomes, including shifts in production areas of food and non-food crops.

Food security

Recent extreme climatic events, such as heat waves, droughts, floods, and wildfires, are combining with long-term trends including rising temperatures and changes in precipitation patterns, with broad and deep implications for the agricultural sector and global food security. Terrestrial ecosystems that provide a variety of services vital for agricultural production, including nutrient cycling, waste decomposition and seed dispersal, will be undermined and even lost through climate change. After habitat loss, climate change is the most important threat to pollinating insects on a global basis.

Crop yields

Greenhouse gas emissions over many decades are already affecting production of rice, wheat and maize. Without adaptation, local temperature increases of 2°C are expected to reduce yields further. While CO_2 in most cases has a stimulating effect on plant growth, ozone reduces growth. Elevated ozone levels have very likely suppressed global production of crops, causing estimated losses of 10% for wheat and soybean. These are some aspects of a complex picture involving interactions between CO_2, ozone, mean temperature rise, temperature extremes, reduced water availability and changes to the nitrogen cycle, whose overall effect is difficult to predict. In addition, areas suitable for cultivation of coffee, tea and cocoa, which support millions of smallholders in over 60 countries, are likely to be significantly reduced by temperature rise and other factors. These projected impacts will occur as demand for crops is expected to increase by about 14% per decade until 2050. Risks are greatest in tropical countries.

Developing countries

Climate-related risks for agriculture are particularly acute in developing countries. They expose vulnerabilities of farmers and pastoralists who lack resources fundamental to resilience including finance, technology and knowledge. Moreover, climate-related risks interact with existing environmental stressors such as biodiversity loss, soil erosion, and water contamination, and with social stressors such as inequality, poverty, gender discrimination, and lack of institutional capacity. These interactions compound risks to agricultural production and food security.

Water security

In many regions, changing levels and patterns of precipitation, melting snow and ice, and retreating glaciers are altering hydrological systems, affecting water resources and quality. Climate change is projected to reduce renewable surface water and groundwater resources significantly in most dry subtropical regions. Each degree of warming is expected to decrease renewable water resources by at least 20% for an additional 7% of the global population.

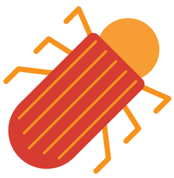
Climate impacts are expected to affect the rural poor disproportionately.

Price volatility

A major factor in recent food price rises has been increased crop demand, notably driven by increased take-up of land for biofuel production. Yet weather-related fluctuations in food production are also believed to have played a role, with recent price spikes often following climate extremes in major producing nations. Price rises of 37% (rice), 55% (maize), and 11% (wheat) are projected by 2050 from the additional stress of climate impacts. Increased volatility has negative implications for business as it heightens uncertainty, potentially increases the costs of production, and impedes access to vital commodities. From a development standpoint, climate-related price rises have a disproportionate impact on the welfare of the poor. The 2010/2011 food price spike is estimated to have pushed 44 million people below the basic-needs poverty line across 28 countries.

Food quality

The quality of some foods is likely to be affected. Growing wheat, rice, barley or potato in high CO_2 concentrations reduces the protein content by 10–14%. Some crops may also show reduced mineral and micronutrient concentrations.



Pests and disease

Some pest outbreaks are attributed to climate change. Rising land temperatures, changes in precipitation patterns, and increased frequency and intensity of extreme heat undermine natural regulation of pests and diseases, while increasing the ranges of various pests. This in turn can lead to losses of important ecosystem services and facilitate the increased dominance of damaging invasive organisms. Expected increases in crop damage by pests are projected to affect food production further and raise the cost of key commodities.

Livestock

Increased heat stress coupled with more frequent extreme weather events will have negative consequences for livestock. Varieties bred for high yields are particularly at risk. Breeds in developing countries tend to be more tolerant to heat and poor seasonal nutrition. Pathogens dangerous to livestock are expected to expand their geographical range as a result of climate change.

Labour

Falls in labour productivity are likely in the agricultural sector, particularly for manual labour in humid climates, as a result of heat stress and vector-borne diseases.

Supply chain

Food production is but one part of the agricultural supply chain. The sector also depends on refrigeration, transport, processing and retailing. Each of these links in the chain is exposed to climate risks, such as disruption of operations and the need for more extensive temperature control.

Agriculture – managing risk and enhancing resilience

Climate change poses significant risks for the agricultural sector and for global food security. Resilience to the impacts of a warming world will be enhanced by keeping the inevitable rise in average global temperature below certain key thresholds.

Agriculture in a Warming World

Recent extreme climatic events, such as heat waves, floods, droughts, and wildfires, are combining with long-term trends including rising temperatures and changes in precipitation patterns, with broad and deep implications for the agricultural sector.

Reduced security and quality of freshwater resources

Reduced crop yields for staples such as wheat, maize and rice

Higher prices and enhanced market volatility for agricultural commodities

Damage to agricultural production caused by pests

Destruction and/or disruption to agricultural infrastructure

Falls in labour productivity, particularly for manual labour in humid climates

Shifts in production areas of food and non-food crops

Threats to livestock, especially from heat stress

Steps for Mitigation

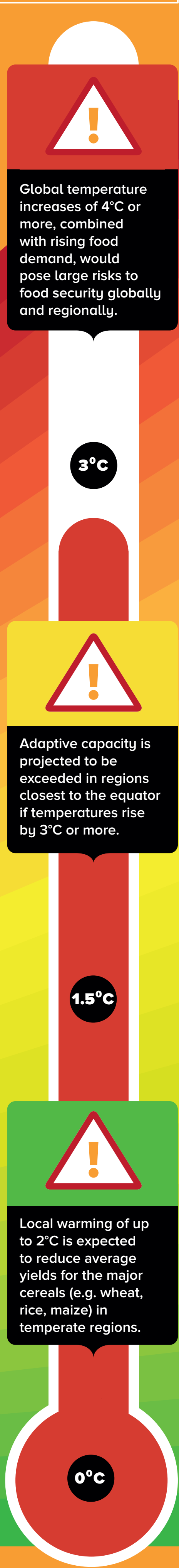
Greenhouse gas (GHG) emissions from agriculture comprised about 10–12% of man-made GHG emissions in 2010. This is the largest contribution from any sector of non-carbon dioxide (CO_2) GHGs such as methane, accounting for 56% of non-CO_2 emissions in 2005. The agricultural sector has significant potential to make cuts in GHG emissions.

Steps for Adaptation

Adaptation is highly context-specific, and no single approach for reducing risk is appropriate across all regions, sectors, and settings. Farmers can adapt to some changes, but there is a limit to what can be managed. Agricultural companies can draw from a range of options to maximise adaptive capacity based on a solid understanding of risks.

Resilience requires both mitigation and adaptation

We are currently on a path to a global mean temperature rise in the range 1.5 to 4.5°C by the end of the century. The higher end of this range would push agriculture far beyond manageable thresholds. The agricultural sector's own interests are best served by implementing ambitious approaches to mitigation to ensure that key temperature thresholds are not crossed, while also working to enhance adaptive capacity to inevitable temperature rises and associated climate events.



Supply Side Options

- Improve feeding and dietary additives for livestock
- Improve agronomy, nutrient and fertiliser management for cereals
- Establish agro-forestry systems
- Replace fossil fuels by biofuels
- Integrate bioenergy production and food production

Demand Side Options

- Reduce overconsumption in regions where it is prevalent
- Reduce loss and waste of food in supply chains
- Change diets towards less GHG-intensive food

Livestock Options

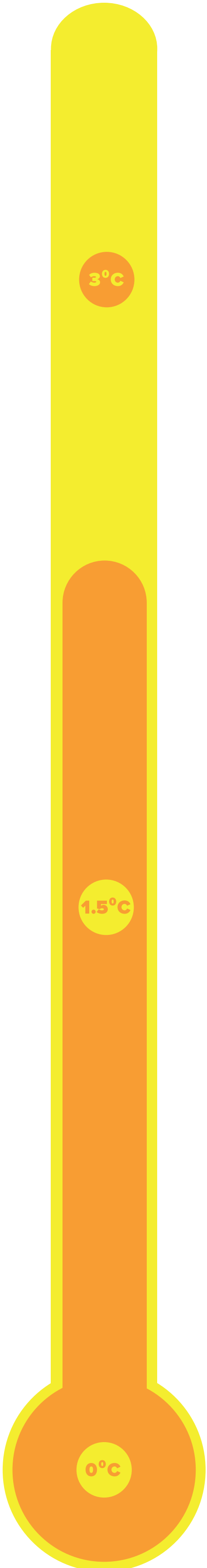
- Match stocking rates with pasture production
- Adjust herd and water point management
- Use more suitable livestock breeds or species
- Manage livestock diet quality
- More effective use of silage, pasture spelling and rotation
- Monitor and manage the spread of pests, weeds and diseases

Policy Options

- Index-based weather insurance
- Risk sharing and transfer mechanisms
- Public-private finance partnerships
- Payments for environmental services
- Improved resource pricing
- Trade reform

Crop Options

- Improve tolerance of crops to high temperature
- Breed additional drought-tolerant crop varieties
- Use adaptive water management techniques
- Alter cultivation and sowing times
- Improve crop rotation systems



Resilience

Farmers and other players in the food production chain have options for adapting to some climate change impacts. Adaptation is highly context-specific, and no single approach for reducing risk is appropriate across all regions, sectors, and settings. The ability of the agricultural sector to cope with climate events will decline as the climate warms, and is likely to be exceeded at certain temperatures.

Strategies for effective, sustainable, and resilient crop production include enhanced understanding of growing seasons, improved crop rotation systems, adaptive water management techniques, and higher quality weather forecasts. There is increasing evidence that farmers in some regions are altering cultivation and sowing times to deal with changing local conditions. Warming may extend the growing season, so changing planting dates is a frequently identified option for cereals and oilseeds provided there is not an increase in drought at the end of the growing season. Changing planting dates may increase yields by a median of 3–17%. Early sowing is being facilitated by improvements in machinery and by the use of techniques such as dry sowing, seedling transplanting and seed priming.

Moreover, the optimisation of crop varieties and planting schedules appears to be an effective approach to adaptation, increasing yields by up to 23% compared with current practices. This may be supplemented by further research on ‘climate-proofing’ aspects of food production and its transport along the supply chain. Businesses that have extended agricultural supply chains can evaluate and address vulnerability at the farm level to reduce risk, both for themselves and for growers.

High temperatures reduce crop yield and quality; so improving heat tolerance is a frequently identified adaptation for almost all crops. Improving gene conservation and access to extensive gene banks could facilitate the development of better-adapted crop varieties. Increasing drought in many regions raises the need for breeding more drought-tolerant varieties.

Adaptive water management techniques include enhancing storage and access to irrigation water, more efficient water delivery systems, improved irrigation technologies such as deficit irrigation, more effective water harvesting, agronomy that increases soil water retention through practices such as minimum tillage, and canopy management. These complement measures that integrate climate forecasts at a range of scales. Further down the supply chain, companies with significant water footprints for crop production and/or processing can track changing water resources and adjust their sourcing strategies and production needs accordingly.

GHG EMISSIONS FROM AGRICULTURE COMPRISED ABOUT 10–12% OF GHG EMISSIONS IN 2010.

ADAPTATION MEASURES ARE NEEDED IN THE AREAS OF CROPS, LIVESTOCK AND POLICY.

While most adaptation options are local, there is a role for global action.

Many livestock systems are highly adapted to past climate fluctuations, which may provide a sound starting point for adapting to future climate change. Approaches include matching stocking rates with pasture production, adjusting herd and water point management to altered seasonal and spatial patterns of forage production, managing diet quality, more effective use of silage, pasture spelling and rotation, using more suitable livestock breeds or species, and monitoring and managing the spread of pests, weeds and diseases.

These approaches are preventative in nature, in that their principal goal is to minimise climate-induced disruption. Other approaches to resilience building, such as index-based weather insurance, are more responsive and are principally designed to enhance capacity to respond and rebuild in the face of climate shocks.

While most adaptation options are local, there is a role for global action. Deepening agricultural markets and improving the predictability and reliability of the world trading system through reform could reduce market volatility and help manage shortages. Moreover, economic instruments can foster adaptation by providing incentives for anticipating and reducing impacts. These instruments include risk sharing and transfer mechanisms, loans, public-private finance partnerships, payments to farmers for conserving ecological services, improved resource pricing (e.g. water markets), charges and subsidies. Taken together, these approaches could improve yields by about 15–18%.

While these approaches can contribute to effective adaptation at temperature increases less than 2°C above pre-industrial levels, they are likely to be insufficient for warming above 4°C when combined with population-driven demand.

A series of interconnected barriers can undermine adaptation planning and strategies for resilience. These barriers include uncertainty about climate impacts, limited financial and human resources, limited coordination of different levels of governance and decision-making, different perceptions of risk, inadequate responses from political institutions, competing values, absence of leaders and champions, and limited tools to monitor effectiveness.

Some strategies for resilience can also reduce emissions. Practices implemented locally for soil carbon sequestration will increase the ability of soils to hold moisture and withstand erosion. Reducing fertiliser use and increasing crop diversification, promoting legumes in crop rotations, increasing the availability of high-quality seeds and integrated crop/livestock systems, promoting low-energy production systems, improving control of wildfires, and promoting efficient energy use by commercial agriculture and agro-industries will all contribute to cropland adaptation while curbing emissions.

Mitigation Potential

Cost-effective mitigation options include cropland management, grazing land management, and restoration of organic soils.

Supply-side options

Emissions from agricultural soils and enteric fermentation (the production of methane in the digestive systems of livestock) together represent about 70% of total agricultural GHG emissions. Other significant contributions come from paddy rice cultivation (9–11%), biomass burning (6–12%) and manure management (7–8%). The use of synthetic fertilisers is projected to increase over the coming decade, and this will become the second largest source of agricultural emissions after enteric fermentation.

For cereal production, mitigation options include improvements in agronomy, nutrient and fertiliser management, tillage and residue management and the establishment of agro-forestry systems. In the livestock sector, mitigation measures include improved feeding and dietary additives. Emissions intensity varies across sectors. It increased from the 1960s to the 2000s by 45% for cereals, but decreased by 38% for milk, 50% for rice, 45% for pig meat, 76% for chicken and 57% for eggs.

Across the world economy, a major strategy for reducing GHG emissions is to reduce use of fossil fuels in energy systems. One option is to replace them with biofuels, in solid, liquid or gaseous form. This can substantially reduce overall emissions provided that conversion of high carbon density ecosystems (forests, grasslands, peat-lands) is avoided and best-practice land management is implemented. Biofuels can be used in agriculture as well as other sectors. Bioenergy production can be integrated with food production (for example through crop rotation or use of by-products and residues). If implemented sustainably this can result in higher food and energy outcomes, and hence reduce land use competition. However there is a risk of increasing competition for land, water, and other resources. This may generate conflicts with important sustainability objectives such as food security and biodiversity, pointing to possible food price rises of 82% in Africa, 73% in Latin America and 52% in Pacific Asia by 2100 (compared to a reference scenario without forest conservation and bioenergy) if large-scale bioenergy deployment is combined with strict forest conservation.

Demand-side options

Complementary interventions to reduce demand for food could have a significant impact on GHG emissions. These include reducing loss and waste of food in the supply chain as well as during final consumption, changing diets towards less GHG-intensive food (e.g. substitution of animal products with plant-based food), and reducing overconsumption in regions where this is prevalent.

Policies encouraging changes in consumption patterns can complement supply-side mitigation action.

Rough estimates suggest that about 30–40% of all food produced is lost between harvest and consumption. In developing countries, up to 40% is lost on farm or during distribution due to poor storage and distribution. In developed countries, these losses are smaller, but a significant amount is wasted in service sectors and by consumers. In developing countries, this can be tackled through investments in harvesting, processing and storage technologies. In the developed world, awareness raising, taxation and other incentives to reduce retail and consumer-related losses would be beneficial.

Substituting food items with high GHG emissions per unit of product with low-GHG products can reduce emissions. Changes in diet would strongly affect future GHG emissions from food production, with some estimates suggesting that agricultural non-CO_2 emissions (methane and nitrous oxide) could triple by 2055 if current dietary trends and population growth continue. The potential for reducing emissions through changes in consumption could be substantially higher than technical GHG mitigation options. Companies in the agricultural sector could look to change business models that encourage overconsumption, educate consumers, influence purchasing decisions, and change the retail environment in order to address emissions caused by overconsumption.

Regional perspectives

Two cases of particular vulnerability

In **sub-Saharan Africa**, climate change is expected to reduce land productivity by 14–27% by 2080, amplifying existing stresses on water availability and agriculture. Rising temperatures and changes in precipitation are very likely to reduce cereal crop productivity, with strong adverse effects on food security. Progress has been achieved on managing risks to food production from current climate variability and near-term climate change, but these measures will not be sufficient to address long-term impacts. Climate change is a multiplier of existing health vulnerabilities including insufficient access to safe water and improved sanitation, food insecurity, and limited access to health care and education.

Greenhouse gas emissions linked to agriculture are highest in **Asia**. Moreover, climate change will cause declines in agricultural productivity, with Southeast Asia expected to see decreases in the range 18–32% by 2080. Other subregions will see a decline in yields of staple crops such as rice. Drought in western Turkmenistan and Uzbekistan could reduce cotton production, increase water demand for irrigation, and exacerbate desertification. Cereal production in northern and eastern Kazakhstan could benefit from the longer growing season, warmer winters, and a slight increase in winter precipitation. Projections of precipitation in most parts of Asia are uncertain; but increased water demand from population growth, increased consumption per capita, and lack of good management will increase water scarcity challenges for most of the region.

Policies governing agricultural practices are most effective when involving both mitigation and adaptation.

Conclusion

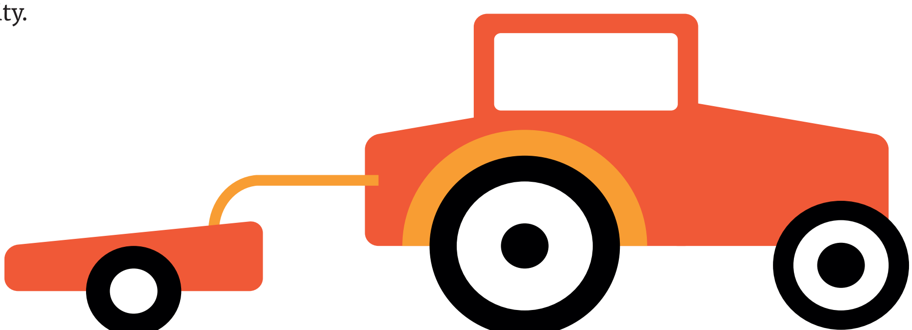
Mitigation strategies from combined action on agriculture, forestry, and bioenergy could contribute 20–60% of the emissions reduction needed by 2030 to remain within the 2˚C target.

Overall, climate change is projected to cause food production to fall, with lower yields from major crops. These projected impacts will occur in the context of simultaneously rising crop demand, which is projected to increase by about 14% per decade until 2050. Without adaptation, local warming of up to 2°C is expected to reduce average yields for the major cereals including wheat, rice, and maize in temperate regions. Impacts are expected to lead to increased pressure on freshwater resources, price and market volatility, further damage to production from weeds and pests, and substantial losses to land-based ecosystems and the functions they provide.

In 2010, governments agreed a target of keeping the rise in average global temperature since pre-industrial times below 2°C, which implies the necessity for major cuts in GHG emissions. The agricultural sector has enormous potential to make cuts. Land-related mitigation strategies from combined action on agriculture, forestry, and bioenergy could contribute 20–60% of the total emissions reduction needed by 2030 to put society on a trajectory compatible with the 2°C target. A further cut of 15–45% is feasible by 2100. Action to reduce emissions while building adaptive capacity needs to be managed with care as multiple barriers to progress remain, and there is a danger that climate progress could be made at the expense of other sustainability concerns including food security.

Efforts to reduce hunger and malnutrition will increase per-capita food demand in many developing countries, and population growth will increase the number of people requiring a secure and nutritionally sufficient diet. Thus, a net increase in food production is an essential component for securing sustainable development. How to manage this at a time when emissions need to decrease rapidly will be challenging.

Although this summary report deals with resilience and mitigation separately, the agricultural sector has the option of dealing with both simultaneously. As AR5 illustrates, adaptive capacity is projected to be exceeded in low-latitude areas with temperature increases of more than 3°C. As a consequence, the agricultural industry's own interests are best served by implementing ambitious approaches to mitigation to ensure that key temperature thresholds are not crossed, while also working to enhance adaptive capacity to inevitable temperature rises and associated climate events.



Glossary

ADAPTATION

The process of adjustment to actual or expected climate and its effects. In human systems, adaptation seeks to moderate or avoid harm or exploit beneficial opportunities. In natural systems, human intervention may facilitate adjustment to expected climate and its effects.

BIODIVERSITY

The variability among living organisms (at the genetic, species, and ecosystem level) from terrestrial, marine, and other ecosystems.

BIOENERGY

Energy derived from any form of biomass such as recently living organisms or their metabolic by-products.

BIOFUEL

A fuel generally in liquid form, produced from organic matter or combustible oils produced by living or recently living plants.

BIOMASS

The total mass of living organisms in a given area or volume. The term is also used to denote solid biofuels.

CLIMATE CHANGE

Any significant change in climate that persists for an extended period, typically decades or longer.

CLIMATE IMPACT

The effects of climate change on natural and human systems.

ECOSYSTEM SERVICES

The direct and indirect contributions of natural ecosystems to human well-being.

FOOD SECURITY

Secure access to sufficient amounts of safe and nutritious food for normal growth, development, and an active and healthy life.

GREENHOUSE GAS

A gas in the atmosphere, of natural and human origin, that absorbs and emits thermal infrared radiation. Water vapour, carbon dioxide, nitrous oxide, methane and ozone are the main greenhouse gases in the Earth's atmosphere. Their net impact is to trap heat within the climate system.

MITIGATION

A human intervention to reduce the sources or enhance the sinks of greenhouse gases.

PROJECTION

A potential future evolution of a quantity or set of quantities, often computed by a model. Projections involve assumptions that may or may not be realised, and are therefore subject to substantial uncertainty; they are not predictions.

RESILIENCE

The capacity of social, economic, and environmental systems to cope with a hazardous event or trend or disturbance, responding or reorganising in ways that maintain their essential function, identity, and structure.

SUSTAINABLE DEVELOPMENT

Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.

"Continued emissions of greenhouse gases will cause further warming and changes in all components of the climate system. Limiting climate change will require substantial and sustained reductions of greenhouse gas emissions."

IPCC, 2013

Disclaimer:

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Cambridge Judge Business School (CJBS) is in the business of transformation. Many of our academics are leaders in their field, creating new insight and applying the latest thinking to real-world issues.

BSR is a global nonprofit business network of more than 250 member companies. We develop sustainable business strategies and solutions through consulting, research, and cross-sector collaboration.

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