



Agriculture and Climate Change: Towards Sustainable, Productive and Climate-Friendly Agricultural Systems

Highlights

- The uncertain impacts of climate change will further increase the production risks faced by the agricultural sector.
- Agriculture also contributes a significant share of the greenhouse gas emissions that cause climate change – 17% directly through agricultural activities and an additional 7-14% through land use changes. It is therefore part of the problem – and potentially an important part of the solution.
- To support the objectives of sustainable, climate-friendly and productive agriculture, reforms are needed at the international, national and sector levels to correct misaligned incentives and redirect policy efforts to specific investments in pursuit of these explicit objectives.



What's the issue?

Climate change has created challenges for the agricultural sector – and will continue to do so. Climate change-induced increases in temperatures, rainfall variation and the frequency and intensity of extreme weather events are adding to pressures on global agricultural and food systems.

Climate change is expected to negatively affect both crop and livestock production systems in most regions, although some countries may actually benefit from the changing conditions. The changing climate is also adding to resource problems, such as water scarcity, pollution and soil degradation.

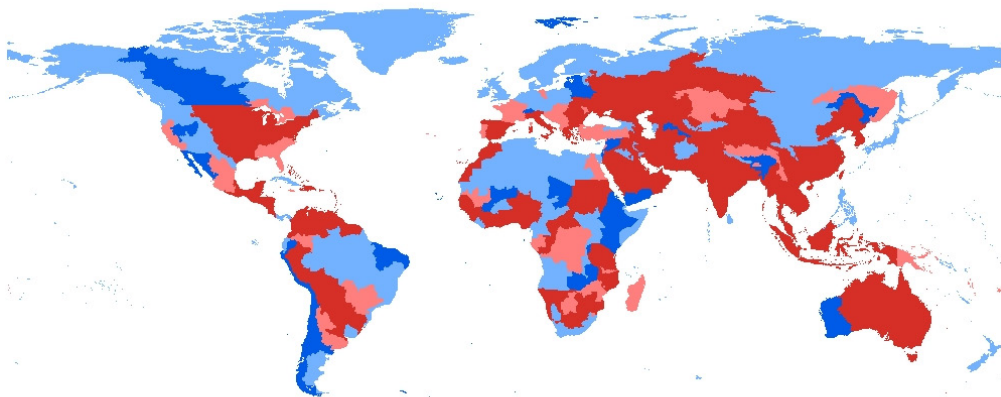
Agriculture contributes a significant share of the greenhouse gas (GHG) emissions that are causing climate change – 17% directly through agricultural activities and an additional 7-14% through changes in land use. It is therefore both part of the problem – and potentially an important part of the solution.

The main direct agricultural GHG emissions are nitrous oxide emissions from soils, fertilisers, manure and urine from grazing animals; and methane production by ruminant animals and from paddy rice cultivation. Both of these gases have a significantly higher global warming potential than carbon dioxide.

EFFECTS OF CLIMATE CHANGE ON YIELDS HAMPER YIELD GROWTH IN MOST PRODUCING REGIONS (RED SHADING), HOWEVER, YIELD GROWTH IN SOME REGIONS MAY ACTUALLY INCREASE (BLUE SHADING)

Example of maize

< -15% **-15% to 0%** **0% to 15%** **>15%**



Note: Projected changes in yields for maize in 2050 under climate change as compared with potential 2050 yields if there had been no change in climate after 2005. This map is without prejudice to the status of or sovereignty over any territory, to the delimitation of international frontiers and boundaries and to the name of any territory, city or area.

Source: Adapted from OECD / IFPRI (2014), *Modelling Adaptation to Climate Change in Agriculture*, OECD Food, Agriculture and Fisheries Papers, No. 70, <http://dx.doi.org/10.1787/5jxrcljnbxq-en>.

Self-initiated efforts by farmers to adapt to climate change while decreasing the GHG footprint of agriculture are unlikely to be sufficient, given uncertainties surrounding the timing and nature of climate change. The share of agriculture in global emissions, the need for further global mitigation efforts, and continued projected agricultural emissions growth in many countries all combine to underline the necessity of stronger, more effective policies.



What should policy makers do?

Policy reforms are needed within and beyond the agricultural sector to strengthen farmer incentives to achieve sustainable productivity growth without sacrificing climate change mitigation and adaptation.

At *international* level:

- **Implement the Paris Agreement reached at the 2015 United Nations climate change conference – COP21.** Both the text and the country-level strategies for emissions reduction, which are outlined in the form of Intended Nationally Determined Contributions (INDCs), recognise the threat which climate change poses to sustainable food production, and offer valuable opportunities for agriculture and the food chain to be an active part of the solution to climate change.

At *national* level:

- **Wider social, economic and environmental policy settings – such as trade, investment, infrastructure, and education policies – should consistently support sustainable productivity growth, in combination with adaptation and mitigation efforts.** Inconsistent or contradictory signals, such as import restrictions that protect water-intensive crops, can exacerbate poor choices by farmers. Improving overall policy coherence will be more effective than the marginal fine-tuning of existing agricultural policies.

At *sector* level:

- **There is a need to reform misaligned and distortive agricultural policies that encourage unsustainable intensification and the overuse of natural resources and potentially damaging inputs.** More than half of agricultural support across the OECD area continues to be potentially damaging to the environment, while measures targeting sustainable productivity or climate change goals remain marginal. Over-subsidised insurance, market price support and input subsidies should be reduced with a view to their eventual elimination.
- **Further investment in research and development (R&D) is needed to spur innovation that can improve sustainable productivity growth.** Governments may further facilitate private sector innovation by, for example, addressing investment barriers that impede R&D, ensuring that private knowledge is disseminated, and encouraging – where appropriate – public-private partnerships for R&D that have public goods outcomes.

- **Policies that aim to address climate change should emphasise outcome-based farmer incentives and knowledge transfer systems** that enhance farmer capacity to achieve sustainable productivity growth through mitigating and adaptive practices.
- **Where possible, financial incentives should target sustainability performance, as opposed to practices.** Untargeted incentives can encourage farmers to adopt measures that have high upfront costs, or that are socially beneficial but costly at private level.
- **Governments should ensure the provision and dissemination of relevant and up-to-date information on resource use efficiency and risk management** to help farmers and other private agents make informed investments in adaptation and mitigation measures. Strengthening access to knowledge and risk management mechanisms is key to increasing adoption of sustainable and productive practices. It is often advisable to streamline adaptation and mitigation advisory actions into existing institutions and to coordinate such actions with the private sector.



Further reading

This document is based on the evidence and analysis found in a number of OECD reports and papers published in recent years:

- **Mitigating Droughts and Floods in Agriculture: Policy Lessons and Approaches**
- **Drying Wells, Rising Stakes: Towards Sustainable Agricultural Groundwater Use**
- **Adapting Agriculture to Climate Change**
- **Compendium of Agri-environmental Indicators**
- **Modelling Adaptation to Climate Change in Agriculture**
- **Farmer Behaviour, Agricultural Management and Climate Change**
- **Policy Measures Addressing Agri-environmental Issues**

A complete list of relevant books and papers can be found at <http://oe.cd/taking-stock> or on the Agriculture Ministerial website at www.oecd.org/agriculture/ministerial.

