

# Climate change and agriculture



**Vincent Blanfort**

Chargé de mission changement climatique  
UMR Selmet



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## Context and issues

By the end of the century, changes in temperature and rainfall, rising sea levels and a probable increase in the frequency of extreme climatic events will have had a considerable impact on agriculture. On a global scale, agriculture, deforestation and other types of land use are responsible for some 25% of greenhouse gas (GHG) emissions. In view of these changes, ensuring food security for all, and particularly the world's poorest people, is a major global challenge. Farming systems will have to adapt to new contexts. Mitigating GHG emissions is also a priority. This means making major changes.

### Context plays a major role



The expected effects of climate change vary substantially from one region to another, including over short distances. Irregular growing seasons, excessive heat and water shortages cause huge disruption to crop cycles. Changes in practices, varieties and crop combinations will therefore have to be tailored to local conditions. Furthermore, it is necessary to come up with solutions on a territory scale, taking account of their multifunctionality, from food and energy production through to

social wellbeing and the quality of the environment.

### Tropical regions are particularly vulnerable



Tropical countries, in which the rural sector is both important and largely non-artificial, are particularly vulnerable to the effects of climate change. Modelling has shown that dry zones in such countries will become drier and humid zones more humid. An average temperature increase of 2°C is much more serious in tropical than in temperate zones. For these countries, making their populations less vulnerable is a priority. Adaptation is seen as a more important issue than mitigation. However, deforestation, irrigated rice growing and livestock production are responsible for substantial GHG emissions, and changing practices helps mitigate emissions or trap carbon. "No regrets" adaptation measures (ie that are useful whatever happens) are therefore desirable whatever the degree of climate change, or even in the absence of change, particularly if they contribute to mitigation. They are particularly relevant in southern countries.

### Public policy, from a local to a global level



The increased risks associated with any decision made, whether by producers or public- or private-sector decision-makers, call for the introduction of new economic, social and environmental resilience mechanisms. For politicians, it is not only a question of ensuring food security and boosting agricultural output. There are many aims, centring on livelihoods, the repercussions for poor populations, and the preservation of biodiversity, forests

and environmental services. Each has significant effects on human wellbeing, and all need to be taken into consideration by means of an integrated approach.

In particular, agriculture is impacted by population growth, changing consumer demand, and market functioning. The science-policy interaction should be of use in developing appropriate tools to ensure that the right decisions are made. The approach taken could vary from one place to another and from a local to a global level. It will need to take account of possible conflicts between targets, and if necessary choose between them.

## The climate-smart agriculture challenge



The climate-smart agriculture concept is based on the assumption that it is possible to ensure production operations that both satisfy farmers' requirements and can adapt to and mitigate climate change. This is what is known as a "hat trick", or the three pillars of climate-smart agriculture. Taking up this challenge does not just mean using improved techniques. It calls for an integrated approach that allows for climate parameters, notably the uncertainties of climate change and its local nature. Public- and private-sector decision-makers need to be involved

so as to help draft innovative public policy and find funding mechanisms for the changes required.

For further information: [Climate smart agriculture](#)

## What's CIRAD doing?

For CIRAD, as an agricultural research organization working for and with southern countries, Climate change is relevant to many of CIRAD's fields of research.

The aim is to pinpoint and design the many innovations that could help change behaviour, for instance:

- Modelling plant responses to climatic constraints
- Ensuring rational water management
- Breeding plants suited to high temperatures, salinity or a lack of water
- Fostering those ecosystem services that have a positive effect on greenhouse gas emissions
- Working on the synergy between adaptation to climate change and its mitigation
- Drafting new public policies
- Analysing the issues raised by international climate talks
- Imagining new economic instruments
- Designing "carbon-rich" cropping systems, crop combinations, farms or landscapes
- Imagining highly environmentally efficient livestock production systems
- Rethinking local energy production so as to reduce fossil fuel use
- Integrating the question of standards and certification into production strategies
- Improving agricultural by-product recycling
- Understanding the links between climate change and animal or plant health.

## Resources

### Books and documents



- [Les agricultures face au changement climatique](#), E. Torquebiau, *Cahiers Agricultures*, special issue, 26, 2017. [Web]
- *Climate change and agriculture worldwide*, Torquebiau Emmanuel (ed.), Springer, 2016.
- Climate-smart agriculture for food security, L. Lipper et al., *Nature Climate Change*, 4: 1068-1072, 2014. Doi: 10.1038/nclimate2437
- [Climate Smart Agriculture](#), J. Verhagen et al., CIRAD, WUR, the World Bank, University of California, FAO, CSIR, CGIAR, 2014.
- [Changement climatique : impacts et adaptations](#), Dossier d'Agropolis International, n° 20, 2015.

### Scientific websites

- Scientific websites on climate change
- Agrisource, Europe's first open innovation platform for climate-smart agriculture

### Science for all

- Resources for the general public (Reports, brochures, etc.)