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Prepare farms for the future

Scientists must work closely with farmers to ensure that agriculture can stand up to the ravages of climate change.

Ignore the climate sceptics who set up a straw man of the need for 'settled science' and then burn it to the ground. Ambiguity is the acknowledged refrain of the climate-change symphony. From storms to sea-level rise, all projections of future change are surrounded by a residual uncertainty that will not go away, no matter how sophisticated our climate (and climate-impact) models may become.

The future of global agriculture is one of the most urgent issues in a warming world. Farmers must prepare for, and adapt to, a changed climate that is likely to feature more erratic rainfall, temperature extremes, drought, soil erosion, invasive weeds and durable pests. Science, error bars included, has much to offer these efforts. But if adaptation is to work, climate scientists, agricultural researchers, farmers and government officials must work closely together.

As a reminder of how sensitive farming is to extremes, consider the record-breaking 2003 European heatwave, which caused more than €13 billion (US$14 billion) in damage to agriculture and forests. In less-developed parts of the world, prolonged drought and other extremes come with even more direct social costs, in the guise of increased hunger and risk of violent unrest.

Reliable climate services, such as those being established around the globe under the auspices of the World Meteorological Organization, can provide valuable early seasonal forecasts to farmers and governments. Their accuracy and coverage must improve in the face of the coming climate crisis. But the strategic decision-making that climate change will increasingly force on the farming sector requires forecasts that look further ahead. And climate change is far from the only uncertain outcome that farmers must grapple with as they prepare for the future. Trade, technology and socio-economic change can affect agriculture just as profoundly as changes in rainfall and temperature.

Farmers are natural adaptors. They have been tweaking and changing their practices since humans first began to grow food, and most today have a keen sense of what works best on their fields. But climate change may require drastic measures beyond the capability of individual farmers, from expensive irrigation schemes to the transformation of farming systems. These may not materialize through economic growth alone. And specific needs and adaptation options will substantially differ from region to region — or perhaps from village to village — depending on farm types, soils, local climate and topography. There are as many different ways for agriculture to adapt to climate change as there are different types of agriculture.

Models of different scenarios concerning crops, climate and economics can help, but only up to a point. Agriculture is an early adopter when it comes to using science to inform and guide adaptation. However, this use of science does not rely only on the scale of models and the skills of modellers: trust, intuition and cultural empathy are just as important.

Developing an improved crop variety in the lab is a very different thing from convincing farmers to adopt conservation agriculture, switch to semi-arid farming systems or do anything else that may not come with an immediate, tangible benefit. To produce any 'actionable' outcomes, the science of climate-change adaptation must therefore engage and listen to the people it is supposed to serve.

As we discuss in a News Feature on page 396, adaptation researchers are increasingly aware of this communication challenge. Science-led initiatives, such as Modelling European Agriculture with Climate Change for Food Security and the Agricultural Model Intercomparison and Improvement Project (AgMIP), are being pursued in close consultation with local experts and farming communities. Such programmes are a valuable step beyond coarse academic projections of climate impacts such as changes in global crop yields, which lack regional specificity.

"The science of climate-change adaptation must engage and listen to the people it is supposed to serve."

Regional studies suffer from the inevitable uncertainty over the magnitude and manifestations of climate change, and perhaps even more over the course of socio-economic and technological development. But carefully crafted regional case studies, informed by locally sourced data, can produce plausible future scenarios from which local planners can draw a range of tailored adaptation options.

AgMIP aims to produce a standard experimental protocol to study climate impacts on farming, which will help adaptation efforts even further. If it succeeds, the programme should solidify adaptation research, in the same way that model comparisons have improved the consistency of the physical climate sciences. The future is uncertain, but that cannot be used as an excuse to fail to plan for it. ■

Timeless advice

The best guidance on how to get ahead in science stands the test of time.

How can a young researcher get ahead in science? They need perseverance: "You do experiments and 90% of them aren't going to work. Nobody warned me about that." Boldness: "People don't ask enough questions. They're embarrassed." Mastery of the basics: "I didn't even know where the pipettes were." And perhaps a dose of reality: "Rejection is an ever present companion in science."

Those quotes, all from researchers interviewed for a Careers Feature on page 491, demonstrate that there is more to a successful scientific