LWEC
Living With
Environmental
Change

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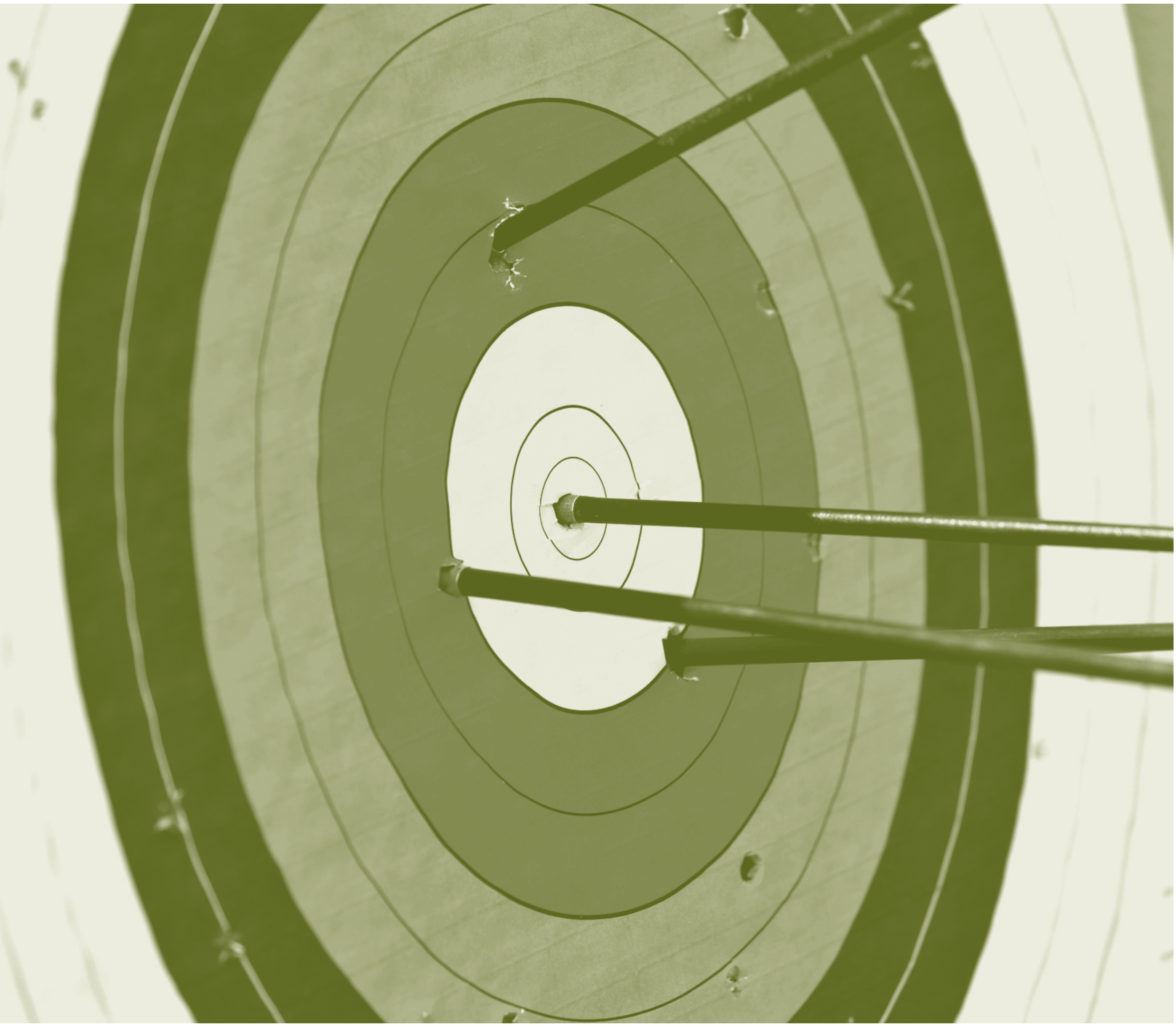
Climate impacts: taking action in the face of uncertainty

Uncertainty is an inherent feature of our knowledge about climate but decision makers need to be able to plan for the future while understanding the uncertainty involved.



Living With Environmental Change Policy and Practice Notes

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The Living With Environmental Change Partnership brings together 22 public sector organisations that fund, carry out and use environmental research and observations. They include the UK research councils, government departments with environmental responsibilities, devolved administrations and government agencies. The private sector is represented by a Business Advisory Board.

Climate variability and change affect a wide variety of decisions, including those made in international policy, humanitarian and development work and UK local government. Since uncertainty is an inherent feature of knowledge about climate, decision makers must be ready to make decisions based on incomplete knowledge. Scientists, for their part, need to continue to work on characterising – and narrowing – uncertainty in ways that support decision makers. Communication of climate information has to convey the degree of confidence associated with scientific statements and recognise the complex, dynamic contexts in which decision makers are operating.

Whose decisions are affected by climate?

A very wide variety of decision makers need to use climate information of some sort. These include:

- Local authority planners
- Healthcare professionals
- Farmers and others whose livelihoods are dependent on natural resources
- Agricultural advisers
- Businesses
- Humanitarian and development agencies working at local, national, regional and international levels

Why are predictions of climate uncertain?

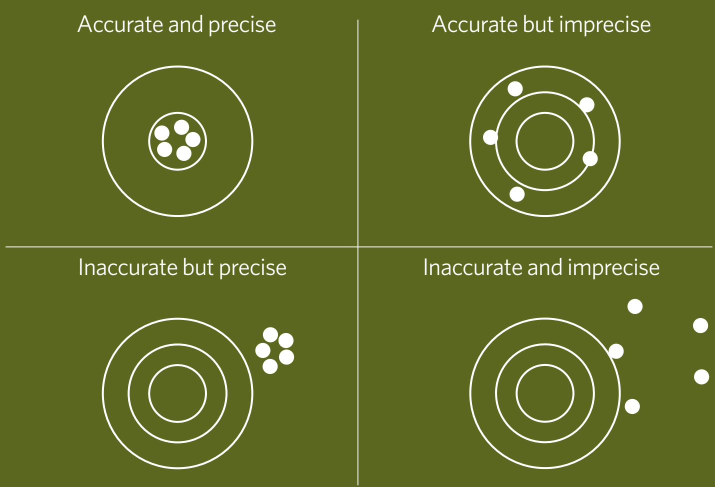
Many things are already known about the climate. For example we know that over many decades elevated CO_2 causes global mean temperatures to rise. However, knowledge about climate variability and change always includes an element of uncertainty because:

- There are theoretical and practical limitations to the ability of models to predict climate precisely.
- Climate change is a multi-faceted problem with different implications for different people, places and times – knowing about global mean temperature change is not the same as knowing about impacts in a particular place.

How do scientists deal with uncertainty when making predictions about climate?

Scientists use multiple computer simulations, called ensembles, to quantify uncertainty:

- They recognise that it is better to be imprecise and correct, for example by providing a range of possible temperatures, than to be precise but wrong (see diagram below).
- No single simulation is definitive; that is why they use these multiple simulations.
- The more geographically specific the simulation, the more uncertain it is likely to be.
- Not all uncertainties are equally important. For any given scientific prediction the uncertainties will vary according to the time and the place, so it may be necessary to consider carefully, in each instance, just how important any uncertainties may be.
- There are analysis techniques that can be used to identify key uncertainties. For example, methods have been recently developed to identify and rank sources of uncertainty in assessing future crop yields and how climate change might affect these.
- Whatever methods are used, there may be several different interpretations of the same piece of science, so there is a need to engage expert judgement.



Who is best placed to deal with uncertainty?

Effectively managing uncertainty requires scientists, planners and communities to work together. This is because:

— The questions that scientists are answering may not be the same as the questions that decision makers are asking, or need to ask.

— Before work begins, it is important that scientists and decision makers agree which research questions are both tractable and useful. Decision makers need to understand relevant aspects of the science, and scientists need to understand how information about climate and its impacts can better inform specific decisions.

— Discussion may produce avenues of research that are not immediately obvious. For example, climate change is more predictable in the tropics than in the UK. But this may not be as negative as it seems for a UK decision maker, because crop failures in the tropics can help us to assess potential knock-on effects on UK agriculture and food prices.

— Communicating areas of consensus and diversity of views in science requires mutual respect and trust, and clarification of expectations and respective areas of expertise. Establishing this process may need to take place over an extended period of time.

How can decisions best take account of uncertainty?

Uncertainty does not preclude appropriate action and adaptation:

— It is crucial that uncertainty is accurately characterised and communicated when developing options in response to weather and climate information.

— However, a focus on the uncertainty rather than on the problem being addressed is likely to be unhelpful.

— Problems may arise when there is an overemphasis on uncertainty from the public communication or policy perspective. It is easy for the settled areas of science to become confused with the areas where uncertainty remains.

— The differences between the scientific method and the decision-making processes of business and policy can lead to overestimates of uncertainty.

— Focusing on a particular, practical problem can help. For example, a decision maker may be interested in the agricultural developments needed in order to adapt crops to climate change. In this case, the research can focus on varieties of crops that produce high yields under the predicted changes in climate.

Could researchers communicate more effectively?

The uncertainty involved in predictions about future climate may be difficult to communicate to a general audience. It is important for researchers to remember that:

— Engaging with users, and understanding their decision-making processes, is crucial to successful use of climate and impact information.

— Decision makers have key knowledge about their sectors and can play an important role in communicating information about climate change and uncertainty. Information can, for example, be developed for particular user groups or via channels most trusted by at-risk groups.

— Information about climate change and the uncertainty involved needs to be user-friendly. For example, it may be more useful to give stakeholders information about how much time they are likely to have in which to adapt to changes in climate, rather than expressing the information as likely temperature intervals at a given time. This also conveys better the certainty about eventual temperature rise.

— A wide variety of participatory and visual approaches have been developed to support communication of probabilistic information. Scenario methods and descriptions of trade-offs can be helpful. For example, analysis of model results could be used to say that "warmer temperatures will reduce the time to maturity of crops, thus reducing yield. Model results suggest that increases in rainfall will compensate for this in 40-60% of cases."

What are the implications for researchers, decision makers and other stakeholders?

Researchers and funders need to remember that:

— It is often easier to communicate ideas by taking a real-world problem and showing how it could be addressed. This usually requires an interdisciplinary, cross-sectoral approach.
— People outside the research community have knowledge to contribute to the research process and this should be valued appropriately alongside scientific knowledge.
— The scientific community may judge research very differently from wider society; the papers that scientists value most may not be the ones that lead to the most significant changes.

Decision makers need to work with scientists to:

— Identify researchers who have both the scientific expertise and ability to communicate issues that are important for decision making.
— Help formulate research questions that are based on real-life problems.
— Engage throughout the decision-making process in developing strategy, programmes, policies and projects.
— Identify the most important areas of uncertainty and how they may be communicated effectively.
— Ensure that climate information is taken into account in decision making across all sectors and timeframes.
— Build the capacity of communities and information users to work with scientists on identifying research questions that are both useful and tractable.
— Allow for difference of opinion, understanding that scientists may not always agree on the interpretation of evidence but this does not mean that the evidence is wrong.

Further information

This policy and practice note was written by Professor Andy Challinor, University of Leeds, with input from NERC Knowledge Exchange Fellow Emma Visman. It draws on research from EQUIP (End-to-end Quantification of Uncertainty for Impacts Prediction), a three-year project that brought together the UK climate modelling, statistical modelling, and impacts communities to develop risk-based prediction for decision making in the face of climate variability and change.
www.equip.leeds.ac.uk

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www.elrha.org/dialogues

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