# Climate Scenarios, Decision-Making and Uncertainty: Do Users Need What They Want?

## Policy and Practice Note 1 - How tailoring climate scenarios can improve the effectiveness, and substantially reduce the costs, of building resilience to a changing climate.

**Policy & Practice Note 1**
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Adapting to a changing climate is a major challenge facing society. What decisions to take, and what risks are acceptable, depend on new kinds of information and new ways of thinking and learning. **Project ICAD**, **I**nforming **C**limate **A**daptation **D**ecisions, is a European Research Council funded programme, which sheds light on the differing needs, experiences, and pressures of those involved in producing and using climate impact information to inform long-term planning.

**Climate scenarios, based on computer model simulations, allow us to visualise how the earth's climate may change under different social and economic futures. Government agencies, businesses and the third sector put these to use in designing, planning and implementing strategies to lessen exposure to climate risks and exploit opportunities. Getting decisions right relies on a robust evidence base. Such efforts can be weakened due to inherent uncertainties in building climate scenarios, however. Growing demands from users to make uncertainty explicit, supported by advances in climate science, have led to a move away from single projections to embrace more probabilistic ones.**

**ICAD research suggests that greater complexity favours some adaptors over others. Those without technical degrees, or the time to interrogate multiple options, are often left disadvantaged. Different users have different needs. What users want and what they actually need (or can do) are not always the same. Tailoring climate scenarios to fit user needs can make them more effective, inclusive, and better value-for-money. Beyond climate change, this Policy and Practice Note has relevance to many kinds of problems where future scenarios are used to make policy or management decisions.**

## What are climate scenarios?

- Climate scenarios are consistent and plausible representations of **future climates**. Often maps are used to depict how the climate may change.
- They explore the **impacts** of climate change by modelling the effects of increased greenhouse gases emissions on temperature and precipitation patterns amongst others variables. They are designed to inform the development of **adaptation** strategies.
- They are not concerned with predicting long-term weather for particular days. Instead, they provide information on the characteristics of **average weather** and **weather extremes** over periods of 10, 20, and 30-years or more.
- The UK's fifth generation of climate scenarios, **UKCP09**, are internationally recognised as an example of probabilistic regional projections. Produced by the Met Office Hadley Centre, in conjunction with other partners, these scenarios have quantified modelling uncertainties through **Bayesian probabilities**.

## Why do we use climate scenarios?

Climate scenarios can **support decision-making** in water, energy, healthcare, agriculture, transport, construction, environment and finance sectors, for many reasons. These can be grouped into three broad headings:

### 1. Motivations

Visualising futures helps communicate the urgency of action. Due to the high likelihood that human activities have changed the earth's climate; the significant impact that a changing climate will have on society and the natural environment; and inertia in the climate system, from past and present greenhouse gas emissions, we are committed to future changes that **cannot be avoided**.

### 2. Identify risks and rewards.

Extremes events like heatwaves, or flooding episodes, have to be managed through **interventions** that are proportionate, cost effective and timely. Yet change can be slow and expensive. Climate scenarios can examine a range of possible outcomes allowing decision makers to take action to minimise negative consequences and maximise opportunities.

**3. Prioritise resource allocation.**
Investment of public resources involves prioritising limited funds. Whether that be finding the best way to protect flood-vulnerable communities or private investment to cope with changing energy demands. Testing out different strategies, before weighing up their **costs** and **benefits**, is made possible through the use of climate scenarios.

## How can climate scenarios become problematic?

**Framing uncertainty** in climate scenarios is tricky. Probabilistic projections, as used in UKCP09, make some uncertainties explicit but multiple probabilities can also make them too complex to use. Uptake (or lack thereof) of climate scenarios, and the effect that has on decision-making, can cause problems, as detailed in the five points below.

a) Outstripping the pace at which users can absorb scientific advances, in this case Bayesian probabilities, means those without technical backgrounds, or working in sectors where the level of technical information needed is lower, can be **excluded** from using climate scenarios altogether or use them inappropriately leading to maladaptation.

b) Unable to examine the data in any depth, users turn to heavily digested summaries, cherry-pick graphics and texts, or punt for the **convenience** of paying consultants to interpret the scenarios, all of which limits the wider communication of uncertainty to those who are not already in the know.

c) Lacking viable alternatives, users have little choice but to accept these scenarios. Rather than encourage decision-makers to take more **responsibility** for handling uncertainty they can have the reverse effect. Users can become overly dependent upon these briefing reports, typographic materials and consultants' work, and are rarely able to challenge or even adapt to them.

d) Conditioned to think through only a limited number of options, the prospect of multiple equally compelling climate scenarios encounters resistance amongst decision-makers due to the **extra time**, **effort** and **paperwork** needed to justify resource commitments.

e) Confusion over what users **want** and what they actually **need (or can do)** has made matters worse. Not only do different users have different needs but they also have different capacities to respond, or adapt, to technical advances. People unable to (fully) use such technical tools can be further disadvantaged as inequalities develop between those in the know who can take steps to be more resilient and those less able who become more vulnerable.

## Can climate scenarios and user perspectives be reconciled?

- Government funding, as well as a desire to deliver the **'best' possible science**, certainly instils trust in the climate scenarios but an inability to fully interrogate probabilistic modelling can **reduce** the utility of these scenarios.

- If probabilistic projections are here to stay, then, the practice for developing climate scenarios needs to move away from a **'one-size-fits-all'** approach to embrace a more **'tailored'** one. One concern is that divergent approaches introduce clumsy solutions through national inconsistencies, although diversity can also offer the benefits of reducing the risk of **maladaptation**.

- Users, from all walks of life, will need to be **engaged** during the **design** and **modelling process** to help frame how the climate scenarios can be used in decision-making. Greater feelings of **ownership**, **familiarity**, and **fitness-for-purpose** can, then, be developed.

- Efforts will be needed to go beyond simply asking: what do users **want**, to find a new way to discover exactly what they **need (or can do)**.

## How can policymakers help to improve the utility of climate scenarios?

**To ensure climate scenarios are 'fit-for-purpose' policymakers should consider adopting the following practices:**

- **If people are to accept and widely use climate scenarios, they need to be involved early on and throughout the modelling process.**
- **Appreciate that the 'best' possible science is not always the most user-friendly. Distinguishing between what people say they 'want' and what they actually 'need' (or can do) is essential to ensuring these tools are suitable, effective, and value-for-money.**
- **Offering training, although helpful, favours those (in bigger organisations) with time to invest. Wherever possible, climate projections should be 'tailored' to reflect the differing technical backgrounds and information requirements of individual users.**

## Further information.

Funded by the European Research Council, the Advancing Knowledge Systems to **I**nform **C**limate **A**daptation **D**ecisions programme, known as the **Project ICAD**, explores the creation, translation and use of climate information for adaptation in the UK.

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## Useful resources.

To engage practitioners, policymakers and decision-makers, and to follow Project ICAD's work, two social media outlets have been developed in the form of a blog [http://www..adaptationow.com] and twitter account [@project_icad].

Tang, S. and Dessai, S. (*In Press*) Usable Science? The UK Climate Projections 2009 and decision-support for adaptation planning, *Weather, Climate and Society*.

Hulme, M. and Dessai, S. (2008) Negotiating future climates for public policy: A critical assessment of the development of climate scenarios for the UK, *Environmental Science and Policy*, 11, pp.54-70.

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**Project website.**
http://www.see.leeds.ac.uk/research/sri/project-icad/

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