

The climate change challenge

UK climate trends and impacts

Climate change is with us. The three warmest years on record have occurred since 1998, 19 of the warmest 20 since 1980. Long-term monitoring by ECN and others is detecting impacts on ecosystems

Frequent and destructive storms, melting polar ice-caps, sea level rise. These are some of the predicted global-scale effects of climate change, but what does climate change mean for the UK, and what is ECN's role in helping societies to face this challenge?

Present day realities

Many of the predicted effects of changing climate can already be detected in the 350 year UK climatic record. The UK Climate Impacts Programme (UKCIP)¹ reports that:

- The 1990s was the warmest decade in central England since records began
- Warming over land has been accompanied by warming of UK coastal waters
- Summer heatwaves have become more frequent, while there are now fewer frosts and winter cold spells
- Over the last 200 years, winters have become wetter compared with summers and a larger proportion of winter rain and snow now falls as heavy rainfall events than was the case 50 years ago
- Since the start of the 20th century, the average sea level around the UK has risen by about 10 cm.

Climate predictions

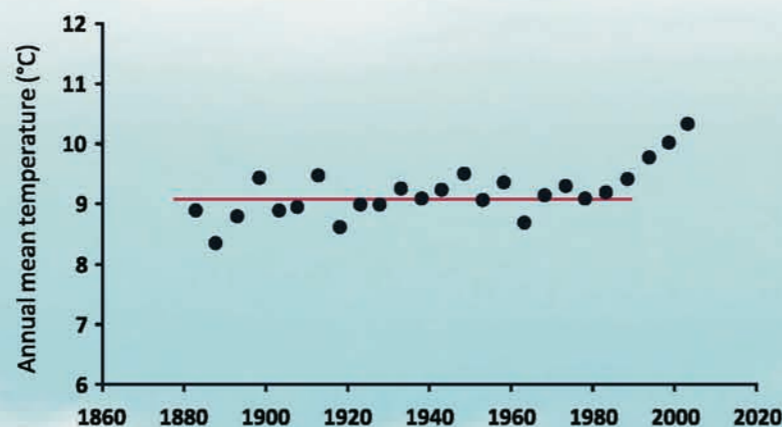
Climate change scenarios have been developed by the UKCIP to show possible changes in climate over the 21st century¹. The UK's climate is predicted to become warmer during all seasons, with drier summers and wetter winters. The models predict:

- A rise in mean annual temperature of between 2 and 3.5°C by the 2080s (up to 5°C in some areas)

- More frequent occurrences of extreme high summer temperature
- Fewer very cold winters
- Increased temperature of coastal waters
- Increased intensity of heavy winter rainfall events, but less snowfall
- Sea level rise in all areas, up to 86 cm in southern England by the 2080s.

The climate change challenge

Climate change impacts the natural environment. Some species inhabit limited climatic 'spaces'. As the climate changes so these spaces shift northward (and up mountains), and more mobile species are expected to migrate



▲ **The Rothamsted "hockey stick".** Data from the ECN Rothamsted site showing 5-yearly averages of annual mean temperatures from 1878-2005. Temperatures were relatively stable over the period up to the late 1980s. Since then temperatures have generally exceeded the long-term mean (red line; mean for 1878-1990) and indicate progressive warming. (Data courtesy of Rothamsted Research Ltd.)

with them. In contrast, less mobile species could become increasingly restricted because of habitat fragmentation and shrinking climatic space. Climate-driven migration also leads to changes in competition among species. The timing of many natural events (phenology) is also changing, causing problems when tightly-coupled events (e.g. rearing of young timed to coincide with an abundance of a key food source) become desynchronised.

Societies and governments must address climate change and its many impacts. The UK government is committed, under the Convention on Biological Diversity (CBD)², to protect species and habitats. One of the key drivers of sustainable management of natural resources is the need to maintain functioning ecosystems, which provide 'goods and services' essential for human health and well-being. These services include clean air and water and healthy, productive soils³.

Certain types of organism are known to play essential roles in maintaining ecosystem health, but the extent to which they are vulnerable to change is not fully understood. How far can an ecosystem be altered before the goods and services upon which we rely become threatened, and what actions might be necessary to safeguard them? The human response to climate change needs to be based on sound evidence. Whole ecosystem studies and long-term monitoring like that undertaken by ECN are critical in helping society meet the challenges.

Long term monitoring and associated research at ECN sites is detecting changes in the abundance of species, range-shifts and phenological changes. At a time when the natural environment is under pressure from multiple factors including air pollution and changes in land use, ECN's integrated monitoring of the physical, chemical and biological environment enables us to disentangle these various effects and determine more confidently the role of climate in driving these changes.

- The growing season for plants in central England has lengthened by about one month since 1900
- Long-term monitoring of beetle populations at ECN sites indicates that southern species generally appear to be increasing in number, whilst northern and western species are declining
- Between 1973 and 1998 more than a quarter of Essex saltmarshes, critical to biodiversity and functioning as important fish nursery grounds and as feeding grounds for birds were lost to rising sea levels
- As spring becomes warmer and longer, swallows are arriving earlier, and there is a trend towards the early leaf emergence of oak trees. At ECN sites, frogs are beginning their breeding cycle earlier
- With only a 1°C increase, egg-laying dates of 20 bird species are 4–17 days earlier than 25 years ago
- Monitoring at the River Bush ECN site indicates that survival rates of North Atlantic salmon, an economically important species, have declined markedly, possibly due in part to climate change

Some impacts of climate change in the UK

Exploring further

The IPCC Fourth Assessment report (published in 2007) is available from the IPCC website: www.ipcc.ch. It presents data that, in the view of the IPCC scientists, indicate the extent of climate change, its impacts, its likely cause and likely scenarios of future climate change.

Climate change scenarios for the UK are prepared by the UK Climate Impacts Programme (UKCIP). For more information see www.ukcip.org.uk.

The Millennium Ecosystem Assessment was a global assessment of the consequences of global change for human well-being, providing a snap-shot of the current state of the world's major ecosystems and the goods and services they provide. For more information see: www.millenniumassessment.org.