

# Understanding and preparing for climate change

Science for risk assessment and adaptation  
in the environment and food chain



## Understanding our changing climate

The work of CSL scientists is increasing our understanding of climate change – and driving policies to minimise its impacts

Scientific consensus is that the global climate is warming and weather patterns changing. Even in the UK we are experiencing more severe storms, flooding and heat waves, supporting the view that our weather is becoming increasingly unpredictable and subject to greater fluctuation.

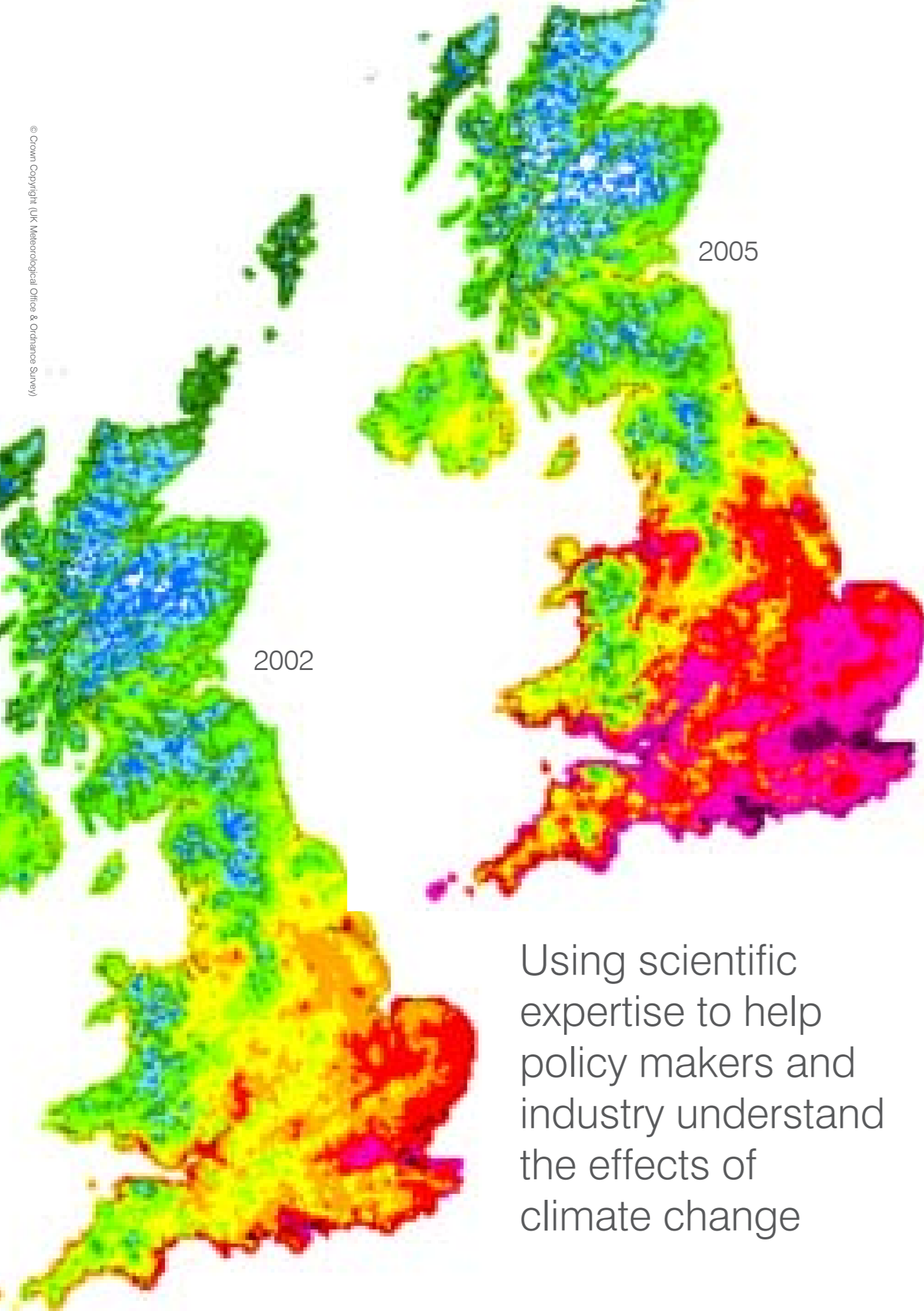
These changes have significant implications for humans, industry and ecosystems. Government has a huge part to play in creating policies that will help to mitigate the damaging effects of climate change. Industry, too, must play its part, and businesses are increasingly taking action to improve their sustainability and minimise their impact on the environment.

But policies and mitigation strategies must be driven and directed by robust evidence and a deep understanding of the implications of climate change in all its complexity. That's why the work of scientists at CSL has such a crucial role to play in shaping policies to help the UK adapt to a changing climate.

CSL uses its unrivalled scientific expertise and resources to research and monitor a whole array of environmental and biological factors in relation to the changing climate; from insect populations, to plant and animal diseases and chemical pollutants. Our findings contribute to the evidence for climate change, and enable our scientists to predict potential consequences of a warming climate. We assess risks to the environment and food supply chains, and we contribute to formation of Government policies aimed at reducing the impact of climate change.

Please read on to discover more about our work in this important area.

Using scientific expertise to help policy makers and industry understand the effects of climate change



Collating information that helps to understand the consequences of a changing climate

## What is changing? – Gathering the evidence

A warming climate has implications for entire ecosystems – and monitoring the changes underpins all our work on climate change

Robust, scientific evidence is the starting point for all our work at CSL. In our research we gather information on many characteristics of the environment and food chain such as changes in cropping patterns, biodiversity, insect populations, disease prevalence and chemicals in the environment. We then use this information to develop models that predict future changes and formulate risk assessments that guide Government policy decisions in areas such as agriculture, international trade, food safety and conservation.

Our monitoring and measurement activities over the past 30 years have enabled us to build up comprehensive datasets on the occurrence of everything from pesticide usage and crop diseases to invasive pest species across the UK. These long-term datasets are valuable tools to help understand more accurately the impact of climate change since they provide baseline data which pre-dates the recent changes in weather patterns.

### Web of complexity

From the broad range of monitoring carried out by our scientists, it is becoming very obvious that changes in the environment, ecosystems and food chain are all highly inter-linked. Wherever we look we see evidence of inter-dependency and complexity.

For example, the warming climate is already extending the growing season, creating conditions favourable to the spread of pests and insects beyond their traditional ranges. Such expansion

is likely to demand changes in pesticide use over wide areas of the UK, leading to increased levels of chemicals in the environment and potentially the food chain. Biodiversity may be affected as cropping patterns change in response to warmer conditions, while non-native species moving to the UK as conditions become favourable alter the balance of our ecosystem and bring with them new disease threats.

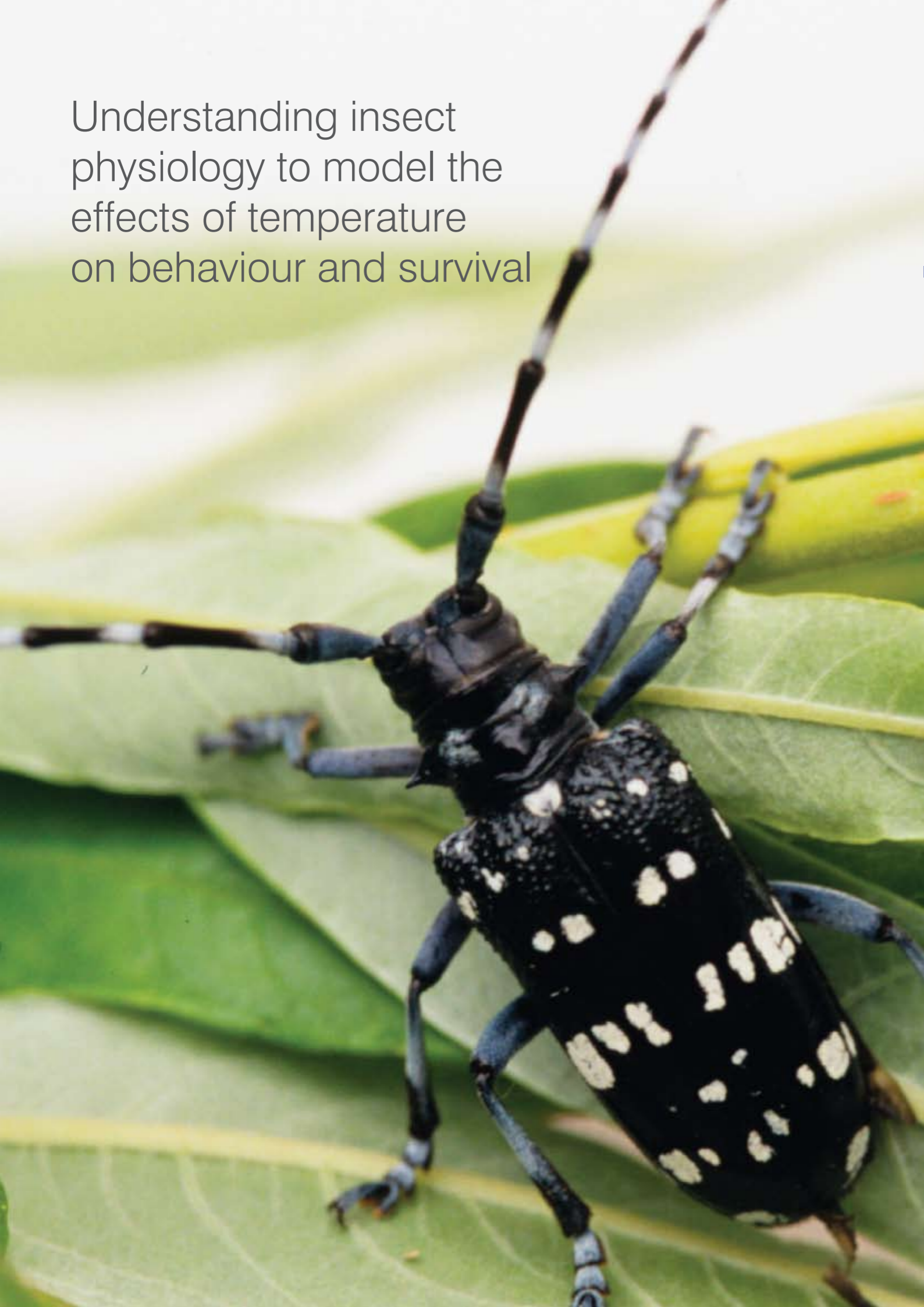
The breadth of expertise at CSL means that we have the scope to explore fully the interlinked nature of these changes, and to ensure well-balanced judgements are made.

### Shifting targets

As our climate warms, we have to be alert to new organisms in the environment, and new indicators of change. Our scientists are adept at identifying what they need to monitor to ensure robustness of data, and in finding methods to measure these target indicators. Collecting data on prevalence of disease in wildlife, for example, is not straightforward, but it is a challenge our ecologists have mastered.

Measuring and monitoring produces vast quantities of data. We have specialist statisticians and modellers who bring order to these data, and play a key role in interpretation. Mapping and visualisation of information on, for example, abundance of birds, insects, and crop disease, is an essential part of tracking the consequences of a changing climate.

## Understanding insect physiology to model the effects of temperature on behaviour and survival



## What are the likely impacts? – Assessing the risks

### Risk assessments and predictive models provide the basis of actions to combat the adverse effects of climate change

The data we gather through monitoring a host of environmental factors provides the raw material for detailed scenario modelling. These models enable us to build risk assessments and forecasts that shape the UK's response to climate change.

#### Complex changes

Changing climatic conditions are already putting pressure on the ecology of the UK environment. The exact nature of many of the risks to environmental quality, natural ecosystems and human health remain uncertain, but work at CSL is shedding new light on the issues.

CSL scientists are involved in modelling future land-use trends. New cropping patterns, perhaps with a focus on energy crops, will alter the pressures on existing biodiversity, and this in turn has knock-on effects on the ecology of adjacent habitats. CSL is at the forefront of predicting the consequences of these changes and providing recommendations to Government.

We have the tools to examine how the dynamics of pest species will change with the climate. Of key importance here is the balance between insect pests and their predators. Our understanding of insect physiology enables us to model the effects of climatic conditions on insect behaviour and provide detailed assessments of the risks posed by different species.

#### Alien species

Warmer temperatures increase the risk of alien insect pests gaining a foothold in the UK, and many try. Diseases, too, are influenced by weather, and previously minor diseases such as tan spot in cereals are becoming more prevalent.

Disease prevalence in animals is changing, posing challenges to livestock and wildlife. The risk to human health from disease 'reservoirs' in wildlife is likely to increase as more people take up outdoor activities and come into contact with infection sources such as ticks.

#### Food safety

In the food safety arena, climate change is likely to have significant implications for chemical residues in food, allergens and microbial contaminants. The risk from mycotoxins increases in warmer, wetter conditions, both in the growing crop and in stored grain. With higher numbers of crop pests and animal parasites, there is likely to be greater use of chemical treatments, with the consequent risk of residues in foods. CSL is helping to assess the implications, both for human dietary intake, and for health of the environment.

An increasingly important area of study at CSL is that of the behaviour of chemicals such as pesticides and veterinary medicines in the environment. Rising temperatures and changing rainfall patterns will have major influence on the rate of breakdown and on movement through the soil and water bodies. Not all chemicals respond in the same way to a changing climate, and the risks to human and environmental health are being studied.

As our understanding of the effects of climate change advances and models for the consequences become more sophisticated, CSL is leading the way in using risk assessments as a core element of strategies for adapting to climate change.

## Minimising the adverse effects – Policies and information

How well the UK adapts to climate change depends on decisions made today  
– and CSL provides crucial evidence for effective policy making

CSL predictive models and risk assessments play a key role in supporting decisions about how to tackle the damaging effects of climate change. We work closely with Defra and other Government departments to provide the evidence and forecasts that underpin policy decisions. We also model the long-term effects of any strategies designed to minimise the impact of climate change.

It is accepted practice across Government to base policies on robust scientific evidence. And providing that evidence is CSL's strength.

Recent examples of where our data and knowledge have supported policy making include the agri-environment schemes, biomass and land usage, invasive species quarantine measures, and pesticide usage guidelines. In all cases, CSL specialists have contributed to the debate with impartial and robust information.

### Business decisions

But as we understand more about the impact of climate change, it is not only governments who have to take action. Businesses, too, have to play their part in reducing their carbon footprint through introduction of innovative processes. In order to make pragmatic business decisions, organisations need to understand the risks they face, and the impact of climate change on these risks.

CSL is developing tools to model life cycle analysis for biofuels, and helping companies consider the implications of using renewable fuels in their businesses. We already publish online forecasts of crops diseases which support decisions by farmers on pesticide spray programmes. Similar tools for pests are on the way. In times of unpredictable

weather – leading to atypical pest and disease situations – forecasts and risk assessments are vital to farmers and growers in order to maintain profitable production.

### Science with purpose

Above all, CSL's information is practical and our science has purpose. Examples of where our work is helping to adapt to climate change include:

- Development of novel pesticides to overcome the problem of pesticide resistance, which will increase in warmer climates
- Risk models for the safety of foods produced on land subject to river flooding
- Risk assessments for a wide variety of alien pests and diseases of crops, wildlife and humans
- Improving food safety through minimising risk of mycotoxins in cereal crops.

### Responding to emergencies

Climate change inevitably brings unforeseen events and consequences. CSL's long experience of responding to emergencies in the environment and food supply chains, and our broad skill set means we are well suited to this role.

Our technologies for detecting contaminants or disease organisms are rapid and can often be used at the site of any outbreaks. Because we understand the environment and food production, we make perceptive interpretations on which to base decisive actions. Climate change is likely to increase the frequency of unforeseen events but, as now, CSL will maintain constant readiness.

We model the spread and produce risk assessments for non-native species



## Facilities and capabilities

Our climate change specialists benefit from an extensive shared knowledge base and state-of-the-art scientific facilities

CSL has more than 500 multi-skilled scientists across the full range of environmental, plant health, animal health and food science disciplines. By drawing together our knowledge and expertise from across all areas, we provide unique insights into the effects of climate change on our environment and food supply chains.

### Multi-disciplinary studies

Our primary role of providing technical information and risk assessments on environmental quality and food safety to Government customers equips us very well to play a leading role in climate change research. Within our science teams we have detailed knowledge of agriculture and land use, ecology, chemical safety, plant and animal health, biodiversity and pest control, among others.

The broad and urgent challenges presented by climate change require expertise of many disciplines to be pooled effectively. Sharing knowledge and working collaboratively is part of the science culture at CSL – we always work in this way to deliver the quality of service our customers expect.

### Collaborative research

And we don't just rely on our own skills. Collaboration with leading climate research organisations in the UK and overseas gives us the opportunity to expand our programmes, and gives us access to the latest climate data on which to run our models. It is through being part of the international science community actively studying the impact of climate change that we can bring to our customers robust, well-founded risk assessments and scenario models.

Our work is supported by state-of-the-art facilities, including laboratories, quarantine standard glasshouses, controlled-environment chambers, diagnostic facilities, tissue banks, experimental silos, geographic information systems and high level statistical skills.

Climate change is a major challenge for us all. By using our science skills, we at CSL are developing the most advanced risk assessment and modelling tools and conducting research that, every day, improves our understanding of the changing climate and its impact on our finely balanced planet.

### Taking the debate forwards

Climate change effects us all. Addressing the challenges it presents requires the application of many skill sets of scientists, engineers, economists and sociologists. CSL, as a centre of expertise in environmental safety and food chain protection has a role to play.

By pooling our knowledge with that of other leading organisations, we can measure the changes, assess the risks, and help business and Government with decision making for management and adaptation.

If you would like to know more about CSL's unique approach to climate change, or to discuss how we may be able to help you meet specific challenges, please contact us via [climate.change@csl.gov.uk](mailto:climate.change@csl.gov.uk).

Through sharing knowledge we are improving techniques for assessing changes in the environment



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L0024/EBGO/0807