



Health Climate Change Impacts

Report Card 2015

This LWEC Report Card is aimed at those responsible for the health of communities across the UK and anyone else interested in how climate change may affect our health.

Climate change is likely to have a wide range of impacts on health – some harmful, others potentially beneficial. This card is designed to make it easier to understand the nature of possible change and to help inform decisions that will protect our wellbeing. Specifically, it looks at the effects of climate change on people's health in terms of physical and mental illness and disease, and on the resilience of the UK's health services. Many of these impacts are likely to result from changes in the frequency of extreme weather events such as floods and heatwaves.

Focusing on human health and health systems¹, the card synthesises findings from 10 detailed Technical Papers prepared by leading scientific experts and academics, and based on the best available science from peer-reviewed academic literature.

It complements the Report Card on Infrastructure, which assesses the impact of climate change on the built structures that provide services important for our safety, health and economic development. Previous publications also include the LWEC Biodiversity and Water Climate Change Impacts Report Cards and the Marine Report Card produced by the Marine Climate Change Impacts Partnership (MCCIP). Together, all of these publications help build a more extensive and comprehensive picture of existing and future changes resulting from climate change in the UK.

The report card covers the following topics:

- Health effects of heat and heatwaves
- Health effects of milder winters
- Flooding and health
- Impacts of extreme events on health services and social care
- Outdoor air quality
- Pollens and other allergens
- Food-borne disease and contamination
- Emerging infections

¹ According to the World Health Organization, "a health system is the sum total of all the organisations, institutions and resources whose primary purpose is to improve health".

The UK climate is changing

Since 1980, temperatures have increased by 0.8-1°C, with an increase in hot weather and a decrease in cold days. Although average rainfall does not show a strong trend, more rain is falling as heavy events.

Many people will experience climate change through extreme weather

Floods may increase due to increases in heavy rainfall and sea level rise. Some coastal populations will become more at risk of storm surge events. Apart from deaths due to drowning, the most significant health impact from flooding is on mental health, which can persist for many months due to household disruption and displacement.

Climate change will entail hotter summers and more heat waves

Deaths and illness due to very hot weather are likely to increase, and the growing number of older people means more of the population will become vulnerable to hot weather. However, the rate at which a population adapts to higher temperatures is not well understood.

Climate change will entail milder winters which will benefit health

Although declining, cold-related deaths and illness remain a large public health problem in the UK. Milder winters are likely to produce a relative reduction in cold-related deaths, but this may be counteracted by the increase in the number of older people.

Climate change may affect the risk of emerging infectious diseases

Climate change may facilitate the introduction of new diseases to the UK, in the context of other important factors that increase this risk (e.g. the movement of people and goods around the world). Native insect and tick species may become more capable of transmitting diseases that affect humans.

Climate change may affect the quality of the air we breathe

Air quality is currently poor in some urban areas of the UK. Future emissions of pollutants (some of which also cause climate change) are likely to be more significant than climate change itself in terms of affecting air quality over the next few decades. However, there may be an increase in the number of episodes where high levels of pollution are caused by particular weather patterns (e.g. heatwaves and 'stagnation' events).

Our health systems are affected by extreme weather, with adverse impacts felt by patients, staff and equipment

The delivery of health and social care is disrupted by extreme weather such as floods, storms, heatwaves and severe winters. Overheating in hospitals can be reduced by retrofitting and by good design.

Producing this Report Card

This Report Card is an initiative of the Living With Environmental Change (LWEC) Network. Bringing together UK public sector organisations that fund, carry out and use environmental research and observations, LWEC aims to make sure that decision-makers in government, business and society have the information, knowledge and tools they need to adapt to and, where possible, benefit from environmental change. The card was developed with funding from LWEC.

Both this high-level summary of key findings and the detailed Technical Papers underpinning it have been reviewed by independent experts to assure their quality. The overall process that has produced these outputs was steered by an expert panel drawn from academia and government agencies responsible for our health and the environment. The Technical Papers are available from the LWEC website.

A Climate Change Impacts Report Card on Infrastructure was developed in parallel with this card. It covers risks to transport and to water and energy supplies, all of which can have implications for human health.



Our climate is already changing. In some cases, these changes can be partly linked to the influence that human activities are having on the climate system. In others, we may be able to detect a trend but are not yet able to pinpoint the cause. It is particularly difficult to attribute the cause of changes at the scale of the UK as a whole, where the climate is naturally very variable and there are other influences on the climate system.

What has happened to date?

- Average temperatures have increased by 0.8-1°C since 1980, with an increase in hot weather, and a decrease in cold days. All ten of the warmest years for the UK have occurred since 1990. This includes 2014, which was the warmest year on record in the UK.
- It is extremely likely² that human activity has had an influence on recent global warming and there is evidence that human activity has also influenced UK warming.
- Human influence on the climate may have strongly affected the frequency of extremely hot European summers in the past 10-15 years. Although summers as warm as 2003 are still rare, they are now much more likely to occur.
- Annual average rainfall has not changed significantly since records began in 1766, but there has been some increase in the past few decades. It appears that winter rainfall has increased and that more is falling in heavy events in some regions. Summer rainfall has decreased though the trend is less clear.

- During the 20th century, sea level around the UK rose by an average of 1-2mm/year. Over the past decade, however, the global rate has increased to over 3mm/year. Peak sea levels during extreme weather events appear to be rising at a similar rate to that of the time-average sea level.
- Severe windstorms around the UK have become more frequent in the past few decades, although it is not clear whether this is part of a long-term trend.

What could happen in the future?

- **Temperature:** All areas of the UK are expected to warm, more so in summer than in winter. Changes in summer mean temperatures are expected to be greatest in parts of southern England and least in the Scottish islands. Winter nights are also expected to become milder.
- **Heatwaves:** The frequency and intensity of extreme heatwaves are both expected to increase over this century.

- **Rainfall:** Whilst annual average rainfall may not change much over the 21st century, regional and seasonal changes may occur. The west of the UK may see winter rainfall increase by up to a third by the end of the century, with small decreases over the Scottish Highlands. There will be an increased chance of summers having lower rainfall, particularly in southern England, but downpours may become heavier when they occur. Changes in summer rainfall over Scotland are not clear.
- **Sea level:** Sea levels will continue to rise and are likely to do so at a faster rate than we have observed in the last century. This will lead to higher peak sea levels during extreme events.
- **Solar radiation:** This may increase on average across the UK, with the greatest increase expected in southern England.
- **Humidity:** Relative humidity may decrease by 5 - 10% in summer with the greatest reductions in Southern England, and smaller reductions further north.

- **High winds:** Changes to atmospheric circulation may shift storm tracks north or south but changes in wind speeds are uncertain.
- **Stagnation events:** The impact of climate change on stagnation events and some of the factors that lead to stagnation, such as blocking, remains uncertain. However, we expect sizeable year-to-year variations to continue into the future.

How will the risk of flooding change in the future?

- River flooding is expected to increase in magnitude and frequency through the century and coastal flooding is expected to increase due to sea level rise, but the scale of these increases is unclear.
- Future flood risk is also determined by the construction and maintenance of flood defences, environmental management and the number of people that are living in flood risk zones.



Why are people concerned about health and climate change?

Many aspects of the weather affect our health. The most obvious are extremes of temperature (heatwaves and cold spells) and extremes of rainfall and wind (floods and storms). However, many diseases are also sensitive to climate factors and show a seasonal pattern. For example, climate factors affect the spread of diseases caused by pathogens transmitted by cold-blooded hosts (e.g. mosquitoes and ticks). These types of health impact can be affected by changes in local weather patterns resulting from changes in the global climate system caused by human activity. Most of our knowledge of future impacts is based on what we can observe now about the relationship between specific diseases and weather/climate factors.

Climate change also presents a risk to human health beyond these direct and more obvious impacts. The UK population is not isolated but linked to, and inter-dependent with, other environments around the world. It is very likely that climate change will be associated with longer-term changes that take place over decades in vulnerable regions of the globe, and our health and wellbeing will be at risk from such changes. For example, climate impacts in countries from which the UK imports food may have a knock-on effect on food prices here, exacerbating food poverty and influencing diet. Climate change overseas may also indirectly impact social factors that determine people's health by disrupting international relations and economic systems.

Source: *Morris et al.*

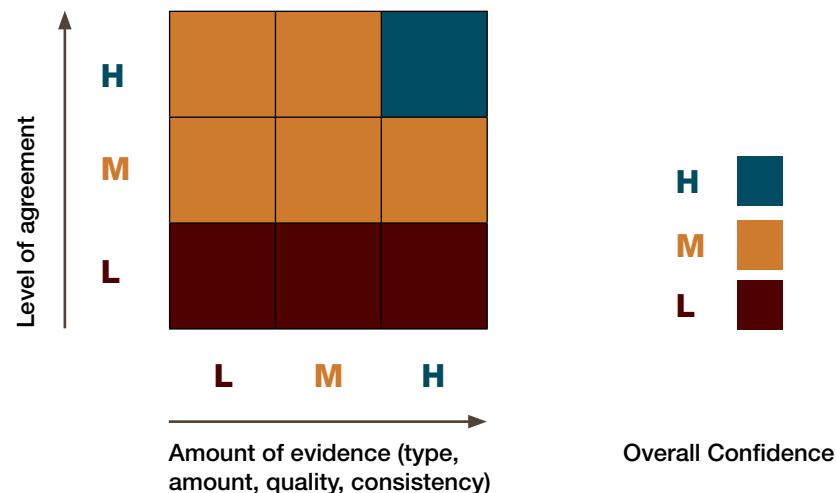


Confidence in this Report Card's assessments

This Report Card assesses scientific evidence regarding the relationships between climate factors and health issues, particularly in relation to extreme weather events. These assessments (see pages 8-15), which should be read in conjunction with 'Changes in the UK's Climate' (see pages 4-5), also consider the extent to which (i) climate change may affect health in the future and (ii) the health impacts of climate change can be avoided by public health and other measures.

In developing the card, a key objective was to be clear about the level of confidence in the various statements made about the impacts of climate change on health in the UK. A confidence level – high, medium or low – has therefore been attached to each statement. Assigned by scientific experts, this level reflects the degree of scientific agreement in each case as well as the amount of information available. For example, there would be a low confidence level in a conclusion drawn from a few studies that disagreed with each other or several poorly conducted studies that were in agreement, but high confidence in cases where many separate investigations reached the same conclusion.

The Report Card has simplified the assessments to provide an overall confidence level of high (H), medium (M) or low (L). Low confidence results are still based on evidence and still reflect expert judgment.



High Confidence ■H
Medium Confidence ■M
Low Confidence ■L

The health effects of hot weather and heatwaves

Arbuthnott and Hajat

The main findings of this Report Card are presented in the following pages. The first column highlights what we know about existing trends and sensitivities relevant to the relationship between the health of the UK population and climate. The second column summarises what may happen over the rest of the 21st century.

What do we know

The number of warm³ days in the UK has increased since the 1970s. ■H

Heatwaves in 1976 and 2003 were the most significant in terms of extreme temperature and the resulting impact on health. ■H

Heatwaves are sometimes associated with high pollution exposures. ■H

Days with hot weather and heatwaves (i.e. sustained episodes of very hot weather) increase the risk of deaths in some groups among the UK population. ■H

The elderly are most at risk of heat-related deaths, along with people who have a pre-existing chronic disease. ■H

During hot weather, there is a small increase in the use of health services (e.g. in emergency admissions for respiratory diseases and injuries). ■M

What may happen

The frequency and intensity of extreme heatwaves are both expected to increase over this century. ■H

Events like the 2003 heatwave will become much more common by the middle of the century, perhaps occurring every other summer on average from some emissions scenarios. ■H

Much uncertainty surrounds how quickly populations can adapt to a warmer climate, but the number of heat-related deaths is likely to increase due to climate change. ■M

The health burden of hot weather is likely to be amplified by the UK's ageing population. ■H

Health impacts are likely to be greatest in London ■H and to increase in southern, central and eastern England. ■M

Risk of injury or death may increase among some groups of workers (such as drivers and construction workers) due to occupational heat exposure. ■L

³ Warm days defined as the 90th centile of daily maximum temperature.

The health effects of milder winters

Hajat

What do we know

Cold-related deaths and illness are a large and mostly avoidable public health problem in the UK. ■H

Ambient temperature is the weather factor of most importance to health, and temperatures do not need to be particularly extreme before the risk of death and illness is heightened. ■H

The UK population has become less vulnerable to cold over recent decades. ■M

The elderly are most at risk of cold-related deaths, but there is no clear link between this risk and socio-economic factors. ■H

The greatest body of evidence on interventions to reduce cold-related risks relates to home energy efficiency measures, which are likely to result in health benefits for some population groups. ■M

Emergency hospital admissions for falls (associated with snow and ice) and ambulance response times both increase during harsh winters. ■M

What may happen

Winter temperatures are likely to become milder. ■H

Cold, snow and ice-related disruptions are likely to decrease, although severe cold spells will still occur. ■M

Climate change leading to milder winters is likely to result in reduced exposure to cold in future and a relative reduction in cold-related deaths, although factors such as population ageing may counter this to some extent. ■M

Even if cold spells become more common in future due to increased climate variability, there is little evidence that sustained periods of low temperatures are associated with additional risk of death compared to individual cold days. ■M



The health effects of flooding

Milojevic

What do we know

Recent major flood events include the 2007 floods and the winter storms of 2013/14. Coastal defences have been breached on a number of occasions since 1953, including winter 2013/14. ■H

Flooding has a range of effects on human health including deaths from drowning, injuries and mental health impacts. Flooding has also been associated with cases of carbon monoxide poisoning in the post-flood clean-up phase. ■M

Flood events generally have a small effect on the spread of infectious disease. ■M

Floods increase the rates of self-reported depression/anxiety ■M and post-traumatic stress disorder (PTSD) ■L in affected populations. Flooding will also exacerbate illness in people with pre-existing depression. ■M

People who have been flooded report a range of health concerns, often made worse by difficulties occurring after the floods, such as being displaced from home or problems with insurance. ■M

Many households are displaced from their homes for months after a flood. ■M In Hull, 59% of flooded households were displaced after the 2007 floods and more than 10% remained out of their homes for more than a year.

What may happen

There is expected to be an increased likelihood of high sea level conditions resulting in coastal flooding and disruption of infrastructure. ■H

There is likely to be increased frequency of high river flows and therefore increased likelihood of flooding of dwellings in river floodplains. ■M

The overall increase in flood risk will be substantially higher if new development occurs in coastal or river floodplains at the same rate as elsewhere (based on projected population growth and the requirement to increase the number of homes). ■H

Any increase in future flood events is likely to have adverse consequences for human health and wellbeing ■M although there is considerable uncertainty about the implementation of future flood prevention measures.



Impacts on the UK health and social care system

Curtis *et al.*

What do we know

Heatwaves impact the functionality of buildings used to deliver health care and have adverse effects on staff, patients and equipment. ■M

Risk of death from heatwaves is relatively higher in nursing and care homes compared to the general population. ■M

Flood events can interrupt health services and may also disrupt other essential infrastructure on which health services depend. ■M

Past floods have damaged health system buildings (e.g. GP clinics, hospitals, blood transfusion centre). ■M

Flood events interrupt access to health services for affected populations. ■M

Cold, snow and ice make it difficult for patients and staff to access health facilities and for care staff to get to people's homes. Ambulance response times are longer during the very cold weather. ■M

Low-energy and relatively low-cost options are available to adapt existing hospitals and design new buildings for improved thermal comfort and operational resilience during heatwaves. ■M

The health system has updated surveillance and monitoring systems to improve responses to extreme weather. ■H

What may happen

Future extreme weather (heatwaves, floods and possibly storms) has the potential to damage health system infrastructure, affecting delivery of health services. ■M

Cold, snow and ice-related disruptions are likely to decrease, although severe cold spells will still occur. ■M

Future heatwaves are likely to disrupt health care at hospitals unless adaptive measures are taken. ■M

Impacts of future heatwaves may be exacerbated by changes in social protection measures and the level of social care that elderly or vulnerable individuals receive. ■M

A proportion of health system infrastructure is sited in flood risk areas and vulnerable to an increased risk of flooding. ■M



Climate change effects on outdoor air quality

Doherty *et al.*

What do we know

Some air pollutants are also climate pollutants. Short-lived climate pollutants include black carbon (a component of particulate matter, or PM), methane and ground-level ozone, which are the most important contributors to climate change after carbon dioxide (CO₂). ■H

Air pollution, particularly PM and ground-level ozone, has adverse impacts on health. ■H

Local air pollution levels are determined by weather, by emissions from transport, industry and agriculture (some from neighbouring countries), and by how well emissions are regulated. ■H

Extreme air pollution episodes are associated with stagnation events and, sometimes, heatwaves (e.g. August 2003). ■H

Governments have implemented control measures to reduce emissions, resulting in declining trends in many pollutants. ■H

Due to the complexities of the processes linking emissions and air quality, it is not straightforward to make connections between, on the one hand, emissions control, and, on the other, the impact that weather and climate has had on UK air quality and on health improvements in recent years. ■M

What may happen

Climate change will have complex regional and local effects on the chemistry, emission, movement and deposition of air pollutants. ■H

In the next few decades, the impact of changes in the emissions of pollutants on air quality is likely to outweigh the impact of physical climate change. ■M

Higher temperatures may trigger regional feedbacks during stagnation events that will increase peak ground-level ozone. ■M

The impact of climate change on the frequency of stagnation events in the UK is uncertain. ■L

Average ozone levels over Europe are expected to decrease generally in future in conjunction with lower emissions of ozone precursors, except in a future scenario where high methane emissions offset this decrease. ■H

Higher temperatures increase natural emissions of volatile organic compounds (VOCs), which are pollutant precursors. ■H

In polluted areas with high levels of nitrogen oxides, warming is likely to enhance ozone levels. ■M

Climate change, pollen and allergic diseases

Osborne and Eggen

What do we know

Acute exposure to allergenic pollen is associated with a range of health effects, such as hay fever, eczema and asthma episodes in susceptible individuals. ■H

Individuals vary in their susceptibility to different pollens. ■H

The timing of pollen release – ‘the pollen season’ – varies depending on plant species and environmental conditions. In the UK, the season is typically between late March and mid-May for tree pollen, between mid-May and July for grass pollen, and between the end of June and September for weed pollen. ■H

Timing, abundance and distribution of pollen release are affected by vegetation cover and environmental conditions, including climate. ■H

Across Europe in recent decades, the pollen season for some species has started earlier, consistent with the climate warming that has been observed and the earlier onset of spring. For example, between 1970 and 1999, the onset of the birch pollen season in London has occurred earlier by 4 days per 10 years. ■H

Increases in hospital admissions due to respiratory conditions have been associated with thunderstorms and high pollen episodes at the time (‘thunderstorm asthma’). ■M

What may happen

Climate change will have complex and local effects on production (i.e. timing and abundance), movement and deposition of pollen. ■H

Climate warming and increases in atmospheric CO₂ concentrations may increase plant productivity and lead to greater pollen release, assuming other factors such as water availability do not limit this. ■M

Changes in climate may influence the capacity of some species of pollen to cause allergic reactions. ■L

The impact of climate change on the length of the pollen season and on the total burden of pollen-related ill-health is very uncertain. ■L

Climate change may increase the frequency of thunderstorms in the next few decades, although this is very uncertain. ■L



Food-borne disease and contamination

Lake

What do we know

Food-borne disease can have both infectious causes (e.g. bacteria) and non-infectious causes (e.g. pesticide residues).

Higher temperatures increase the number of cases of Salmonella infection ■H but overall the incidence is declining in the UK due to improvements in food hygiene. ■H

Food-borne illness caused by Campylobacter is an important and increasing public health issue. Environmental and weather factors play a role in transmission. ■M

For both Salmonella and Campylobacter infections, the burden of illness is greatest in older adults and young children. ■H

Vibrio bacteria occur naturally in estuary and marine waters, with some types causing illness in humans. There is some evidence that cases of food poisoning from this source in Northern Europe are associated with high sea-surface temperatures. ■L

Food safety is highly controlled at the national UK and the European Union level. ■H

What may happen

There are a large number of pathways through which climate change may affect food-borne disease and contamination. Only a few of these have been investigated to date. ■M

Higher temperatures are unlikely to have a significant effect on the future incidence of food poisoning cases due to Salmonella because the incidence of this disease is declining. ■H

Uncertainty regarding the mechanisms by which environmental and weather factors affect transmission of Campylobacter makes it difficult to make any assessment regarding climate change impacts in this regard.

Rising sea temperatures may increase the risk of infections from marine pathogens (e.g. Vibrio bacteria) in temperate regions, but the public health consequences for the UK are unclear. ■L



Emerging infections

Baylis

What do we know

An emerging infection is defined as a disease that has newly appeared in a population or has been known for some time but is rapidly increasing in incidence.

Several vector-borne diseases (i.e. diseases spread by insects and ticks) have emerged in Europe in recent years. These include vivax malaria, West Nile fever, dengue fever, Chikungunya fever, leishmaniasis, Lyme disease and tick-borne encephalitis. The vectors of these diseases are mosquitoes, sand flies and ticks. ■H

The emergence of diseases in the UK is linked to increased transport of people and goods, as well as land-use change. The role of warming is unclear. ■M

Climate factors affect diseases caused by disease-spreading microbes that spend a part of their lifecycle outside of the human host in a cold-blooded vector (e.g. a mosquito or tick). ■H

Climate affects three major aspects of disease occurrence:

- where disease occurs
- when disease occurs within the year
- the incidence of disease. ■H

The most important vector-borne disease currently established in the UK is Lyme disease (also called Lyme borreliosis), which is transmitted by ticks. It is present throughout the UK.

The UK has endemic mosquito species capable of transmitting malaria and probably other diseases. ■H

What may happen

Higher temperatures will increase the suitability of the UK's climate for invasive species (i.e. species from outside the UK) and increase the risk that they may spread disease. ■H

The UK already harbours mosquito species believed to be able to transmit West Nile virus. Higher temperatures will increase their ability to spread the virus, should it be introduced. ■H

The risk of transmission of dengue fever and Chikungunya viruses depends on the risk of invasion by relevant types of mosquito, which is expected to remain low in the near term. ■M

The threat of malaria transmission will remain low. ■H

The incidence of Lyme disease may continue to increase and climate warming may enable it to spread to higher altitudes. ■M



Potential future health effects by season due to climate change



Spring

- Earlier onset of grass pollen season
- Increased pollen abundance

Summer

- Increased abundance of insects, including pests
- Longer season in which insects are active
- More heatwaves
- More air pollution episodes



Autumn

- Extended season of biting insects and ticks
- Extended transmission season for Lyme disease



Winter

- Milder winters
- Less disruption to health systems from snow and cold spells
- More air pollution episodes



Summary by region

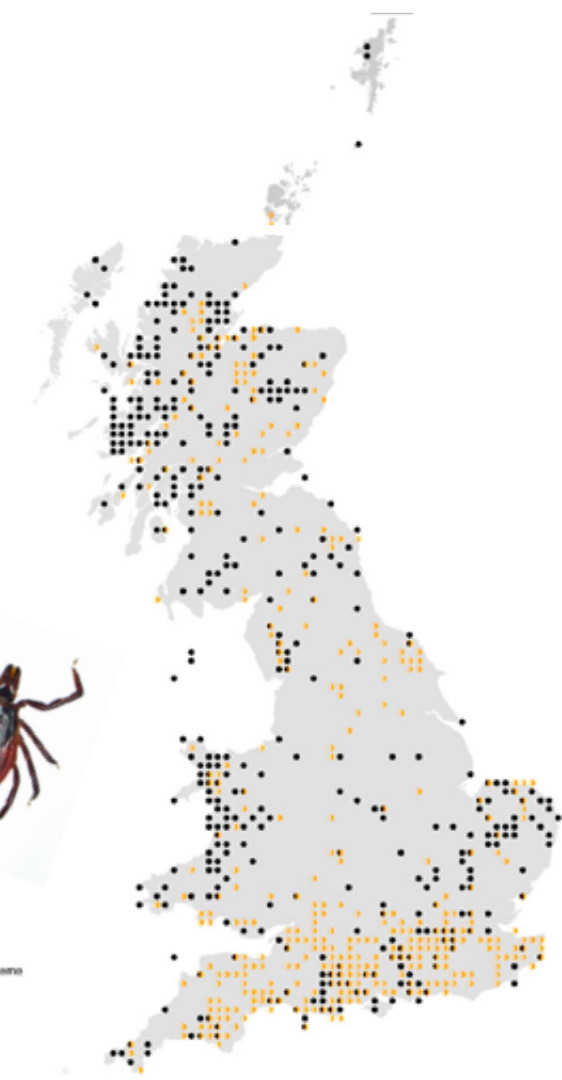
Tick distribution

*This map shows the distribution of the tick *Ixodes ricinus* in Great Britain. Tick distribution is mapped using the Public Health England (PHE) National Tick Recording Scheme which dates from 2005 to present and the Biological Records Centre tick distribution data which dates from early 1890s to 2001. These datasets are drawn at 10km resolution. Each point on the map represents a location at which *Ixodes ricinus* has been collected. Areas with no records do not necessarily represent areas of absence of the tick, but simply that no records have been received for that location. © Crown Copyright and database rights 2013.*



Ixodes ricinus

- PHE Tick Recording Scheme
- BRC Tick Distributions

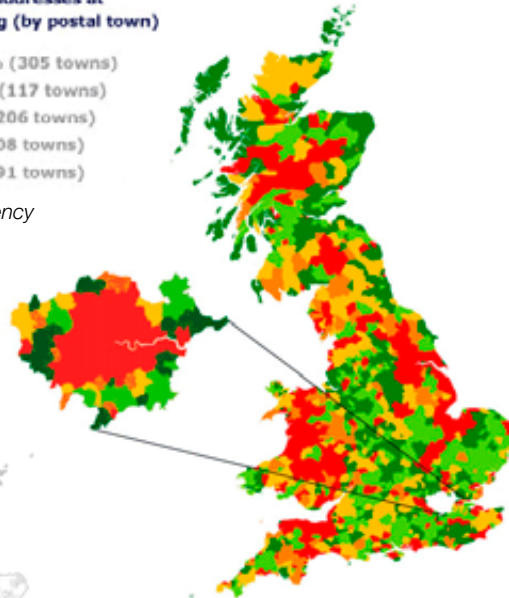


Around 5 million people live in flood risk areas in England and Wales

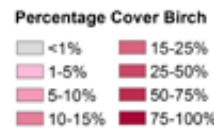
Percentage of residential addresses at potential risk from flooding (by postal town)



Source: Environment Agency

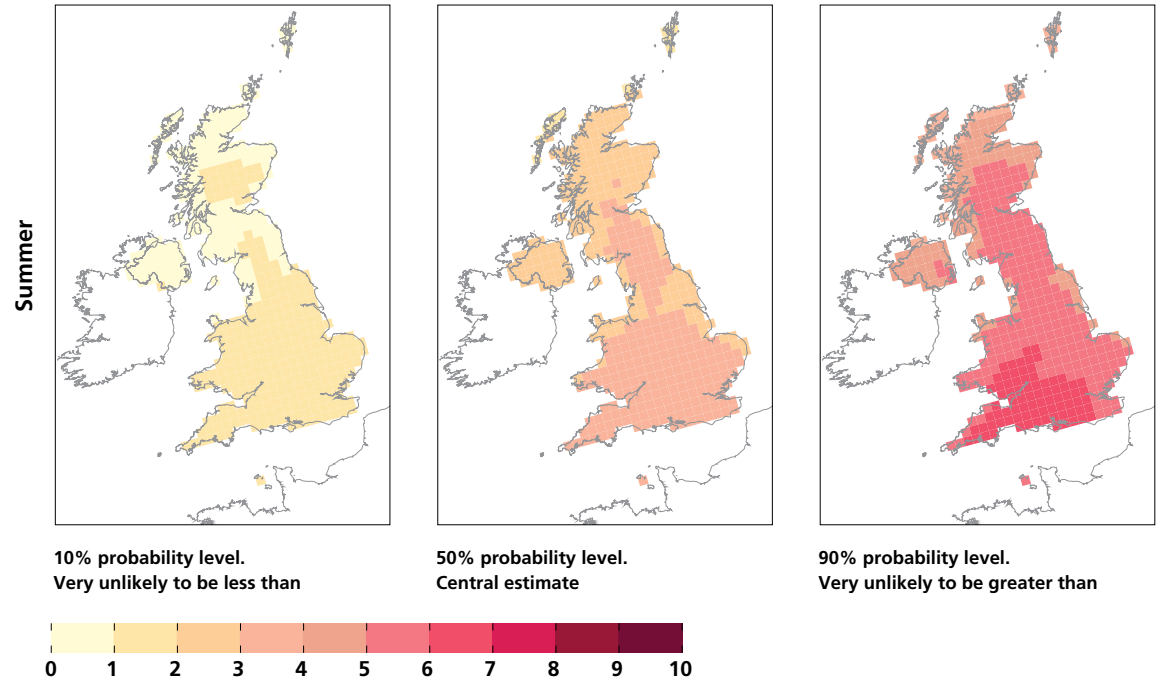


Pollen distribution



Contains or is based on, information supplied by the Forestry Commission. Produced by the Met Office © Crown Copyright, 2015.

Future temperature change in the Summer in the UK on a medium emissions scenario by the 2050s



Change in maximum temperature (Degrees Celsius) Source: UK Climate Change Projections 2009



Who will be affected by climate change?

- Climate change is likely to have different health impacts among different groups of people. This is due to differences in their exposure, their sensitivity and also their capacity to respond to events (i.e. their resilience) or adapt in the longer term. Currently, the UK population has generally good health due to the infrastructure in place, public health measures, environmental regulation and the National Health Service, but those health benefits are not evenly distributed throughout the population.
- Old age, pre-existing medical conditions and social deprivation are key attributes that make people more at risk of health effects from extreme weather and other climate-related impacts. Climate change will also have different effects across the different regions of the UK.
- The future health impacts of climate change will occur over a period of time when changes are going to take place in the age structure of the population, in public spending and in public service delivery. For example, the number of people aged over 60 is projected to increase by 50% by 2035, compared to 2010. Climate change, an ageing population and changing public expenditure on health and social care may alter the inequality of health outcomes relating to climate variability and extreme weather events.
- Health education and measures to improve public preparedness that explicitly take into account differences in exposure, in sensitivity and in the capacity of different groups of people to adapt to change can help to address health and social inequalities. A range of adaptation strategies to reduce the health effect of climate change are being developed however, some adaptation strategies may exacerbate health and social inequalities due to their selective uptake.

Source: Paavola



This Report Card is a summary of ten Technical Papers that were specifically commissioned to support this card. Each paper covers a separate topic and has been peer reviewed by relevant experts. The Technical Papers can be accessed from the links below.

Technical Papers

1. Hotter summers and heatwaves: Katherine Arbutnott and Shakoor Hajat, London School of Hygiene and Tropical Medicine.
2. Health effects of milder winters: Shakoor Hajat, London School of Hygiene and Tropical Medicine.
3. Climate change impacts on human health through its effect on air quality: Ruth Doherty, Mat Heal, University of Edinburgh; Fiona O'Connor, Met Office.
4. Pollen and human health. Impacts of anthropogenic climate change: Nicholas Osborne, University of Exeter; Bernd Eggen, Public Health England.
5. Food-borne disease and climate change: Iain Lake, University of East Anglia.
6. Impact of extreme weather events and climate change for health and social care systems: Sarah Curtis, University of Durham; Alistair Fair, University of Cambridge; Jonathan Wistow, University of Durham; Dimitri Val, Heriot-Watt University; Katie Oven, University of Durham.
7. Potential impact of climate change on emerging infections in the UK: Matthew Baylis, University of Liverpool.
8. Flooding and health: Ai Milojevic, London School of Hygiene and Tropical Medicine.
9. Health impacts of climate change. The implications of health and social inequalities: Jouni Paavola, University of Leeds.
10. Climate change and health in the UK. Scoping and communicating the longer-term "distal" dimensions: George Morris, University of Exeter; Stefan Reis, NERC Centre for Ecology & Hydrology; Sheila Beck, NHS Scotland; Lora Fleming, University of Exeter; Neil Adger, University of Exeter; Tim Benton, University of Leeds; Mike Depledge, University of Exeter.

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