Climate Change in the UK: Impact on Environment and Health

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Evidence that the climate is changing

The global climate has always been subject to change. Antarctic ice cores reveal cyclic fluctuations in temperature over thousands of years and indicate that another ice age is 'due' in about 10 000 years. In the northern hemisphere, observations and recordings show a dramatic increase in temperature over the last 100 years, reflected, for example, by the extension of the growing season in the UK and changes in the timing of natural events. This temperature increase has been attributed to an increase in CO_2 in the atmosphere, mainly due to human activities such as the burning of fossil fuels.

How will the UK climate change?

Climate models, such as those from the Hadley Centre, have been used to predict changes in the UK climate over different periods of time, and with varying emissions and economic development scenarios. For a medium/high emissions scenario it is predicted that increased levels of CO_2 in the atmosphere will result in a rise of 2°–5°C in global temperature by the 2080s. For the UK, this will mean that winters will be milder and wetter, with less snow, but stormier and windier. Summers will be hotter and drier and the sea level will rise. In addition, an increase in ambient UV levels is predicted because of stratospheric cooling and decreased summer cloud cover.

Impacts on the environment

Increased coastal flooding, resulting from rises in sea level, and river flooding and flash floods, because of increased rainfall, can be expected. Droughts will threaten the water supply.

Climate change, together with economic factors such as changing world markets and agricultural practices, will result in altered land use and landscape, with consequent visual impact.

Climatically sensitive areas, such as montane regions, chalk rivers and beech woodland, have been identified. The phenology, distribution and population size of species will be affected, differently for different species, with consequent implications for conservation.

Impacts on health

Important lessons can be learnt from previous examples of flooding, such as the East Coast floods of 1953. The immediate effects of flooding are injuries. Search and rescue may be hampered by obstructions and hours spent in cold water may result in hypothermia. In the early days and weeks after the event, flooding may result in respiratory infections and skin

infections. In subsequent months and years, psychological problems such as anxiety, and social and relationship problems are expected to predominate.

Storms can cause physical damage, injury or accidental death, for example by trees falling on vehicles or chimneys falling from damaged buildings. The time of day at which storms occur has a major effect on the outcome.

Higher temperatures may have a direct effect on disease organisms or their vectors, increasing their survival and growth. New strains of infectious agents might emerge as a result of climate change. Population growth and urban living, with its dependence on services, could increase the transmission rate of infectious diseases and make coping with epidemics more difficult. These effects of climate change are compounded by the increase in global travel. Changed behaviours, for example increased use of air conditioning or swimming pools, may increase the risk of contracting infections such as legionella or cryptosporidiosis. Higher ambient temperatures will make storing and transporting food safely more difficult and food poisoning more likely.

Heatwaves can increase heart attacks and respiratory disease. Warmer, drier summers will encourage changes in behaviour that lead to increased exposure to sunlight and UV with resultant health risks, such as skin cancer, cataracts or possible immune effects.

Although the world has extreme climates, over the centuries different groups of people have learnt to live with these and adapt to them. However, if global climate change is rapid, cultures and society may not be able to adapt quickly enough.

Adapting to climate change

The likelihood of climate change means that planning horizons must be extended, for example for irrigation projects, and expectations of the design life of structures such as bridges may have to be modified. Adaptation requires a sufficient lead time, for instance to replace the stock of obsolete houses. Hospitals in the UK are not designed to provide a good environment for a highly vulnerable population while minimising energy use. In Southern Europe, buildings are designed to deal with sun and hot weather, and comfort can be achieved without air conditioning. Preparedness for climate change will involve land use planning, assessment of risk and cost–benefit analysis, and coordination of a range of sectors, such as housing and agriculture.

Long-term preparations for flooding must include the improvement of warning systems, and new approaches to development control and land use planning. Risk mapping of areas most at risk of flooding and assessment of the safety of sea defences are important. For individual communities, awareness of risk must be raised before the event, emergency plans prepared, advice and information made available, flood warnings given and practical help, such as sandbags, made available. During flooding, emergency practical help must be provided together with accurate information. Afterwards, help with cleaning will be needed, and also advice, child care and counselling. There may be a need for temporary housing.

Conservationists have to consider their responses to the effects of climate change on habitats and wildlife. Should attempts be made to preserve existing habitats (such as that characterised by the Snowdon lily), adopt a dynamic solution that works with the direction of change (perhaps protecting areas further north so that species can move there) or take a laissez-faire approach, with local solutions? These responses might involve maintaining the integrity of existing sites, creating new sites, or helping species to spread.

The Meteorological Office has developed statistical models to predict the workload associated with demands on the health service, for example emergency admissions to hospitals, for specific weather patterns. The nine-day forecasts predict trends, not details. The aim is to be sufficiently accurate for the purpose, with the data delivered to the right person at the right time in a format that aids decision-making. Measurable benefits have been found, for example a saving of £400 000 was achieved by one hospital as a result of one forecast. Experience of responding to short-term forecasts might better equip the UK to respond to longer term climate change.

At the individual and family level, lessons can be learnt from extreme heatwave events such as that which occurred in Chicago, for example the need to watch out for neighbours. Health warning systems (such as that in Toronto), public warnings and education all play a part. Setting up a web site may not be enough, especially for the elderly, and a community response is needed, such as the US 'Buddy' system for looking after vulnerable people in an area. Age Concern has set up an equivalent system in the UK.

Mitigating climate change

The control of ozone depletion is an example of successful management at the global level. However, depletion of the ozone layer was a clear-cut scientific case for which solutions were available. Importantly it was not a challenge to the economic interests of developed countries. Climate change is a more difficult problem, being gradual and complex with much scientific uncertainty and no simple solution. In addition to the uncertainty resulting from incomplete scientific knowledge, there is added the problem of predicting behaviour and its consequences, for example choosing values and lifestyle, and balancing the needs of the developed versus the developing world (for example the Kyoto agreement).

Multidisciplinary efforts will be needed to understand the effects of climate change on environment and health. Control of the physical environment will require scientific evidence, environmental control technologies and strategies, education, and legal, administrative and fiscal mechanisms to provide a 'protective envelope'. The task is to understand what should be done now to ensure the efficacy of this envelope in the future. Climate change management will require input from all interested groups, and include investigation of the linkages between fuel, health and pollution. If climate is to be stabilised by, for example, control of emissions, then decisions must be made about what targets to aim for in negotiations, taking into account equity for the developing world and for future generations. Systems will have to be resilient as the outcome may not be what is expected, for instance climate change may be well beyond the predicted range. The question of who is to apply any necessary controls needs to be addressed, bearing in mind technological latency.

In developed economies, 50% of energy is used in buildings (domestic being the largest sector), 25% in transport and 25% in industry. There is thus a need for energy efficiency in buildings while achieving affordable heating and/or reduction in thermal stress (high temperatures). With climate change, air conditioning may become more widespread, hence alternative cooling methods will have to be found if fossil fuel use is to be reduced. Socioeconomic factors play a part in energy availability and use, for example 'fuel/cooking poverty' and damp housing putting vulnerable groups at risk of heat stress or cold. Requirements might be placed on energy providers to achieve better energy efficiency. Research and development into nuclear power and renewable systems might provide solutions that will reduce fossil fuel use.

The choice of global economic policy, for example regional enterprise or local stewardship, will have a major effect on the extent of climate change. Ways need to be found to decouple economic growth from emissions and achieve sustainable development. Predictions have to consider different pathways, for example choice of crops, (cereals, biofuels), changing use of

agrochemicals, new technologies or land going out of use. Certain management choices may result in use of the same amount of agricultural land but with lower yields. Climate change will impinge on changes that may already be occurring. An holistic view of world trade is required that considers whether it is appropriate to ship foodstuffs across the world or to introduce trade barriers with their concomitant effects on developing countries.

Health effects occur downstream of a host of environmental and social changes, hence there may be a lag in response to climate change. Good health surveillance is crucial in detecting the links between health and climate change. Hence, augmentation of surveillance systems and the linkage of health data for whole populations and vulnerable groups with climate data must be a priority. Surveillance must ask the right questions; there may be other explanations for health changes.

Observed changes in coastal habitats, woodlands or gardens may make people aware of climate change and the implications of their actions. Individuals need to be convinced that changing their attitudes and lifestyle (for example forgoing air conditioning) in order to avoid adverse climate change effects would be worthwhile. People's perception of risk varies and they may be prepared to take risks to attain a certain lifestyle. Climate change can have both negative and positive effects, for example new lifestyle possibilities, a reduction in winter mortality or an increase in vector-borne diseases, loss of a species or interruption to public services. Perhaps the possibility of an increase in something undesirable, for example rats, rather than a decrease in 'nice' species might have a greater influence on behaviour. Unfortunately, mismanaged crises may reduce the readiness of the public to heed governmental advice.

Consumers are important drivers of change. For consumer pressure to work, consumers need to believe that climate change will have a negative impact. Actions that consumers might take include asking how far food products have been transported, choosing products originating from renewable resources (for example wood source of charcoal) and recycling. To achieve this providers must offer a choice, label goods informatively and be demand-responsive.

Attempts are being made to consider the social cost of carbon, that is how to value things explicitly from a policy perspective. This can be expressed as a percentage of GDP or the cost of controlling CO_2 per tonne. The EU uses a value of £14 per tonne; in UK policy analysis, £20 is used. This enables account to be taken of the full cost of a product or process. Tensions and interactions will occur between actions taken against the causes of climate change and adaptation to this. Systems are needed that are resilient to change and mechanisms must be put in place to accommodate the different views of stakeholders.

Society must decide what it wants and what policies are appropriate to achieve this. Climate change is an important research and development as well as a challenging policy issue for the UK Government that requires a truly global perspective.

Acknowledgements

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Chairman: Professor M. Hulme	Welcome
Mr Darren Bett BBC Weather Centre	The importance of climate change in the UK
Professor M. Hulme Tyndall Centre HQ and School of Environmental Sciences, UEA	Climate change science and policy: Historical and future perspectives

Environmental effects of climate change and impacts on quality of life

Dr T. Sparks Centre for Ecology and Hydrology	Climate impacts on UK phenology
Dr J Hossell ADAS	Climate change and biodiversity: Future conservation policy and management options
Professor M. Parry Chair, IPCC Working Group II	Changing landscape and practices
Discussion	*Impacts of environmental climate change on quality of life*

Impacts of climate change on health and well-being

Chairman: Professor A. Haines	
Professor G. Bentham Centre for Environmental Risk, UEA	Climate change, ozone depletion and the health effects of sunlight exposure
Dr R. Stanwell Smith Ex-Public Health Laboratory	Pathogen related diseases
Dr P. Baxter Dept of Public Health and Primary Care, University of Cambridge	Acute health effects of extreme weather events
Dr S. Tapsell Flood Hazard Research Centre, Middlesex University	Considered ill or ill considered? The chronic health effects of flooding in the UK
Discussion *Open forum with panel discussion*	*Impacts on health and well-being* *Behavioural and social impacts, adaptation and stakeholder involvement*

Panel speakers:
Professor A. Haines, London School of Hygiene and Tropical Medicine
Professor D. Loveday, Dept of Civil and Building Engineering, Loughborough University
Professor G. Morris, Scottish Centre for Infection and Environmental Health
Dr C. Neary, Welsh Consumer Council
Professor J. Skea, Policy Study Institute, University of Westminster
Mr G. Turner, Enviros
Dr C. West, UK Climate Impacts Programme

Secretariat: Miriam Turner (Seminar Co-ordinator), Pauline Francis (Seminar Administrator), Linda Shuker and Paul Harrison

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