

United Kingdom

Climate change impacts on water systems

Observed changes and trends	<ul style="list-style-type: none"> • Temperature has risen in Central England by about 1 °C since the 1970s, with 2006 the warmest year on record. • Annual mean precipitation over England and Wales has not changed significantly since records began in 1766. Scotland is on average 20% wetter than it was in 1961. • Seasonal rainfall is highly variable but appears to have decreased in summer and increased in winter. • All regions of the UK have experienced more winter rainfall from heavy precipitation events. In summer, all regions except Northeast England and Northern Scotland show decrease in rainfall. 				
Projected impacts	<ul style="list-style-type: none"> • Average annual temperatures may rise by 2 °C to 3.5 °C by the 2080s. • Annual average precipitation across the country might decrease slightly, by 0% to 15% by the 2080s. However, the seasonal distribution of precipitation will change significantly. In winter, increases in precipitation projected in the range of 10% to 30 % over the majority of the country, while a reduction in precipitation is expected in summer. • Summers will continue to become hotter and drier. By 2040, average summer temperature for the UK is expected to rise by 0.5 °C to 2.0 °C, depending on the region. The largest reductions in summer precipitation (of 40 %) are expected in the far South of England. • Milder and wetter winters. By 2030, increases in precipitation of up to 30% in the winter months. • Lower water levels in rivers and lakes would reduce their capacity to dilute pollutants and worsen water quality. • Significant decrease in the amount of snowfall throughout the UK with projected decreases in winter mean snowfall of 65% to 80% over mountain areas and 80% to 95% elsewhere. • Large reductions in summer flows coupled with increasing demand could have significant consequences for water supply. • Increase in the prevalence of extreme weather events. More frequent periods of heavy rainfall leading to increased flooding, especially in winter. • Shifts in water availability and water temperature may have implications for habitats and species and therefore ecosystem services. An increase in certain invasive non-native species may affect water quality and water industry assets. 				
Primary concerns	Water quantity	Water quality	Water supply and sanitation	Extreme weather events	Ecosystems
	✓		✓ (particularly in the South and East)	✓ (floods)	
Key vulnerabilities	<ul style="list-style-type: none"> • Maintaining water supplies during summer droughts particularly in Southeast England. • Flood risk is projected to increase significantly across the UK.¹ 				

1. Annual damage to UK properties due to flooding from rivers and the sea currently totals around GBP 1.3 billion. For England and Wales alone, the figure is projected to rise to between GBP 2.1 billion and GBP 12 billion by the 2080s, based on future population growth and if no adaptive action is taken.

Sources: Department of Energy and Climate Change (2009), *The UK's Fifth National Communication under UNFCCC*, http://unfccc.int/national_reports/annex_i_natcom/submitted_natcom/items/4903.php (accessed 20 June 2012); Department for Environment Food and Rural Affairs (DEFRA) (2012), *Summary of the Key Findings from the UK Climate Change Risk Assessment 2012*, DEFRA, London, UK, www.defra.gov.uk/sac/files/SAC1215-CCRA-Paper-Annex-1-Key-Findings.pdf (accessed 10 November 2012); DEFRA (2011), *Water for Life: Market Reform Proposals*, DEFRA, London, UK, www.gov.uk/government/publications/water-for-life-market-reform-proposals (accessed 20 August 2012); Jenkins, G.J. et al. (2009), *UK Climate Projections: Briefing Report*, Met Office Hadley Centre, Exeter, UK; Jenkins, G.J., M.C. Perry and M.J. Prior (2008), *The Climate of the United Kingdom and Recent Trends*, Met Office Hadley Centre, Exeter, UK; Rance, J. et al. (2012), *Climate Change Risk Assessment for Water Sector*, DEFRA, London, UK.

Key policy documents

Document	Reference to water?	Type	Year	Responsible institution
Climate Change Act ¹		Legal act	2008	Department for Environment Food and Rural Affairs (DEFRA)
Adapting to Climate Change: A Framework for Action	Y	National adaptation strategy	2008	DEFRA
		National adaptation plan	Under development	
Departmental Adaptation Plans		Adaptation plans	2010	Government Departments
England (and UK reserved matters) National Adaptation Programme	Y	National adaptation programme	Planned for 2013	DEFRA
Future Water	Y	National water strategy	2008	DEFRA
Water for Life	Y	Water white paper	2011	DEFRA
UK Climate Change Risk Assessment (UKCCRA)	Y	National risk assessment	2012	DEFRA
Regional Climate Change Partnership (Climate UK)	Y	Sub-national responses		Regional agencies, UK Climate Impacts Programme (UKCIP), and DEFRA

1. The Climate Change Act 2008 gained Royal Assent on 26 November 2008. It made the UK the first country in the world to have a statutory framework for adapting to climate change.

Policy instruments

Areas	Policy mix	Regulatory instruments	Economic instruments	Information and other instruments
Water quantity		<ul style="list-style-type: none"> Statutory requirement adopted in 2007 obliging water companies to prepare and maintain water resources management plans that look ahead 25 years. The requirement aims to secure a long-term sustainable supply and demand balance for the supply of water. 	<ul style="list-style-type: none"> Promote greater trading of abstraction licences and bulk supplies of water to make supply system more flexible (planned). 	<ul style="list-style-type: none"> The Adapting to Climate Change (ACC) Programme: Ensures that policies on both adaptation and mitigation are joined up and complementary,¹ www.ukcip.org.uk/government/central-government/acc. UK Climate Impacts Programme (UKCIP): At the boundary of science, policy and practice, UKCIP co-ordinates and influences research into adaptation to climate change, and encourages organisation to use tools and information to help them consider their climate risks and how to adapt, www.ukcip.org.uk. Green Book Supplementary Guidance on "Accounting for the Effects of Climate Change" produced for the Treasury's Green Book, which sets out the economic guidance used by government to assess spending, investment and policy decisions, http://archive.defra.gov.uk/environment/climate/documents/adaptation-guidance.pdf.
Water quality				
Water supply and sanitation		<ul style="list-style-type: none"> Reporting Power: The Climate Change Act 2008 introduced a new power for the Secretary of State to direct "reporting authorities" (companies with functions of a public nature, such as water utilities) to prepare reports on how they are adapting to climate change. The Government has developed statutory guidance setting out the process that organisations need to go through to assess risks from climate change and draw up adaptation plans, http://archive.defra.gov.uk/environment/climate/documents/interim2/report-guidance.pdf. 		

Policy instruments (cont.)

Areas	Policy mix	Regulatory instruments	Economic instruments	Information and other instruments
Extreme weather events		<ul style="list-style-type: none"> • Flood and Water Management Act (2010): Implements Sir Michael Pitt's recommendations requiring urgent legislation, following his review of the 2007 floods. It provides for better, more comprehensive management of flood risk for people, homes, and businesses, helps safeguard community groups from unaffordable rises in surface water drainage charges and protects water supplies to the consumer, www.defra.gov.uk/environment/flooding/legislation. • National Flood and Coastal Erosion Risk Management Strategy (2011):² Sets out a statutory framework to help communities, the public sector, and other organisations to work together to manage flood and coastal erosion risk. It supports local decision making and ensures that risks are managed in a co-ordinated way across catchments, www.environment-agency.gov.uk/research/policy/130073.aspx. • Sustainable Drainage Systems (SUDS): A range of measures designed to mimic as closely as possible natural drainage and its advantages in providing habitat, filtering pollutants, recharging groundwater. SUDS are particularly important in water stressed areas, and in coping with heavy downpours, thus reducing flood risk. 	<ul style="list-style-type: none"> • Statement of Principles: A voluntary agreement between the Government and the Association of British Insurers (revised in 2008) to ensure that flood risk is managed effectively and that competitively priced flood insurance remains widely available for households and small businesses. It will not be renewed after its expiry in June 2013. Therefore, effort is underway by the Government to reach an agreement with insurers whereby insurance bills remain affordable without placing unsustainable costs on wider policyholders and the taxpayer. 	<ul style="list-style-type: none"> • Local Authority Adaptation Indicator (NI188): The UK Government introduced in 2008 an indicator on climate change adaptation in the Local Government Performance Framework. • Flood Warning Direct: Flood warning service to provide advance notice for floods. In some parts of England, floods from groundwater are also covered, www.environment-agency.gov.uk/homeandleisure/floods/38289.aspx.
Ecosystems				

1. The ACC Programme in England is in two phases. Phase 1 (2008-11) will lay the groundwork necessary to implement Phase 2 – a statutory National Adaptation Programme (NAP), as required by the Climate Change Act. Defra is responsible for developing the NAP, which will be published in 2013, to address the risks set out in the first UK Climate Change Risk Assessment.
2. The Flood and Water Management Act 2010 requires the Environment Agency to “develop, maintain, apply and monitor a strategy for flood and coastal erosion risk management in England”.

Main research programmes

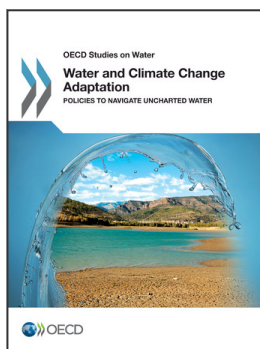
- UK Climate Projections (UKCP09): Provide climate information designed to inform planning for climate change adaptation. UKCP09 is the fifth generation of climate change information for the UK and presents probabilities of different future climates. These probabilities are created by weighting future climate projections on how well they represent the past climate, so they can be seen as the relative degree to which each climate outcome is supported by the evidence available, <http://ukclimateprojections.defra.gov.uk>.
- UK Climate Impacts Programme (UKCIP): See further details below, www.ukcip.org.uk.

Principal financing mechanisms and investment programmes

- Investments for flooding and coastal erosion: Defra expects to spend at least GBP 2.17 billion on flooding and coastal erosion over the next four years 2012-15, an average of GBP 544 million per year. This sum consists of around GBP 1.04 billion in capital investments and around GBP 1.13 billion on other programme and administrative costs, such as maintenance, flood forecasting, and incident response. Defra remains committed to fully funding local authority new burdens under the Flood and Water Management Act. Up to GBP 36 million a year will be provided directly to lead local flood authorities. Defra expected that as a result of this investment, deliver better flood protection will be delivered to 145 000 households by March 2015.
- Real Options Analysis for the Thames Estuary 2100 Project: The Environment Agency's Thames Estuary 2100 (TE2100) project is developing a strategy for tidal flood risk management to the year 2100. The Thames estuary floodplain contains 1.25 million people (one sixth of London's population), about GBP 200 billion of property, and key transport and infrastructure assets, including the London Underground, 16 hospitals and eight power stations. Given the value of assets at risk, the long lead times involved in developing solutions and the uncertainty of future climate effects and the potential for learning, a flexible, adaptive approach to incorporating climate change has been taken. The project identified options to cope with different levels of sea level rise, and the thresholds at which they will be required. The options were designed to implement the small incremental changes common to all options first, leaving major irreversible decisions as far as possible into the future to make best use of the information available. The strategy can be reappraised in light of the new information and options can be brought forward (or put back). See the TE2100 case study in the Supplementary Green Book Guidance (2009), "Accounting for the Effects of Climate Change", <http://archive.defra.gov.uk/environment/climate/documents/adaptation-guidance.pdf>.

Highlights and innovative initiatives

- **UK Climate Impacts Programme (UKCIP):** At the boundary of science, policy and practice, UKCIP co-ordinates and influences research into adaptation to climate change, and encourages organisation to use tools and information to help them consider their climate risks and how to adapt. The range of tools includes, for example, the "Adaptation Wizard" to assess vulnerability, identify key climate risks and development and adaptation strategy. A methodology for costing the impacts of climate change and comparing these to costs of adaptation measure is also available, www.ukcip.org.uk.
- **Green Book Supplementary Guidance:** Green Book Supplementary Guidance on "Accounting for the Effects of Climate Change". New supplementary guidance on adaptation has been produced for the Treasury's Green Book, which sets out the economic guidance used by government to assess spending, investment and policy decisions. The guidance sets out the criteria that determine when it is particularly important to consider the risks and effects of climate change if a programme, policy or project. It provides tools for climate change risk assessment and offers real options analysis as an options appraisal framework, able to incorporate the uncertainty of climate change and the value of flexibility into decision making, <http://archive.defra.gov.uk/environment/climate/documents/adaptation-guidance.pdf>.



From:
Water and Climate Change Adaptation
Policies to Navigate Uncharted Waters

Access the complete publication at:
<https://doi.org/10.1787/9789264200449-en>

Please cite this chapter as:

OECD (2013), "United Kingdom", in *Water and Climate Change Adaptation: Policies to Navigate Uncharted Waters*, OECD Publishing, Paris.

DOI: <https://doi.org/10.1787/9789264200449-42-en>

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