



# **EMERGENCY PLANNING: ADAPTING TO CLIMATE CHANGE**

September 2009

# CONTENTS

Summary .....	2
1. Introduction .....	2
2. National action on adaptation .....	3
What is climate change adaptation? .....	3
The UK Adapting to Climate Change Programme .....	3
Recent measures to strengthen local resilience to severe weather .....	6
3. Projected climate change.....	6
How will the UK climate change? .....	6
Local information .....	8
4. The growing risks from severe weather.....	9
Risks that may become more common .....	9
Some lessons from recent severe weather .....	11
5. What could Local Resilience Forums do now?.....	12
6. Further information .....	13

## Acknowledgements

Thanks to the following for their contributions: Maddi Bali, Joan Bennett, Rosanna Briggs, David Buxton, Catherine Duggan, Jo Hughes, Mike Lees, Andrew Martin, Jane Maughan, Laurie Newton, and Jeff Stacey.

## SUMMARY

Recent climate projections reveal that further climate change is now unavoidable, no matter how successful we are at reducing greenhouse gas emissions in future. Local Resilience Forums (LRFs) already plan for severe weather, but climate change projections suggest that in future LRFs may need the capacity to respond to long term changes in the climate.

This workshop summary offers some initial thoughts on how emergency planning may need to respond, but our understanding of how to adapt to climate change is still in the very early stages and much further work is needed. It draws on discussions at a practitioner workshop held in June 2009. The Emergency Planning Society's Environmental Risk Professional Working Group intends to further develop the ideas in this document.

This note discusses:-

- Work that is currently being undertaken for the UK Adapting to Climate Change Programme that could in future provide valuable information to help emergency planners to better understand the growing risks from climate change.
- Sources of information on projected climate change and its consequences.
- A checklist of possible increased risks from severe weather that LRFs and other partners might increasingly need to consider.
- Ideas on what action LRFs could take now to prepare for increasingly severe weather

## 1. INTRODUCTION

Recent climate projections reveal that further climate change is now unavoidable, no matter how successful we are at reducing greenhouse gas emissions in future, because past emissions will continue to influence climate for at least several decades to come.

Local Resilience Forums (LRFs) already plan for severe weather, but climate change projections suggest that in future LRFs may need to consider how the long term changes in climate will affect their capacity to respond.

This workshop summary offers some initial thoughts on how emergency planning may need to respond to climate change. But our understanding of how to adapt to climate change is still in the very early stages and much further work is needed.

It was developed jointly by [The Emergency Planning Society \(EPS\)](#), the [UK Climate Impacts Programme \(UKCIP\)](#) and the [Nottingham Declaration Partnership](#) and draws on discussions at a practitioner workshop held in June 2009. The Emergency Planning Society's Environmental Risk Professional Working Group intends to further develop the ideas in this document.

The project was funded by the [Local and Regional Adaptation Partnership Board \(LRAP\)](#), a collection of local and regional bodies supporting adaptation and supported by Defra. The LRAP board,

established in 2008, aims to facilitate action and understanding of the risks from long term changes in climate at a local and regional level. This note on emergency planning forms part of a wider LRAP research and support programme aimed at supporting different sectors to explore and understand the risks and opportunities from long term changes in climate.

## 2. NATIONAL ACTION ON ADAPTATION

### WHAT IS CLIMATE CHANGE ADAPTATION?

Adaptation describes actions to reduce the negative consequences and enhance the beneficial consequences of weather and climate events. It implies strengthening resilience and maintaining business continuity in the face of a changing climate.

**Adaptation** = addressing the impacts of climate change

**Mitigation** = addressing the causes of climate change

### The difference between weather and climate

Adaptation responses are required to address the impacts of both weather and climate, so it is important to recognise the difference.

**Climate** is the average weather in a locality over an extended period. Climate scientists normally use a thirty-year period which, in periods of stable climate, has been sufficient to provide a reliable average including the inevitable peaks and troughs of natural variability.

**Weather** describes what is happening at any point in time, be it torrential downpours of rain, exceptionally high temperatures or thunderstorms.

These differences are important because of the different impacts that can be expected and therefore the different responses that are required. Emergency planners will usually have to respond to severe weather rather than climate change per se.

### THE UK ADAPTING TO CLIMATE CHANGE PROGRAMME

Over the last few years there has been a significant growth in national efforts to prepare for the impacts of long term changes in climate. The UK Government has a national Adapting to Climate Change Programme - a cross Government programme co-ordinated by the Department of Environment Food and Rural Affairs (Defra). The Programme's objectives are to:

- Develop a more robust and comprehensive evidence base about the impacts and consequences of climate change.

- Raise awareness of the need to take action now and help others to take action.
- Work across Government at the national, regional and local level to make sure the need to adapt to climate change is embedded into Government policies, programmes and systems
- Evaluate progress and take steps to ensure effective delivery of the Programme's objectives.

Four projects in the national programme which are perhaps of most relevance to Emergency Planning are the:-

1. UK Climate Change Risk Assessment
2. Infrastructure and Adaptation Project
3. Adaptation Reporting Power
4. Government Departments' Adaptation Plans

All of these could in future provide valuable information which will help emergency planners to better understand the growing risks from climate change.

#### UK CLIMATE CHANGE RISK ASSESSMENT

The Climate Change Act (2008) requires that a national climate change risk assessment (CCRA) must take place every five years. Defra is co-ordinating the development of the first CCRA. It is expected to be completed in January 2012. The CCRA will provide evidence and analysis to:-

- **Understand the level of risks** (threats and opportunities) posed by climate change - the likelihood and scale of impacts
- **Compare the risks** of a changing climate with other pressures on the Government
- **Prioritise** adaptation issues geographically and by sector
- **Assess the costs** and benefits of adaptation actions and support the case for resources for these

#### INFRASTRUCTURE AND ADAPTATION PROJECT

In April 2009 a two year cross-departmental project was set up to examine and implement solutions to "improve the long-term (i.e. 20-90 year timeframe) resilience of new and existing infrastructure in the water, transport and energy sectors to future climate change impacts".

The project is examining the long-term technical risks and operational implications to infrastructure in the three sectors from climate change and how the risks might be overcome, e.g. identifying issues such as financing, regulation, design, engineering and policy as well the type of infrastructure that may be required in the future. It will work with a wide range of professional bodies, particularly engineering bodies. The expected outputs include:

- A better understanding of the long-term climate risk of the three sectors, in particular the long-term technical and operational risks, their interconnectivity, how to increase their resilience and the barriers to do this.
- How change could be implemented in each sector to increase the sector's resilience to long-term climate change.

A significant amount of adaptation work is already underway for the strategic road and rail networks. The Highways Agency for example, is preparing a [Climate Change Adaptation Strategy](#). This considers the predicted climate change impacts and how they might affect the strategic road network. It also looks at possible measures to minimise the impacts of extreme weather. This is expected to be published in autumn 2009. The rail industry has an extensive research programme in place to analyse the possible impacts of climate change on its network. It is also aiming to identify adaptation measures to build resilience to impacts such as higher temperatures and increased rainfall.

#### THE ADAPTATION REPORTING POWER

The Climate Change Act gave Government the power to direct reporting authorities (public sector bodies and statutory undertakers) to prepare reports on the current and future predicted impacts of climate change on their organisation and their proposals for adapting to climate change.

The Government has recently consulted on which bodies will be asked to report. A final decision has yet to be made, but it is likely to include: water and energy companies; Network Rail; strategic airport operators; and harbour authorities for larger commercial ports. A number of other bodies of relevance to emergency planning may be invited to report including: the Highways Agency; petroleum companies; telecommunications companies; and major food manufacturing, supply and distribution companies. The first reports are expected by the end of 2011 and will help to inform the national adaptation programme and CCRA.

#### DEPARTMENTAL ADAPTATION PLANS

In June 2009 the Government announced that all Ministerial Departments would publish their own adaptation plans, to cover their strategic objectives, operations and estates. All Departments are currently reviewing potential risks arising from direct and indirect climate impacts. Long term resilience of critical national service delivery to a changing climate will form a key part of their considerations.

The first departmental adaptation plans will be published by spring 2010, to complement the forthcoming work by reporting authorities and that already underway at regional and local level. Thereafter, departmental adaptation plans will be reviewed and updated on a five-yearly basis to follow each new national Climate Change Risk Assessment.

## RECENT MEASURES TO STRENGTHEN LOCAL RESILIENCE TO SEVERE WEATHER

In recent years much work has been done to improve emergency preparedness for floods and heatwaves.

The *Pitt Review: Learning lessons from the 2007 floods* has led to a substantial strengthening of flood resilience planning. The draft Flood and Water Management Bill proposes a duty for local authorities to prepare local flood risk management plans - covering flooding from surface water, groundwater and watercourses.

Following on from the 2003 European heatwave, the Department of Health and Health Protection Agency prepared a Heatwave Plan for England which is updated annually. It has promoted local heatwave planning to protect those most at risk in the community, care homes and hospitals. A CLG study into the *Effects of Climate Change on Fire and Rescue Services in the UK* predicted an increase in the number and severity of grassland and forest fires due to drought and heatwaves.

## 3. PROJECTED CLIMATE CHANGE

Information on the anticipated changes to the local climate and its potential consequences for floods and storm surges may be gained from:-

- The UK Climate Projections 09 (UKCP09)
- Regional Climate Change studies
- Flood and shoreline plans and information

## HOW WILL THE UK CLIMATE CHANGE?

### KEY FINDINGS FROM THE UK CLIMATE PROJECTIONS

New UK Climate Projections 09 (UKCP09) were launched in June 2009. The table above summarises the key changes that are expected.

Summary of projected climate change in the UK	
<b>Long-term / seasonal averages</b>	<b>Extremes</b>
<ul style="list-style-type: none"><li>• Warmer, drier summers</li><li>• Milder, wetter winters</li><li>• Rising sea levels</li></ul>	<ul style="list-style-type: none"><li>• More very hot days</li><li>• More heatwaves especially in the south and east</li><li>• More rain on the wettest days of the year</li><li>• Fewer frost nights</li></ul>

Climate changes are likely to be most pronounced in the south of the country due to the proximity to the continental landmass, and less so in the north due to the thermal buffering of the Atlantic Ocean.

#### WHAT IS AND IS NOT INCLUDED IN UKCP09?

UKCP09 presents information on temperatures, precipitation (rain, hail and snow), cloud, humidity, sea level rise, storm surges, waves and sub-surface changes. It does not interpret how these changes might feed through into other impacts that will be crucial for emergency planning such as floods, storms, high winds and coastal inundation. Research is now underway to use the new projections in impacts studies. In the meantime information on some of these impacts may be obtained from other sources (see below).

#### EMISSIONS SCENARIOS AND PROBABILITIES

Climate change projections are inherently uncertain due to uncertainty about the course of future emissions; limitations in our ability to model the climate precisely (model error); and the effects of natural variability (year to year fluctuations in the overall trend).

Because we cannot be certain about future emissions, UKCP09 uses three emissions scenarios (based on the IPCC's<sup>1</sup> Special Report on Emissions Scenarios) – high, medium and low. As a result of the lag in how the climate responds to emissions, the alternative scenarios do not result in a significant variation in the projections up to 2040, but after 2040 the projections start to diverge noticeably.

All of the projections in UKCP09 are representative of thirty year periods - for example the period 2070-2099, which is known as “the 2080’s”. The first time period is 2010-2039. As the results are a thirty year average, UKCP09 does not give information on very near term climate.

For the first time, UKCP09 also gives a measure of the uncertainty from modelling and natural variability by assigning probabilities to different outcomes. These probabilities should be seen as a measure of the strength of evidence for different future climates based on expert judgement. The probabilities do not include all possible sources of uncertainty, but they go far beyond previous scenarios that only used a single “best guess” estimate.

The probabilities allow decision makers to use the Projections by assessing their attitude to risk. For example, if expensive and critical infrastructure is at risk, they may want to take a very risk averse approach and focus on planning adaptive strategies that protect against low probability, high impact events (such as very high levels of sea level rise).

---

<sup>1</sup> The UN's [Intergovernmental Panel on Climate Change](#)

## LOCAL INFORMATION

### LOCAL PROJECTIONS AVAILABLE FROM UKCP09

The [technical UKCP09](#) site presents overview information such as:-

- Key findings for the whole of the UK and for administrative regions
- UK maps of how seasonal mean precipitation and temperatures are likely to change

Users can also use the *Customisable output* available from the user interface to view projections for their locality and generate maps and graphs. As well as seasonal and annual means, the *Weather Generator* tool gives statistics of extremes that occur at a daily scale, such as hot days and dry days. This could be important for understanding the potential characteristics of extreme weather events in future.

### GENERATING LOCAL PROJECTIONS

Before interrogating the UKCP09 data, check if the local authority or the LSP is already analysing the data, perhaps for a Climate Change Plan, NI 188 Improvement Plan, Local Development Documents or other purpose. Most councils have one or more officers who lead on climate change. Speak to them first.

### REGIONAL CLIMATE CHANGE STUDIES

Many [Regional Climate Change Partnerships](#) have published Regional Climate Change studies and / or strategies. These may contain useful evidence and consider the indirect impacts of climate change, such as changes in work, immigration or tourism patterns.

### FLOOD AND SHORELINE INFORMATION

#### DIFFERENT TYPES OF FLOODING

**River flooding** occurs when a watercourse cannot cope with the water draining into it from the surrounding land. This can happen, for example, when heavy rain falls on an already waterlogged catchment.

**Coastal flooding** results from a combination of high tides and stormy conditions. If low atmospheric pressure coincides with a high tide, a tidal surge may happen which can cause serious flooding.

**Surface water flooding** occurs when heavy rainfall overwhelms the drainage capacity of the local area. It is difficult to predict and pinpoint, much more so than river or coastal flooding.

**Sewer flooding** occurs when sewers are overwhelmed by heavy rainfall or when they become blocked. The likelihood of flooding depends on the capacity of the local sewerage system. Land and property can be flooded with water contaminated with raw sewage as a result. Rivers can also become polluted by sewer overflows.

**Groundwater flooding** that occurs when water levels in the ground rise above surface levels. It is most likely to occur in areas underlain by permeable rocks, called aquifers. These can be extensive regional aquifers, such as chalk or sandstone, or may be more local sand or river gravels in valley bottoms underlain by less permeable rocks.

Two plans that will provide information on flood and coastal erosion are:

- [Catchment Flood Management Plans](#) (to be published shortly). These analyse flood risk in catchment areas now and in the future.
- [Shoreline Management Plans](#) (second generation SMP plans are currently in production) provide similar insights into anticipated coastal flooding and erosion.

Both plans recommend the best ways of managing future risks over the next 50 to 100 years. They will help with identifying the locations most at risk of flooding and coastal erosion and if these risks may be reduced by future management measures or if, for example, coastal retreat is proposed.

Strategic Flood Risk Assessments (SFRA) may also contain useful information on areas at risk from flooding. They are produced by Local Planning Authorities to inform their Local Development Documents (LDDs). The SFRA will evaluate the effects of climate change on all sources of flooding and consider appropriate policies for development in or adjacent to flood risk areas.

The Environment Agency has recently provided data to local authorities on [Areas susceptible to flooding from surface water](#).

Locations considered to be at highest risk from surface water flooding will be undertaking Surface Water Management Plans over the next few years. In priority areas local authorities will lead on the development of the plans that will assess the local flood risk from surface water, ground water and smaller watercourses and consider actions for managing this risk. As they develop, these plans will be a valuable source of information.

## WIND AND STORMS

As yet there are no projections available for changes in wind speed and storms.

## 4. THE GROWING RISKS FROM SEVERE WEATHER

### RISKS THAT MAY BECOME MORE COMMON

The [National Risk Register](#) (NRR) identifies severe weather as an important risk for the UK and considers the potential impacts of: storms and gales; low temperatures and heavy snow; heatwaves; drought; and floods. With the exception of flooding, the impact of severe weather is classed as relatively low compared with other risks faced by the UK.

Although LRFs have greatly strengthened their preparations for severe weather, climate change predictions suggest that in future severe weather events will become even more disruptive and frequent with a wider range of possible impacts due to the increased severity and duration of adverse weather. Unlike floods, impacts such as heatwaves will not be confined to defined and foreseeable localities, but widespread across the affected area.

The June 2009 Practitioner workshop concluded that there was an urgent need for further research and guidance on the implications for emergency planning. By discussing recent experience of severe weather, workshop participants developed some initial ideas on the kind of risks from severe weather that LRFs and other partners might increasingly need to consider. See the table below. The *italics* note the events and other sources that influenced these suggestions.

CHECKLIST OF POSSIBLE INCREASED RISKS FROM SEVERE WEATHER	
Weather / climate & its impacts	Risks
Storm surges & coastal erosion <i>(East Anglia storm surge 2007)</i>	<ul style="list-style-type: none"> <li>• Mass evacuations</li> <li>• Collapse of cliffs taking down buildings and infrastructure</li> <li>• Failure of sea defences. Temporary or permanent inundation of buildings and infrastructure</li> <li>• Communities and/or services cut off e.g. homes, hotels, ports, harbours, beaches</li> </ul>
Heatwaves & drought <i>(European heatwave 2003)</i>	<ul style="list-style-type: none"> <li>• Failure of transport networks due to buckling rails and overheating of train / tram power sources. Travellers marooned enroute.</li> <li>• Water shortages (domestic, agriculture, industry, fire &amp; rescue)</li> <li>• Water pollution caused by a combination low water flow and heat <i>(Galway)</i></li> <li>• Increased hospital admissions and pressure on care services</li> <li>• Failure of power supplies due to overheating of electricity sub-stations</li> <li>• Increase in number and severity of wildfires (grassland &amp; forest fires) and fires more generally</li> </ul>
Heavy rainfall & flooding <i>(English floods 2007)</i>	<ul style="list-style-type: none"> <li>• Flooding of emergency service providers – police, hospitals, fire &amp; rescue – and other critical public services, e.g. schools, council offices <i>(Carlisle &amp; Gloucestershire)</i></li> <li>• Shortages of search and rescue equipment</li> <li>• Loss of supply from critical public services – water, power <i>(Carlisle &amp; Gloucestershire)</i></li> <li>• Failure of transport networks due to floods, collapse of embankments, landslips, flooding of train / tram power sources. Travellers marooned enroute.</li> <li>• Water contamination &amp; water borne diseases <i>(Health effects of climate change, DoH/HPA)</i></li> </ul>
High winds & storms <i>(Birmingham tornado 2005)</i>	<ul style="list-style-type: none"> <li>• Unsafe buildings, evacuations, service disruptions and transport diversions</li> <li>• Damage and injuries from movement of light structures, e.g. mobile homes, vehicles, street signs, lighting and furniture.</li> <li>• Disruption of transport networks due to unsafe bridges and other exposed transport infrastructure</li> <li>• Failure of electricity supplies, trains and telecommunications due to damage to overhead lines and equipment</li> </ul>
Severe weather generally	<ul style="list-style-type: none"> <li>• Pressure on health services due to increased admissions</li> <li>• Long-term health and psychological consequences <i>(Carlisle &amp; Gloucestershire floods)</i></li> <li>• Disruption of food supplies following failure of transport networks</li> </ul>

## SOME LESSONS FROM RECENT SEVERE WEATHER

Delegates at the June practitioner workshop shared their experience and the lessons of the emergency planning response to severe weather. Some brief case studies are shown below.

### **Lessons from 2007 Gloucestershire floods 1: Relearning to be resilient**

On 20 July 2007 Gloucester received one and a half times the average monthly rainfall for July.

The consequences were widespread: 3 people died, around 4000 homes and 500 businesses were flooded, and approximately 10,000 people were stranded on the M5 and other roads overnight. Critical utility infrastructure was flooded, including a water treatment works and an electricity substation, which disrupted water and power supplies.

Gloucestershire County Council's scrutiny review of the response to the flooding made 75 recommendations dealing with emergency management, the resilience of critical infrastructure, how to support people and strengthen community resilience, and spatial planning policy and practice relating to new development.

Maddi Bali, Senior Emergency Management Officer at Gloucestershire County Council, believes that the emergency highlighted a need for more national attention at rebuilding a culture of resilience. Many local communities did get together into strong local support groups, and these are the ones who are now keen to prepare Community Plans. However there is still a lot of work to do to encourage both individuals and communities to be more resilient.

### **Lessons from 2007 East Anglia storm surge: communicate well, communicate early**

In November 2007 the East Anglian coast experienced its biggest tidal surge since 1953. This triggered the issuing of Severe Flood Warnings along the East Anglian coast. Subsequent flooding affected parts of Norfolk, Suffolk and North Essex. Fortunately, a change of weather in the last few hours meant that flooding was less severe than predicted.

The Environment Agency made early warning a priority and worked hard to communicate to their professional partners 24 hours in advance of the storm surge to ensure sufficient time for effective evacuation of vulnerable communities. This emphasis on early warning was a success with 27,000 calls made to the public by the automated Floodline Warning Direct system. In addition the Agency had over 400,000 hits on its website in a few hours.

However, the multi-agency emergency response highlighted the particular challenges of providing for vulnerable people's needs – maintaining support care, meeting special needs and so on – when they are being evacuated, something which would be exacerbated during a prolonged emergency. This is an issue that is likely to affect all emergency planning for any future severe weather events as national provision for specialist care of vulnerable people is already at capacity.

### **Lessons from 2003 European heatwave: be prepared**

At least 35,000 people died in Europe, including over 2000 in the UK, during the summer of 2003 as the northern hemisphere baked in the hottest summer on record.

In response the UK government published its first Heatwave Plan for England in 2004 – this was revised in 2008 to take account of ongoing learning (there was another heatwave in 2006). The plan is designed to enhance resilience during a heatwave, and is an important component of overall emergency planning. The Chief Medical Officer's letter accompanying the launch of the 2008 plan stressed that heatwave planning 'will become increasingly relevant in adapting to the impact of climate change'.

The heatwave plan alert has four levels: green (level one), amber (level two), red (level three) and red emergency (level four). For example, in early July 2009 the Met Office issued a level three alert in London and south-east England, which triggered actions such as daily visits or phone calls to vulnerable groups such as older people.

As well as emergency planning measures the heatwave plan also includes information on how to adapt to the higher temperatures that are likely to be more routine because of climate change. These include how to create cooler environments using vegetation and green spaces.

Even in summers without a heatwave localised water scarcity is common in parts of England. This scarcity can happen quickly, and typically occurs in areas where for historical reasons there is very little capacity or resilience in the water supply networks.

### **Lessons from 2005 Birmingham tornado: meet ongoing health needs**

The Birmingham tornado struck in July 2005. It injured three people seriously and caused damage to hundreds of buildings.

While the immediate emergency response went well, EPs faced the ongoing challenge of rehousing people with existing health needs and maintaining their access to their primary care services (such as medication). This led to knock-on effects in other parts of the health service, for example, A&E.

Although these health needs weren't a direct outcome of the tornado the change in circumstances was – this was an unforeseen consequence that in future needs to be built into emergency planning responses to severe weather events.

## **5. WHAT COULD LOCAL RESILIENCE FORUMS DO NOW?**

The Emergency Planning Society intends to pursue further work that is needed to fully understand the implications of climate change for emergency planning, but there are some activities that LRFs could pursue right now.

1. **Strengthen local understanding of the risks:** Many local authorities are currently undertaking climate change risk assessments for national indicator NI 188 (planning to adapt to climate

change). LRFs could work with local authorities and other partners such as Category 2 responders to strengthen understanding of local risks from long term climate change.

2. **Build future resilience of emergency services:** Encourage LRF members to review the resilience of their own buildings and equipment to future changes in climate. The draft *Statutory Guidance to Reporting Authorities on adapting to climate change* may provide a useful guide for how to go about this process. (See Annex B of the [Consultation on the Adaptation Reporting Power in the Climate Change Act 2008](#).)
3. **Understand the new climate projections:** From now until the end of 2009 there are free regional and national training events in the new UK Climate Projections 09. Further information on what the courses involve and how to book are available on [www.ukcip.org.uk/pip](http://www.ukcip.org.uk/pip). An event specifically for emergency planners is being explored for December 2009.

## 6. FURTHER INFORMATION

1. UK Climate Projections 09
  - a. [Summary site](#)
  - b. [Technical site](#)
2. [UK Adapting to Climate Change Programme](#), Defra.
3. [Climate Change Act 2008](#)
4. [The Adaptation Reporting Power in the Climate Change Act 2008](#), Defra.
5. [The Pitt Review: Learning lessons from the 2007 floods](#).
6. [Heatwave Plan for England](#), Department of Health 2009.
7. [Catchment Flood Management Plans](#), Environment Agency
8. [Shoreline Management Plans](#), Environment Agency
9. [Health effects of climate change in the UK 2008](#), Department of Health and Health Protection Agency.
10. [The effects of climate change on fire and rescue services in the UK](#), CLG 2006.
11. [IRMP Steering Group: Integrated Risk Management Planning: Policy Guidance - Wildfire](#).
12. [After the flood: the health and social consequences of the 2005 Carlisle Flood event](#).
13. [Draft Flood and Water Management Bill](#), 2009.
14. [Developing community resilience through schools project](#).