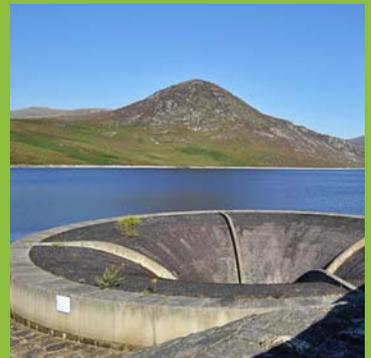


Climate Change & Health: Impacts, Inequalities & Action



A guide for health professionals in Northern Ireland

November 2010



Belfast is a leading member of the WHO European Healthy Cities Network Phase V (2009-2013). This publication has been produced as part of our work on Climate Change and Health.



Climate Change & Health: Impacts, Inequalities & Action

Foreword

Our environment – physical and social – shapes our health, which is one of our most valuable resources. A positive environment is a key way to tackle inequalities in health, which not only limit individuals and communities from reaching their full potential, but are also a barrier to creating a prosperous Northern Ireland.

Climate change has and in the future will have a considerable impact on our physical environment, in particular through a greater risk of flooding and extreme weather events. Our social environment will also be affected; for example the cost of energy and food is likely to rise further, as a result of climate change impacts elsewhere in the world. It should be no surprise that health and health equity will be affected, and it is important that these impacts are taken into account as an integral part of action to deal with climate change.

This publication takes a timely opportunity to highlight how climate change impacts on health, and in particular on inequalities in health. Building on the broad determinants of health, it offers a helpful overview of the many ways in which climate change in Northern Ireland will influence health, health equity and wellbeing. It also outlines promising areas of action that can protect and strengthen health in a changing climate. The examples can inform and support health professionals working to protect and improve health, and also strengthen understanding in other sectors of how their work on climate change also contributes to health and wellbeing.

A key message of the publication is that there are significant synergies between supporting health, protecting the environment and strengthening the economy. New jobs can be created in the green economy at all skill levels, which can improve job and life prospects for many vulnerable and disadvantaged people as well as support business innovation and strengthen Northern Ireland overall. Strong active travel

infrastructure is a prerequisite for active lifestyles and can significantly contribute to tackling obesity, while it also reduces congestion and car dependence, with savings for employers as well as reduced carbon and other pollutant emissions as a result.

This publication clearly conveys the message that climate change is a serious threat to our health and wellbeing, but that it also creates opportunities. It provides an important resource for professionals across sectors, and can significantly contribute to the ongoing process of creating a healthy, sustainable and prosperous future for all.

Michael McGimpsey MLA

Minister for Health, Social Services and Public Safety

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Preface

Climate Change poses a significant threat to our health in the short and longer term. Critical in the years to come will be the capacity of health systems to develop and implement adaptation and mitigation strategies to address climate change and to strengthen a range of key areas of work – from disease surveillance and control and research, to disaster risk reduction – that are essential elements of the capacity for rapid detection of and action to protect health from climate change.

Climate change will have an impact on the work of health professionals at a local level. It is therefore important to ensure that health sector staff are provided with the necessary information to help them make the connections with their role in advocating for health and protecting health from the consequences of climate change.

Climate change is one of the themes within Phase V (2009-2013) of the World Health Organisation European Healthy Cities Networks framework for action. It is within this context that the regional intersectoral Climate Change and Health Group was established, and the need for capacity building within the health sector was identified. This publication provides useful information on health impacts and potential areas for action within the health sector, drawing on the evidence that is available on the impacts on people; communities and social networks; local economy; everyday activities; the built and natural environment. It will strengthen and share the information and knowledge base and create increased understanding on the surrounding issues.

We would like to thank Jonna Monaghan for writing this publication with the support of Ruth Fleming in the Belfast Healthy Cities office. Thanks also go to members of the regional Climate Change and Health Group for their comments and guidance on the development of the publication.

Bernadette Cullen
Chair, Belfast Healthy Cities

Joan Devlin
Director, Belfast Healthy Cities



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Executive summary

Purpose of publication

The World Health Organization (WHO) suggests that 'climate change will be the defining issue for health systems in the 21st century. Health professionals have the knowledge, cultural authority and responsibility to protect health from climate change'.¹

This publication provides an introduction into the health impacts of climate change and aims to outline examples of action that can help reduce negative impacts. The key focus of the publication is on action that can tackle health inequalities, as vulnerable groups are most at risk in a changing climate. Another key point is that there are significant synergies between health, environmental protection and the economy, and that a single action in many cases can contribute to many objectives across sectors.

This publication is aimed at health professionals, to strengthen understanding of the links between climate change and health, and support with identifying solutions that can contribute to improving health and health equity. Professionals in other sectors, whose work is related to health, environmental protection and/or developing the living environment, may also find it useful. The areas the publication focuses on are **physical health impacts, communities, the local economy, daily activities, the built environment, the natural environment, and the local impacts of global climate change.**

In this publication, health inequalities are defined as differences in health outcomes that are due to inequitable social and physical living conditions. The term is used interchangeably with the term health equity, which has a broadly similar meaning but emphasises that inequalities can be tackled, by altering policies and practices.²

Methodology

The publication collates evidence from scientific and professional sources and examples of action currently ongoing in Northern Ireland as well as elsewhere in the UK. The research for the publication was undertaken by Belfast Healthy Cities and it has been peer reviewed by members of the intersectoral, regional Climate Change and Health Group, which is chaired by the Department of Health, Social Services and Public Safety and facilitated by Belfast Healthy Cities.

Structure of publication

The publication is divided into three chapters. Chapter 1 provides an introduction, and Chapter 2 gives a brief outline of climate change in Northern Ireland. Chapter 3 contains the bulk of the report, and focuses on the health impacts of climate change and potential directions for action. This chapter includes a number of case studies, related to each layer of health determinants.

Key messages: how climate change will affect and what can be done

Warmer average temperatures increase the likelihood of heatwaves, while heavy rains and storms can result in floods and power cuts. Floods have particularly far reaching consequences, from long term stress for affected households to disruption of daily care services and, over time, the decline of a community. Heat poses a threat to many vulnerable groups, and will reshape our lifestyles. This could have positive effects, for example if it encourages greater physical activity and community cohesion. Globally, climate change will affect crop yields, which pushes food prices up and increases pressure on low income families, who already are most likely to eat a less healthy diet.

In short, climate change affects people through many pathways. The health sector plays a role in most of these, and can contribute both to protecting health



in emergency situations, and reducing risks. This section provides a summary outline of key impacts and potential directions of action. More detail with full references is available in Chapter 3.

The analysis is structured under the key determinants of health (see appendix 1).

Direct impacts on people

Extreme weather events, floods and higher temperatures can very directly affect people's physical as well as mental health and wellbeing. The key risks that will directly affect people include:

Floods and extreme weather

- Injury and death, e.g. in fast flowing waters and severe gales
- Disease, e.g. infection or poisoning from contaminated floodwater
- Mental ill health - long term mental stress of dealing with aftermath of being flooded

Warmer temperatures

- Excess mortality, especially in first days of a heatwave – linked to complications of cardiovascular and respiratory disease
- Increased risk of skin cancer, linked to greater exposure and potential behaviour change that maximises exposure
- Reduced efficacy of medicines at temperatures over 25 degrees and appropriate storage, in homes and pharmacies
- Increased risk of food poisoning
- Longer pollen season, leading to more respiratory disease and potentially other complications for allergy sufferers
- Longer term, potential for new vector borne disease patterns (in Northern Ireland as well as popular tourist destinations)
- On the positive side, reduced risk of cold related deaths

Impact on inequalities:

Vulnerable households have less resources for cleaning up after a flood and reducing future risk. Therefore, they are at greater risk of long term stress and associated health risks, e.g. unhealthy lifestyles as coping mechanisms and a directly raised cardiovascular disease risk.

People most at risk from warmer temperatures include key vulnerable groups, ie. older people, babies and young children, people with chronic conditions and people less able to alter behaviour, e.g. through illness.

What the health sector can do:

- Maintain and develop flood preparedness, e.g. through emergency and resilience planning
- Conduct flood health risk assessments and identify measures that limit harm to health and equity – including effective implementation of existing measures
- Provide ongoing support to people affected by flooding, including access to mental health care
- Maintain and develop public health information on heat health impacts, including advice on appropriate precautions, actions and remedies
- Develop contingency plans, e.g. strategic heatwave action plan
- Maintain registries of extreme weather events and health impacts e.g. monitoring of vector borne diseases

The case study on page 14 outlines the Heatwave Plan for England developed by the Department of Health, which aims to reduce negative health effects from heat, and the Healthy Outlook Service operated by the Met Office, which aims to alert people with chronic obstructive pulmonary disease to conditions that may raise their health risks.

Communities and social networks

A changing climate will shape communities, and is likely to have a particular impact on people's opportunities to meet with each other and socialise.



This will affect individuals' mental wellbeing, and social wellbeing through shaping opportunities to maintain a sense of place, community and cohesion.

The key pathways that will influence health include:

Warmer temperatures

- Warmer temperatures may encourage people to spend more time outside
- Potential for encouraging physical activity

Floods and extreme weather

- Disruption to everyday social networks, including formal and informal care arrangements
- Potential long term effects if people and households are forced to move

Impacts on inequalities:

People in more deprived areas may benefit less from better weather, where the physical environment does not support or encourage outdoor activities.

Disruption will be greatest for vulnerable groups, who may depend on outside care and support. For some vulnerable people there may be long term harm to social networks, if the weather makes them anxious about going outside.

What the health sector can do:

- Ensure arrangements for vital care and support are in place as part of emergency plans
- Inform people, and in particular service users, of contingency plans
- Support and invest in community development to encourage social interaction and build resilience
- Support and provide physical activity programmes for all ages

The case studies on page 17 and 18 outlines the community response to flooding in Cumbria in late 2009 and research into the impact of recent flooding in Belfast, by the British Red Cross.

The local economy

The local economy can find opportunities in a changing climate, but is at risk from floods and extreme weather.

Key climate change impacts on the local economy, which also affect health, include:

- On the positive side, potential for new job opportunities
 1. related to warmer temperatures and longer summer seasons, eg. in tourism and leisure sectors
 2. linked to tackling climate change and developing green economy, eg. in energy efficiency, renewable energy, local food production
- Stock and financial loss following floods, potentially leading to job losses – particular impacts on farmers and other self employed people
- Disincentives to investment in high flood risk areas – including difficulties in getting house insurance, potential for long term economic and social decline

Impacts on inequalities:

New job opportunities are likely to arise at all skill levels, creating opportunities for improved income and material living standards for low income, unemployed and economically inactive people.

Low and medium income households living in flood prone areas may be unable to afford insurance or move, facing increased uncertainty and associated stress. This, especially if coupled with falling investment in area, can generate rising deprivation and vulnerable communities.

What the health sector can do:

- Support employability schemes
- Explore green economy opportunities within sector
- Explore opportunities to utilise local products and providers in procurement
- Strengthen understanding of links between health and the economy, eg. through emergency planning and resilience fora



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The case study on page 20 outlines examples of new skillsets and business opportunities being developed in Northern Ireland.

Everyday activities: working, moving, learning, shopping

Everyday activities will be influenced by a changing climate, especially during acute crises such as floods. This may change established travel routes and service use patterns, and shape health and wellbeing by affecting access to jobs, services and people. High temperatures can affect learning in schools and productivity at work, and can exacerbate poor performance.

The health impacts associated with these changes include:

- Delay or lack of access to emergency and critical care, e.g. as a result of blocked roads or flooded facilities
- Difficulties keeping warm, cooking and storing food safely during power cuts
- Limited access or lengthy round trips to services during clean up and repair following flooding, affecting mental and physical wellbeing
- Difficulties in keeping cool and maintaining productivity in warm conditions – particular risks for outdoor workers
- On the positive side, opportunities to encourage active travel and tackle obesity in warmer conditions

Impacts on inequalities:

Vulnerable groups, such as older people, people with disabilities and people with long term illness, are more likely to need external care and support and are at greater risk from disruption to normal services. Long term changes to travel or service provision patterns may reduce access to services and create stress for all vulnerable groups.

People in more deprived areas may be less able to take up active travel and benefit from better weather conditions, where the physical environment does not support walking and cycling. This also applies to people living in suburban car centred developments.

What the health sector can do:

- Develop alternative service delivery mechanisms through emergency and contingency plans
- Provide public information on how to prepare for flooding
- Support and invest in community development to build resilience and encourage voluntary support mechanisms.
- Share evidence on health and social benefits of mixed land use, e.g. improved air quality, social cohesion and active travel
- Develop green travel plans, emphasising active travel for staff and patients/clients
- Support and provide physical activity programmes
- Explore use of technology to support service delivery and reduce need to travel
- Explore opportunities to strengthen public transport links to key sites, such as hospitals
- Explore opportunities for supporting mixed land use and reduce need to travel, e.g. through service provision in facilities shared with other public services

The case study on page 24 outlines the Royal Hampshire County Hospital Green Travel Plan.

The built environment

Buildings, streets and other infrastructure will come under considerable pressure in a changing climate, which will increase risks to human health and wellbeing. The impacts can be controlled through land use planning as well as service planning.

Climate change will affect the built environment and health in a number of ways:

- Buildings can become uncomfortably or unsafely warm in summer especially in older buildings

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- Urban areas can become very warm as buildings trap heat at ground level (the urban heat island effect)
- Demand for mechanical cooling will increase, which increases electricity use that contributes to future climate change and raises maintenance costs
- Dry weather leads to a fall in sewer flow, which increases the risk of blockages, and the likelihood of sewer overflows in later heavy rains
- Flood defences in buildings may become increasingly required to protect people and property, including medication and health related equipment

Impact on inequalities:

People who are less able to cool themselves down, through illness or job role, are at greater risk from heat. Greater electricity demand can drive prices up, putting low income households at overall disadvantage by reducing disposable income.

Low income households are less likely to afford flood defence measures or repairs, increasing stress and the risk of being forced to live in low quality housing. However, vulnerable groups can benefit significantly where green space is used as a natural defence against floods and heat.

What the health sector can do:

- Work towards maximising energy efficiency in the health estate, including maximising use of green space for cooling, drainage and shade
- Explore opportunities to utilise renewable energy
- Develop heat action plans
- Provide and signpost support for people affected by flooding
- Share evidence of the multiple health benefits of natural flood defences, in particular green space

The case studies on page 28 explain the BREEAM standard and give examples of sustainable construction in health estates.

The natural environment

The natural environment will be fundamentally affected by climate change; for example many species may disappear, while the habitats of others change. A number of the impacts on biodiversity will also have a clear impact on health and wellbeing.

Many impacts are linked to warmer temperatures and include:

- On the positive side, more viable local food production and greater crop yields, improving food security
- Increased ozone pollution and poor air quality especially in summer, leading to more respiratory disease
- More frequent algal blooms and longer lifespan for pathogens in waterways
- Potential changes in tick borne and infectious disease patterns
- Potential shortages of water and quality issues
- Contamination of water – during droughts rise in effluent concentrations, in storms and floods increased risk of contaminants leaching into waterways

Impacts on inequalities:

Deprived areas are more likely to have poorer air quality primarily because they are located near busy roads. Poorer air quality may have greater negative impacts on people in deprived areas, by compounding and adding to other health risks.

Increased local food production may enable vulnerable and low income households to include more local and healthy produce in their diet, depending on price development.

What the health sector can do:

- Collaborate with other authorities to monitor water quality
- Identify effective measures and protocols for protecting health in flood health risk assessments and emergency plans



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- Maintain and develop monitoring of vector borne and infectious disease
- Explore opportunities to utilise local produce in catering

The case study on page 31 describes the all Ireland demonstration Programme of Community Food Initiatives, which is funded by *safefood*.

Global to local: Impacts on health in Northern Ireland from global climate change

Global changes related to climate change will affect health and wellbeing in Northern Ireland through higher living costs and potentially changed migration patterns. In addition, fossil fuel production is likely to have peaked, which will put pressure on energy prices, as remaining reserves become increasingly costly to extract.

These impacts include:

- Greater vulnerability of the food chain (food security)
- Increased poverty, with associated risk of ill health related to rising cost of living, with particular effects on:
 - fuel poverty
 - diet, potentially affecting obesity trends
- Potential changes to population structure through migration, with particular impacts on mental and social wellbeing

Impact on inequalities:

Rising living costs will have a disproportionate impact on the lowest socioeconomic groups, as they may already find it difficult to make ends meet. In addition, for example more expensive transport may mean that job opportunities some distance away become less viable,

increasing benefit dependence and affecting the health and overall life opportunities for people on the lowest incomes.

Globally, the most vulnerable groups are most at risk from climate change, as they have the least resources needed to reduce risk or adapt to change.

What the health sector can do:

- Work towards maximising energy efficiency
- Explore opportunities to utilise local products and providers in procurement
- Support and encourage community gardens and allotments, as valuable local food production, physical activity and social resilience programmes
- Maintain and develop healthy eating programmes and social marketing schemes
- Maintain and develop services for migrants

Case studies on page 35 look at the Transition Town movement and the wind energy project at Antrim Area Hospital.



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1. Introduction

Climate change is now evident worldwide. In Northern Ireland, it will mean higher average temperatures and more frequent extreme weather events, including floods. In Northern Ireland we are already seeing the impacts with yearly floods.

Overall, vulnerable groups are at particular risk from climate change, since they have the least resources to reduce the risk of or adapt to more difficult living conditions. Climate change is therefore a risk factor that may heighten inequalities in health.

If climate change and its impacts are not tackled, health professionals are likely to face added workload, for example from increasing mental health problems. However, as the Marmot review of inequalities in health in England³ noted, there is now a major opportunity to take action that will both deal with climate change and help improve health and equity. Health professionals can contribute to this through having in place systems for dealing with threats such as heatwaves and floods, and through building capacity of citizens and other professional sectors to adapt to as well as tackle climate change. As one of Northern Ireland's largest

estate managers, the health sector can also lead with example in terms of good building design and resilient maintenance systems.

Action on climate change can also contribute to other goals, within the health sector and in other sectors. There are significant synergies between health and environmental sustainability, and actions that target these areas can also provide economic benefits. In many cases, a single policy or action help meet many objectives.

For example, encouraging and enabling walking and cycling contributes to tackling obesity, but also reduces traffic and traffic related emissions. Energy efficient buildings cut maintenance bills and carbon emissions. Plans for heatwaves and floods can help avoid hospitalisations as well as long term stress for affected people.

Strong leadership is crucial in the coming years, both in tackling the immediate threats and taking the opportunity to create healthier, more sustainable communities. This publication aims to support the development of that capacity.





2. Projected climate change in Northern Ireland

A changing climate is now evident, both in Northern Ireland and globally. Worldwide, the warmest years on record have all occurred since 1995. In the Arctic, summer ice cover has shrunk 20% in 30 years. In Australia, there has been an increase in the incidence of prolonged droughts.⁴

In Northern Ireland, the anticipated change can be summarized as a predicted rise of 1-2 degrees Celsius in annual mean temperatures during the course of the 21st century. Climate change models suggest that winter rainfall will increase relative to the present day and summer rainfall will decrease. More prolonged winter rainfall may well result in an increased incidence of flooding – perhaps similar to that experienced in Fermanagh in Autumn 2009. Conversely, while rainfall in summer is expected to decrease overall, a greater proportion may fall from short duration intense storms, increasing the risk of flash flooding in summer, some evidence of which has already been seen during the first decade of the 21st century. This type of rainfall however tends to be more localised in nature and the reduction in summer rainfall overall would increase the risk of more prolonged periods of exceptionally dry weather or even periods of drought.⁵ In addition, sea level highs recorded in storm surges that now occur once in 100 years, could occur once in five years by 2050.⁶

Due to an increase in hot summer seasons and a series of exceptionally mild winters, annual mean temperatures have increased in some parts of Northern Ireland by up to 0.8 degrees Celsius since 1980.⁷ While there continues to be much inter-annual variability, there are also some signs of rain concentrating in autumn and winter – meaning wetter winters and drier summers than historically prevalent - while the number of snow days has been falling since the late 1980s.⁸

This trend is likely to continue, although it is worth noting that due to the high latitude maritime location of Northern Ireland, the climate change predicted impacts are much less severe than for example in south eastern England.

Projections for future climate are necessarily uncertain, as the outcome will be shaped by changes in emissions as well as other factors, but the most recent climate projections for the UK indicate rising temperatures even in circumstances where emissions are cut significantly. The figures below illustrates projected changes in temperature, and summer and winter rainfall over the 30-year periods 1990s-2020s, 2020s-2050s and 2050s-2080s, in both medium and high emission scenarios.

High, medium, low emission scenarios reflect the degree to which the amount of greenhouse gas emissions, released into the atmosphere by human activities, are reduced. This can be through use of renewables over fossil fuels but also factored in are: population growth: energy usage/efficiency and lifestyle/industrial changes: landuse changes; and technological and natural practices that act as sinks to store greenhouse gases.

The figures show that by the middle of this century Northern Ireland could experience up to 19% (medium and high scenarios) more rainfall during the winter, however the south of England could be facing up to 36% - 40% more rainfall. Projections also indicate that the east of Scotland will face similar impacts to Northern Ireland (up to 20% increase in winter rainfall) but the west of Scotland will be hit harder (29% - 31%).

Mean summer temperatures are projected to rise across the UK. The likely outcome of this is more frequent heatwaves; these will affect the south of England to a greater extent than Northern Ireland.

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Figure 1. Climate projections for Northern Ireland under medium and high emissions scenario

	High emissions scenario 2020s *	Medium emissions scenario 2020s *	High emissions scenario 2050s *	Medium emissions scenario 2050s *	High emissions scenario 2080s *	Medium emissions scenario 2080s *
Change in mean winter temperature	1°C (0.3°C to 1.7°C)	1.1 °C (0.5 °C TO 1.8 °C)	1.9°C (1°C to 2.9°C)	1.7 °C (0.9 °C to 2.7 °C)	2.9°C (1.7°C to 4.4°C)	2.3 °C (1.3 °C to 3.6 °C)
Change in mean summer temperature	1.2 °C (0.5 °C to 2.1 °C)	1.3 °C (0.4 °C to 2.2 °C)	2.4 °C (1.1 °C to 4 °C)	2.2 °C (1.0 °C to 3.5 °C)	4 °C (2.2 °C to 6.2 °C)	3.2 °C (1.7 °C to 5 °C)
Change in winter mean precipitation	3% (-3% to 10%)	4% (-2% to 10%)	9% (2% to 19%)	9% (2% to 19%)	18% (6% to 34%)	11% (2% to 24%)
Change in summer mean precipitation	-3% (-15% to 10%)	-5% (-17% to 7%)	-12% (-28% to 4%)	-13% (-27% to 3%)	-19% (-39% to 4%)	-15% (-33% to 3%)

* 50% probability level (10% to 90%)

Source: UKCP09, DEFRA

(www.ukclimateprojections.defra.gov.uk/content/view/1185/499 (for medium emissions))

(www.ukclimateprojections.defra.gov.uk/content/view/1273/499 (for high emissions))

Figure 2. Climate projections for South East England under medium and high emissions scenario

	High emissions scenario 2020s *	Medium emissions scenario 2020s *	High emissions scenario 2050s *	Medium emissions scenario 2050s *	High emissions scenario 2080s *	Medium emissions scenario 2080s *
Change in mean winter temperature	1.4 °C (0.6°C to 2.2°C)	1.3 °C (0.6 °C to 2.2 °C)	2.5 °C (1.4 °C to 3.8 °C)	2.2 °C (1.1 °C to 3.4 °C)	3.7 °C (2 °C to 5.7 °C)	3 °C (1.6 °C to 4.7 °C)
Change in mean summer temperature	1.5 °C (0.5 °C to 2.7 °C)	1.6 °C (0.6 °C to 2.7 °C)	3.1 °C (1.4 °C to 5.2 °C)	2.8 °C (1.3 °C to 4.6 °C)	4.9 °C (2.6 °C to 8.1 °C)	3.9 °C (2 °C to 6.5 °C)
Change in winter mean precipitation	7% (-3% to 20%)	6% (-4% to 19%)	19% (3% to 40%)	16% (2% to 36%)	30% (7% to 67%)	22% (4% to 51%)
Change in summer mean precipitation	-4% (-24% to 18%)	-8% (-26% to -14%)	-19% (-43% to +9%)	-19% (-41% to 7%)	-29% (-57% to 5%)	-23% (-48% to 7%)

* 50% probability level (10% to 90%)

Source: UKCP09, DEFRA

(www.ukclimateprojections.defra.gov.uk/content/view/1185/499 (for medium emissions))

(www.ukclimateprojections.defra.gov.uk/content/view/1273/499 (for high emissions))



3. The health impacts of climate change and what can be done

3.1 People

Extreme weather events, floods and higher temperatures can very directly affect people's physical as well as mental health and wellbeing.

Risk of death, injury, disease and mental strain

Strong storms and fast flowing flood waters create *an immediate risk of injury and even death*. If the floodwater is contaminated by sewage or chemicals it can also carry a risk of *infection or poisoning*. While official records have not tended to show major infection peaks after floods, a study of flooding in Lewes, Sussex in 2000 indicated an increase in self reported illness, ranging from skin and respiratory diseases to stomach upsets.⁹

Longer term, people affected by floods are at heightened risk of *mental health problems*. The Lewes study found that people in flooded homes had four times more psychological distress than people in unaffected homes. Similar increases in depression and post traumatic stress disorder symptoms among children have been reported internationally. Existing studies suggest that people from lower socioeconomic groups are at particular risk of mental distress, and extreme weather events can therefore exacerbate existing health inequalities.^{10,11} A report on the effects of flooding in Belfast in 2007-09 supports this, and indicates that among those affected, vulnerable groups such as lone parents, older people and people with a disability, are least able to deal with the aftermath.¹²

Floods also create considerable stress, which for those most severely affected can continue for many months. If the flood risk remains, the *stress can become chronic*; examples of this are outlined in the

Belfast study.¹³ Chronic stress, in turn, is a significant risk to health and increases the risk of coronary heart disease, among other diseases.¹⁴ The effect may be direct, or stress may lead people to adopt behaviours that increase the risk, such as smoking, excessive drinking or unhealthy diets.

Excess mortality and chronic illness complications

Changing temperatures are a health threat, as **overexposure to heat is a direct health risk**. Heatwaves, which the Department of Health in England define as periods with daytime average temperatures of 30 degrees and nighttime averages of 15 degrees, may occur more frequently, increasing the risk of *excess mortality*. During the heatwave in July 2006, a four per cent increase (680 excess deaths) in deaths was reported in England and Wales.¹⁵ The more serious heatwave in 2003 resulted in 2,000 excess deaths or 16% of all mortality in England during that period. In France, a serious, long heatwave that occurred at the same time in August 2003 resulted in over 14,000 premature deaths.¹⁶

Most deaths occur in the first days of a heatwave, as human physiology gradually adapts to changing temperatures. Increasing **temperatures of over 23°C are associated with excess summer deaths**, with higher temperatures being associated with greater numbers of excess deaths. At 27°C or over, those with impaired sweating mechanisms find it especially difficult to keep their bodies cool.

The risk for heat related mortality is, however, not solely linked to daytime temperature highs. **Warm and humid nights** can be a greater risk especially for people with underlying health conditions, as warm conditions disrupt the body's recovery functions normally undertaken at night. Most deaths are, indeed, related to *complications of cardiovascular or respiratory disease*, and relatively few are caused by directly heat related illness.¹⁷



Older people are most at risk from heat due to their physiology, as are **babies and young children**. **People with chronic disease** and **people who are less able to alter behaviour**, due for example to illness, are other key risk groups. Some medications alter the body's heat sensitivity, while sweating and dehydration also can affect the body's reaction to certain medicines, increasing the risk for health problems for people on these medications.¹⁸ High temperatures and sunlight in themselves can affect the **efficacy of medication**, which increases the need for public advice on appropriate medicine storage (in the majority of cases, out of sunlight and under 25 degrees Celsius).¹⁹

Heatwaves can therefore put **pressure on health care services**, and **increase hospital admissions**, in particular for vulnerable groups. During the 2003 heatwave in England, hospital admissions of people aged 75 and over in London increased by 16%, although overall hospital admissions across England rose by only one per cent.²⁰

Increased risk of skin cancer

Greater exposure to UV radiation increases the **risk of skin cancer**.²¹ Rates of melanoma, the most aggressive form of skin cancer, have trebled in Northern Ireland between 1984 and 2005, and male mortality from melanoma has also increased. Behavioural issues, such as increased sunbathing, are associated with this increase.²² Warmer, longer summers may encourage behaviour **that further increases exposure and risk**.²³ At the same time, **such changes may help encourage physical activity**, as conditions become more attractive.

Longer pollen and allergy season

Increasing temperatures will **extend the pollen season**, which will lead to increases in **respiratory related illnesses**.²⁴ It is also possible that the productivity of allergy sufferers at work will be affected, as they are exposed over a longer period.

Food poisoning

Warmer temperatures can also lead to an **increase in cases of food poisoning**. The current estimated increase is 4.5%, or about 10,000 cases per year UK wide, at a temperature increase of one degree.²⁵ Pests ranging from flies to rodents may increase in number and be more active throughout the year. Longer term, there may be an **increase in vector borne disease**, such as Lyme disease carried by ticks. This risk is currently estimated to be small, although estimation of potential disease patterns is difficult, as the spread of new vectors or diseases depends on land use and other factors as well as climate.²⁶

Reduced cold related deaths

On the positive side, warmer winters are predicted to **reduce cold related deaths and excess winter mortality**, which approached 1,000 in 2008/09 in Northern Ireland.²⁷ However, **rising fuel prices may lead to higher levels of fuel poverty**, which is a major risk to health and was calculated to affect 33% of households in 2006.²⁸ Longer term, dwindling fossil fuel reserves are likely to put ongoing pressure on prices.²⁹

What action can be taken to reduce health inequalities?

Flooding and extreme weather

Significant action is already being taken to develop **flood preparedness** in Northern Ireland, which will also protect health and wellbeing.³⁰ **Flood health risk assessments**, in particular when coupled with **identification of measures that reduce health impacts and in particular limit health inequalities**, can strengthen these emergency plans. The Department of Health in England emphasises that implementation of these measures is important, and stresses that this can involve better use of existing



measures, including greater collaboration across agencies.³¹ In August 2010, the Planning Service in Northern Ireland announced a review of *Planning Policy Statement 15: Planning and flood risk*, in recognition of new evidence around climate change and flood risk.

Ensuring access to ongoing support after flooding events, including physical and mental health care services, can significantly help reduce longer term health consequences. It is particularly important to focus on vulnerable groups and plan for specific support these populations may require, to ensure that flood preparedness contributes to tackling inequalities in health. In addition, **registries of extreme weather events and their impacts on health** can support future preparation and development of support systems, as well as aid research.³²

Heatwaves and higher temperatures

Continuing to ensure access to public information on the health impacts of heat, and ways to protect health and wellbeing, is one of the most crucial measures that can reduce **heat related illness and death**. This includes continuing information and education campaigns on the range of health impacts, including advice on staying safe in the sun, keeping cool and treating early symptoms of heat stress. It is particularly important that appropriate advice is proactively made available to vulnerable people, such as people with allergies, people with chronic disease and people using medication that increases sensitivity to heat.³³ Messages related to food safety and in particular safe transport and storage of food aimed at the general public are also important, as the majority of cases of food poisoning occur in households. One example of action could be putting our shopping in cool bags between the supermarket and the home during the summer. Social marketing models can be useful in identifying the most effective methods to communicate the messages; it is particularly important to consider the needs of people with literacy problems, as well as hard to reach groups.³⁴

Health promotion and information can be particularly effective when combined with **strategic level responses**, such as the Heatwave Plan described below. Vulnerable groups can benefit from further support, which highlights when to take action, such as the Healthy Outlook service, also described below. This can form part of **contingency plans** to prevent and deal with potential extra hospital admissions during heatwaves, which can be important to help staff and organisations cope.³⁵

Monitoring changes in vector borne disease and strengthening surveillance of infectious disease can help detect any potential increases and develop responses. The Department of Health in England recommends that surveillance systems should include monitoring risks to holidaymakers, including imported diseases. For example, a changing climate may lead to malaria spreading to popular tourist destinations, such as Florida.³⁶

Actions to reduce carbon emissions and mitigate future climate change, as well as reduce flood risk, also contribute to limiting the immediate health risks. These will be discussed below, in particular in relation to the built and natural environment.



Case study: The Heatwave Plan for England

The Department of Health for England operates an annual *Heatwave plan*, which is intended to reduce the risk and negative health effects from heat. The Plan is targeted at the entire healthcare system, but has a particular emphasis on hospitals and care homes. It consists of action at four levels, which also are coded using a traffic light system, to highlight severity of the situation. Implementation of the plan is compulsory for all healthcare bodies, managed by Strategic Health Authorities, and is done in close collaboration with the Met Office. The heatwave threshold varies regionally, but as a rule is defined as 30 degrees during the day and 15 degrees at night.

Level 1 (green) : All year planning and summer preparedness

- Long term planning: Improving heat resistance of buildings, for example through increasing trees and green space, installing water features external shading, reflective paint and improved energy efficiency
- Summer preparedness: identifying high risk individuals, monitoring temperatures, identifying cool areas and raising awareness among staff

Level 2 (amber): 60% risk of heatwave in 2-3 days

- Alert and readiness in the community: public media messages, increased advice to health and social care workers, systems to check on high risk people
- Alert and readiness in care homes and hospitals: monitor temperatures, prepare cool areas, ensure sufficient staffing, check on high risk people and ensure sufficient cool water and ice

Level 3 (amber to red): Heatwave reached in one or more regions

- Heatwave action in community: media alerts, looking out for neighbours, checking on high risk groups, reducing unnecessary travel, reviewing safety of public events
- Heatwave action in care homes and hospitals: monitor temperatures, maximise ventilation and external shading, ensure cool areas stay below 26 degrees, provide regular cool drinks

Level 4 (red): Heatwave for four or more days in two or more regions

- Emergency, if severe or prolonged heatwave affects other sectors than health

High risk groups include women over 75, living on their own and isolated, with severe physical or mental illness; people in urban areas living in south facing top flats and people affected by alcohol and/or over exertion. In care homes and hospitals, high risk groups are women over 75, frail, with severe physical or mental illness; people on multiple medications, and babies and young children.

For more information see the Heatwave Plan for England 2010 at http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_116029.pdf



Case study: The Healthy Outlook service

This service is provided by the Met Office, in partnership with health authorities in England and Wales, and is aimed at people with chronic obstructive pulmonary disease (COPD). The service includes automated alerts to patients, when weekly forecasts covering weather and virus patterns indicate there are particular risks to their health. There is a patient's pack and a clinician's pack, and the Met Office supports Primary Care Trusts and GPs to implement the service. GPs also get online feedback. An independent patient survey found that users found the service helpful; for example users said it encouraged them to make sure they had enough medication (81%), make sure to wear warm clothes outdoors (76%), monitor indoor temperature more closely (69%), and avoid unnecessary trips outdoors when necessary (66%).





3.2 Communities and social networks

A changing climate will shape communities, and is likely to have a particular impact on people's opportunities to meet with each other and socialise. This will affect individuals' mental wellbeing, and social wellbeing through shaping opportunities to maintain a sense of place, community and cohesion.

The key pathways that will influence health include:

Warmer temperatures - support for social life

Warmer and longer summers may indeed help people build stronger **social networks**, as warmer and drier weather **encourages people to meet up and spend time outside**. People may also be more likely to **engage in physical activity**, for example walking or playing in local green spaces, or swimming in local ponds, rivers and lakes, where they are available.³⁷

Floods and storms - major social stressor

Conversely, the increased risk of flooding and extreme weather is a threat to communities and in particular their mental and social wellbeing, as floods **disrupt normal social networks**. These impacts can be considerable, if damage to homes **forces people to relocate**, either long term for repairs or permanently. In some cases, this may affect the social structure of an area, which has significant impacts for the mental wellbeing of individuals and the overall social wellbeing of the community.³⁸ Such impacts can be particularly significant in established communities, where social bonds and networks are strong, as building new networks may take considerable time.

Floods also **block transport routes and access to crucial services**, including health care facilities and food stores. Such impacts were highlighted for example during flooding in late 2009 in Cumbria in England³⁹ and the south and west of the Republic of Ireland.⁴⁰ This can create crises with direct and immediate health impacts, in particular for **vulnerable groups who may depend on outside care and support**. Longer term, damage to infrastructure often complicates everyday life, which can add to the stress of dealing with a flood. A number of people may be severely affected, particularly if the flood makes them **anxious or reluctant to go out**.⁴¹

What action can be taken to tackle inequalities?

Flood preparedness and emergency plans typically involve evacuation and temporary shelter, which are important to protect people from immediate risks.

Prioritising vulnerable people, e.g. people who rely on domestic care packages or meals on wheels, and **informing clients** about these plans can help strengthen the community level response, and also alleviate potential anxiety.

Ensuring access to support following flooding is also important at community level. Measures focusing on supporting vulnerable groups can be particularly helpful, and prevent escalating inequalities. In addition, **community development** work can help build social capital in a community, which increases resilience among all resident groups.⁴²



Case study: Responding to flooding in Cumbria

Parts of Cumbria in northwestern England were affected by severe flooding in November 2009. The floods sparked a major community relief effort, which later resulted, for example, in the re-establishment of the Cockermouth Chamber of Trade, which had been disbanded as it had only three members. By May 2010, the Chamber had grown to 145 members from a wide range of sectors.

As a first step response, the grant managing body Cumbria Community Foundation established the Cumbria Flood Recovery Fund, which reached £1 million within ten days of the start of the floods. The fund provides financial support to households affected by the flood, primarily for flood resilience work, and also voluntary organisations that incurred costs by participating in the relief effort.

In addition, young people affected by the flooding were given priority in the county council's winter 2010 round of funding for youth projects. A multi agency Rural Recovery Group was also established to support farmers whose livestock or lands were damaged by the flood, and special grants were introduced to aid farmers with clearing flood debris.

Transport links were restored as a matter of priority, through collaboration between local and central government. Temporary footbridges were opened in Cockermouth and Workington within weeks, while construction of a temporary road bridge was completed by April 2010. A temporary rail station was established in Workington and public transport was increased to improve access to key transport and business hubs. School transport was arranged for children cut off from their local school. Local councils also chose to suspend schemes such as introducing on street car parking charges, and diverted the funding to bridge repairs.

By May 2010, flood warning systems were extended to another 3,000 households and businesses, and a flood register was set up in the region. Residents have been kept informed through regular bulletins, which included updates using Twitter and a text messaging service about help available to affected households in Cockermouth and Workington. Healthcare services prioritised mental health support; in Allerdale, a mental health service normally available only through GP referral was opened for self referral.

The Cumbria County Council also collates flood news and updates on its website, which provides more information on the Cumbria flood recovery at <http://www.cumbria.gov.uk/floods/floodsnews.asp>.



Case study: Research into the impact of flooding in Belfast

Commissioned by the Belfast Resilience Forum, the British Red Cross in Northern Ireland undertook a study of the impact of flooding on people in identified flooding 'hot spots' in greater Belfast in 2009-10. The study built on interviews with statutory and voluntary agencies, and emphasised interviews with people and households directly affected. It also aimed to highlight vulnerabilities and identify best practice in multi agency response models.

The study concludes that flooding can have a devastating impact and leave those affected with very significant practical and emotional support needs. It also highlights that older people, lone parents and people with a disability are particularly vulnerable and experience similar problems when flooded. Key recommendations are to strengthen early warning systems and improve people's ability to prepare, and build engagement with at risk and already affected communities to strengthen resilience and self help.

Examples of impacts found in the study include:

- Heightened anxiety and fear among people affected; constant vigilance; older people reluctant to leave homes as afraid will be unable to return
- Substantial costs not covered by the £1,000 hardship payment, e.g. extensive repairs, costs of living in temporary accommodation
- Inability to get house insurance or very high excesses of up to £5,000
- Lack of confidence in authorities, especially confusion about who to contact
- Strong resilience where neighbours help each other, weaknesses where social networks are limited

More information: Living in fear of the rain: the impact of recent flooding in greater Belfast, British Red Cross, April 2010. Available at www.informedprepared.eu/pages/multimedia/getdocument.aspx?id=3821.





3.3 Local economy

The local economy can find opportunities in a changing climate, but is at risk from floods and extreme weather.

Acting on climate change opportunity for new jobs and business sectors

Longer and warmer summers can in particular benefit the tourism industry. This includes businesses that offer outside leisure pursuits, as both local residents and visitors may be **more willing to spend time outdoors** in a changed climate, and potentially all year round.⁴³ There may also be other economic opportunities. Especially in the short term, **demand for cooling products may increase** in the summers.⁴⁴

Action to deal with climate change also involves business opportunities, in particular related **to improving the energy efficiency and climate resilience of buildings**. Entirely new jobs and business opportunities can be created in **local food production, green space management, renewable energy and related fields**.⁴⁵

Stock and financial losses key risk from floods

However, the local economy can also be put at risk due to climate change. Flooding and extreme weather events can **damage business property and stock**, resulting in **financial losses through disruption to business and potentially costly repairs and stock replacements**.⁴⁶ In rural areas, severe flooding may result in long term economic loss as **farmland is damaged and livestock is lost**, through disease, drowning, or lack of available fodder. Such effects were reported during severe flooding in Cumbria in England⁴⁷ as well as the south west of the Republic of Ireland in late 2009.⁴⁸ In Fermanagh around the same

time, farmers reported having to throw milk away as flooded roads made collection impossible.⁴⁹

In areas identified as high flood risk, **getting property insurance** has already been identified as a major issue⁵⁰, which may become more widespread if floods increase in frequency and/or severity. This is likely to harm the local economy, as the area will become less attractive to potential residents and investors.

In some cases, existing residents may **choose to leave**, exacerbating the economic downturn. In other cases, selling property in flood risk areas may be difficult or leave households facing negative equity, which **increases stress and with it the risk of ill health**. People from lower socio economic groups are particularly vulnerable in this situation, as they are less likely to have property insurance and are often unable to either strengthen flood defences or move.⁵¹ In Britain, it has also been found that **people from lower socioeconomic groups are more likely to live in flood risk areas than other population groups**. It has also been suggested that these groups are less well equipped to campaign for flood defence measures, compared to more affluent people and communities. An increased flood risk can therefore also **raise the risk of economic degeneration and deprivation**⁵², which is strongly linked to poor health and health inequalities.

What action can be taken to tackle inequalities?

At the level of individual businesses, **flood risk assessments** and **emergency plans**, including **flood defence strengthening** can help prepare for floods and prevent at least some losses. **Reducing the flood risk** through strategic, collaborative action is another key measure for prevention, which also has been identified as an essential component of improving access to insurance.⁵³ This includes **planning policy**, which ensures that construction in



high flood risk areas is highly controlled. In Northern Ireland, there is a specific Planning Policy Statement (PPS15) on Planning and Flood Risk, which advocates a precautionary approach and is intended to ensure new development is not exposed to a direct threat of flooding or increase flood risk elsewhere.⁵⁴

The economic opportunities associated both with adapting to a warmer climate and mitigating future climate change can help bring about new jobs, at all skill levels. Appropriate **training programmes**

as well as **small and medium business support programmes** can help maximise the benefits, by ensuring people have the skills to take up job opportunities and market new services that may arise.⁵⁵ Building these programmes to meet the specific needs of unemployed, economically inactive or low skilled people can also help reduce inequalities in health, by improving employability and access to employment. This directly benefits health by raising household income, and can also boost mental health and wellbeing by strengthening self esteem.

Case study: Examples of developing new skillsets and business opportunities

Colleges and universities in Northern Ireland have identified the potential for new skills and technologies, and a number of training opportunities have been developed over recent years. The South West College (and the constituent Institutes of Further Education which merged to form it in 2007) has been one of the early adopters, and offers the only **accredited wind turbine installers course** in Northern Ireland. Plumbing students are trained in **installing biomass boilers** and the College offers a **Foundation degree in Rural Sustainability** in collaboration with Queen's University of Belfast.

The Innotech Centre at South West College supports the development of new business opportunities, through research and development and technical support and transfer; one of these projects includes **working with and supporting local farmers to increase coppice willow production** and supporting local businesses to utilise biomass energy. The College has also run an **Environmental Entrepreneurs** course aimed to widen the knowledge and skill base of local businesspeople.⁵⁶

Queen's University of Belfast has established a cross disciplinary Institute for a Sustainable World, which aims to be an internationally recognised centre of excellence in education and research that will provide solutions required for one world living.⁵⁷ The university also offers a **MSc in Sustainable development and leadership** and a **MSc in Rural Development**. In partnership with the Rural College, Queen's offers an **MSc in Effective Management for Sustainable Development**.

In the **University of Ulster**, the School of the Built Environment is embedding teaching on sustainable development within all courses within the school. All courses in year one take a module on communicating sustainability and thereafter specific courses build on this. For example, final year environmental health students in the environmental protection module have sustainable development running throughout the module.



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RAFAEL: From Gate to (*Patient's*) Plate!

Procuring food locally can increase the proportion of fresh, local and sustainable food in the health system. It can also help local rural economies retain a larger share of the retail price (Local Multiplier Effect) within the community compared to global food systems, delivering potential economic benefits to the locality. The increase in economic activity and employment can as a result reduce the levels of emotional ill-health among rural communities.

The RAFAEL project aims to increase the proportion of fresh, local and sustainable food onto patient and client menus and ultimately within the public sector in general. Through empowering local producers and processors to respond to invitations to tender from the Health Service, RAFAEL has increased the amount of local, fresh and sustainable food onto patient and staff menus in Western Health and Social Care Trust facilities and increased the value of contracts to this sector of the economy facing increasing economic and social uncertainty.

RAFAEL has found that 60% of local businesses do not contract with the Health Service due to 'lack of information on the process' and perceptions of complicated tendering procedures. This presents a significant lost opportunity to business in the rural economy given the fact that Health Service in NI contracts £23Million of food per annum. A recent Inquiry by the NI Assembly suggested that DHSSPSNI procures more than £702M of goods and services on an annual basis, representing a significant contribution to income and employment throughout Northern Ireland. Hosting 'Meet the Buyer' events has empowered businesses within the supply chain by highlighting the extent of contracts (provided by relevant Trust); what is involved in completing tenders and how to access support to complete the tender (BSO Procurement and Logistics Service); and how to access any financial support necessary to bring their business in line with the tender criteria (Department of Agriculture and Rural Development).

Outputs to date include the recent announcement of £13M of contracts through the RAFAEL programme. Contracts have been secured to four local suppliers of fruit and vegetables worth £3.6Million. One local supplier who had no contracts with the public sector gained a share of £270,000 contracts in the Pilot Phase and this rose to almost £1Million contract over three years in the fruit and vegetable contract. This resulted in at least 9 new jobs to the economy in a socially and economically deprived area.



3.4 Working, shopping, moving, learning

Everyday activities will be influenced by a changing climate, especially during acute crises such as floods. This may change established travel routes and service use patterns, and shape health and wellbeing by affecting access to jobs, services and people. Heat will affect learning in schools and productivity at work, and can exacerbate poor performance, which limits future opportunities.

Blocked roads and disrupted services, key threat from floods and storms

Flooding and extreme weather events will have the most significant impact, as water or fallen trees may **cut electricity supplies and block roads**, which in turn can have serious consequences. In the immediate aftermath, **emergency services may be delayed or unable to reach people in need**, and access to other key services, including health care, schools and food stores, may also be cut. In some cases, the disruption may go on for some time. In March 2010, a snowstorm in Northern Ireland that brought down electricity poles as well trees cut electricity to over 100,000 households, some of which went without power for several days.⁵⁸ In some instances, flooding has **forced hospitals to evacuate or close wards**, including A&E departments.^{59,60}

The impact of this can be **serious for vulnerable groups**, in particular older people who are more likely to depend on family, friends or professionals coming in to provide care and practical support, and who are also

most vulnerable to the impact of cold. Older people are also more likely to live in bungalows or ground floor flats, which can increase their overall vulnerability to flooding.⁶¹ For children and young people, a flood or powercut may have particular consequences if it occurs at a crucial point in the school year, such as during exams. People on lower incomes may feel a considerable impact just from a longer powercut that results in lost frozen and chilled food.

Longer term, **cleanup after flooding is likely to disrupt everyday activities**, and may also prevent people from working for a period of time. People who are able to work may face **additional stress from the burden** of dealing with the cleanup on top of working, and there is some evidence that this burden often falls on women.⁶² **Access to services can also be affected** where these premises have been directly affected. For example, in flooding in Lewes in Suffolk in 2000, a GP surgery was flooded and most of the patients' notes were destroyed.⁶³ Swimming pools and leisure centres are other facilities where clean up may require long term closures that affect people's everyday lives.

Heat – a disruption to everyday life

Warmer temperatures will also influence everyday activities. Outdoor workers are a particularly vulnerable group, as they may have **limited opportunities to seek shelter** from sunshine and heat in the summer.⁶⁴ Higher temperatures within buildings can also affect **learning in schools and productivity in workplaces**.⁶⁵ Ways of dealing with this key issue will be discussed in more detail below in relation to the built environment.

On the positive side, warmer temperatures may **encourage people to walk and cycle more**, which has health as well as environmental and economic benefits. In particular, **increased levels of active travel** have been identified as possibly the **best way to tackle obesity**, which is related to sedentary environments and lifestyles, as well as changing



diets. Obesity, in turn, is a major risk factor for serious diseases including heart disease, type 2 diabetes and some cancers, and creates a considerable burden on the healthcare system.⁶⁶

At present, over 80% of all journeys in Northern Ireland are by car, which in itself contributes to climate change⁶⁷; nearly a quarter of carbon emissions in Northern Ireland are from transport.⁶⁸ **Increased active travel therefore directly contributes to tackling climate change.** In addition, it can **reduce congestion and wear on roads**, which has economic benefits to employers as well as the public purse.⁶⁹

What action can be taken to tackle inequalities?

As previously stated, **flood risk assessments, emergency plans and measures to reduce flood risk as well as health risks from floods** can significantly help prepare communities for dealing with disruption, including by developing **alternative service delivery mechanisms** such as volunteers delivering meals. Focusing on the needs of vulnerable groups, such as low income families and older people in high flood risk areas, in all areas of work can contribute to delivering added benefits through tackling inequalities in health. In relation to the latter, **community development** work, including volunteering or time banks, can help strengthen resilience and reduce the potential isolation of the most vulnerable people. **Public information** on how to prepare for flooding, for example by stocking up on non perishable foods and storing vital documents upstairs or in top cabinets, can also be very effective in reducing negative impacts. Both areas of work were key recommendations in a British Red Cross study of the impacts of flooding in Greater Belfast in 2007-09.⁷⁰

Improving opportunities to walk and cycle is important to maximise the potential for behaviour change. This includes improvements to infrastructure and also incentives for behaviour change. Examples

of measures that can encourage modal switch are incentives for car sharing, 'loyalty' discounts on public transport and demonstration projects, for example cycling proficiency schemes. At organisational level, ensuring appropriate changing facilities can help encourage active travel, while walking groups, staff health checks and similar initiatives can also offer added benefits of better workplace health and wellbeing.

Green travel plans offer a comprehensive framework for increasing active and sustainable travel in individual organisations or workplaces. The case study below outlines one example from England. In Northern Ireland, the Travelwise team in the Department for Regional Development supports organisations in developing travel plans and sustainable travel solutions.⁷¹

Strengthening access to public transport can also support active travel, as journeys usually involve walking at either end, and can directly contribute to reducing emissions and congestion. In addition, **greater use of technology**, such as real time public transport information systems and online carsharing pools, can encourage sustainable travel, and indeed reduce the need to travel.⁷² Overall, a greater emphasis on sustainable travel can contribute to health both directly, and indirectly through environmental and economic benefits.

Improving access to green space can also encourage physically active travel, as it has been shown that people are more active for longer in green space.⁷³ Street trees, green verges and similar measures can be a low cost way of increasing green space in urban areas, and can also make the urban space more attractive and inviting to residents as well as visitors, while reducing flood risk.⁷⁴ However, appropriate **management and maintenance** is important to achieve benefits, as poor quality green space can create fear and stress, as well as invite anti social use with associated problems.⁷⁵



Mixed land use integrates residential development with business and office use. It can therefore **reduce the need to travel**, which contributes to reduced carbon emissions and helps mitigate future climate change. At the same time, fewer trips also reduce demand for fuel. Appropriate planning of complex sites such as hospital complexes can contribute to these aims.

By shortening distances between key destinations, mixed land use can encourage and support active

travel. This type of land use also offers greater opportunities for social interaction, which is important for mental wellbeing and also underpins social cohesion and social capital. In addition, mixed land use combined with improved active travel opportunities and shorter distances can improve access to jobs, by simplifying transport. This can strengthen health equity, as transport can be a barrier to employment especially for people from lower socioeconomic groups, who are less likely to own a car.

Case study: Royal Hampshire County Hospital Green Travel Plan

The Royal Hampshire County Hospital in Winchester serves a population of about 350,000 in mid Hampshire, England. It is the main site of Winchester and Eastleigh Healthcare NHS Trust, which employs around 2,000 staff in the complex. In 2008, the Green Travel Plan *Saving Carbon Improving Lives* was adopted by the Trust, to encourage and incentivise the use of greener travel modes to reduce the Trust's environmental impact.

A key driver and objective for the Plan is also to improve accessibility to the hospital for all users and reduce local congestion. Transport problems have led to missed appointments and have been identified as a barrier for patients to choose the hospital.

The travel plan focuses on staff working core hours, i.e. Monday to Friday 9am to 5pm, as limited public transport poses challenges for shift workers. It covers a range of areas, from initiatives to encourage people to leave the car at home to marketing and information. A 'carrot and stick' approach has been introduced successfully: for example, staff working core hours living less than one mile from the hospital are not entitled to a parking space. Other staff working core hours get parking four days out of five – except for staff who carshare (i.e. switch two parking permits for one), who can park for free all week. Work related journeys are discouraged, and home working is allowed. More effective use of ICT is suggested as a solution in these cases, and it is noted this will save both time and mileage expenses. Staff who buy quarterly or annual public transport seasons tickets are eligible for salary advances and a discounted ticket price, and information about alternative modes has been improved, there is for example a public transport journey planner in the catering department. Facilities for walkers and cyclists are available in key locations across the site.

Further information is available through the Winchester and Eastleigh Healthcare NHS Trust at <http://www.wehct.nhs.uk/>. In late 2009, the Trust introduced a similar travel plan for its other main site, the Andover War Memorial Hospital in Andover.



Case study: Belfast Resilience Forum

The Belfast Resilience Forum was established in 2004 to promote and encourage organisations to develop an integrated approach to planning for emergencies and major incidents in the Belfast City Council area. It was set up because of the need for a co-ordinated approach to emergencies in addition to the response provided by individual organisations.

The strategic direction for the Forum is set by senior representatives from key organisations who sit on the Belfast Resilience Steering Group. At the time of writing in August 2010, this group was chaired by Assistant Chief Constable Finlay from the Police Service of Northern Ireland (PSNI). There is a high level of commitment to the work of the Forum with representatives from more than 50 organisations from across the public, private and voluntary sectors voluntarily giving their time to participate.

The Forum has ten working groups bringing a range of organisations together to discuss particular topics. In recognition of the issue of flooding in Belfast, in late 2009 a Flooding Working Group was established. The group is attended by representatives from the Met Office, Rivers Agency (Department of Agriculture and Rural Development), Roads Service (Department for Regional Development), NI Water, NI Fire and Rescue Service, PSNI, Belfast City Council, Eastern Group Environmental Health Group, Department for Social Development, Northern Ireland Housing Executive and Red Cross. The group's initial work was to produce a local version of the Local Government Emergency Management Group's (LGEMG) Flood Plan template. This plan documented how the organisations would work together before, during and after a flooding incident in Belfast. This plan was produced in consultation with other key organisations including the Public Health Agency and Belfast Health and Social Care Trust.

The group are now working to develop practical community preparedness plans in areas of Belfast which have been affected by flooding in the past. They are also addressing some of the recommendations made by the recent Red Cross research 'Living in Fear of the Rain'. This research focused on identifying the needs of vulnerable people in relation to flooding.

For more information on the Forum, see www.belfastresilience.co.uk



3.5 The built environment

Buildings, streets and other infrastructure will come under considerable pressure in a changing climate, which will increase risks to human health and wellbeing. The impacts can be controlled through land use planning as well as service planning.

Warmer temperatures demand good infrastructure

With higher average temperatures, the **resilience of buildings** in particular becomes increasingly important. Many current buildings may not be designed for warm summers and can therefore become **uncomfortably or unsafely warm indoors**. In urban areas, the urban heat island effect may increase as the greater total surface area traps more heat, further heating up the environment. This increases the **demand for mechanical cooling**, which increases **maintenance costs**. The **increased electricity demand also contributes to further climate change**, as well as potential electricity price pressures.⁷⁶

Drier summers can, importantly, contribute to risks associated with flooding. This is primarily because **low rainfall reduces base sewer flow**, which **increases the risk of blockages and consequently the potential for sewer overflow** in the event of heavy rainfall.⁷⁷ It is notable that the projected changes for Northern Ireland involve drier summers than at present, followed by wetter winter seasons, and also more frequent, often unpredictable heavy rains and storms.⁷⁸

Living conditions of lower income groups at risk in floods

The impact of floods on the built environment has been discussed in some detail in previous sections. While it is possible to **incorporate flood defences in building design**, or **retrofit them** for example as part of repairs following a flood, the costs can be significant. A detailed report of options available in 2007 indicated a **cost of £3,000-£10,000 per domestic property**⁷⁹, which is likely to be prohibitively expensive in particular for households on lower incomes. As noted in the Local economy section, households often cannot get insurance or are quoted very high excess sums.⁸⁰

This **increases the vulnerability of low income groups**, and may lead to **poorer physical and social conditions for low income households affected by flooding**. Poorer households are more likely to be forced to live in partially repaired housing, which increases health risks associated for example with damp. Families may also choose to house children elsewhere to protect them from such harm, which in turn is **harmful to the mental wellbeing of all family members**.⁸¹ In addition, as lower income households are more likely to rely on local support networks, impacts on their mental and social wellbeing may be particularly severe should they need to relocate permanently.⁸²

What action can be taken to tackle inequalities?

Improving energy efficiency in buildings is a key measure for protecting people from heat in summer and damp in winter. In addition, energy efficiency is a crucial measure required to reduce energy demand, which mitigates future climate change and preserves fossil fuel reserves. Energy efficient buildings are also cheaper to maintain, which contributes to tackling fuel poverty as well as efficient use of public resources. Considerable savings can be achieved through



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relatively simple measures, such as ensuring that electrical equipment and lights are switched off when not in use, and equipment used is as efficient as possible.

On a global scale, **renewable energy** is one of the most central measures that can mitigate future climate change. Renewables are also key to strengthening energy security, both in terms of reducing reliance on dwindling fossil fuel reserves and fuel imports. The island of Ireland has significant renewable energy potential; an All Ireland Grid Study indicated that 42% of the island's energy needs could be generated from renewable sources.⁸³ The most significant resource overall is wind, and there may be considerable potential for geothermal and tidal energy, which are more novel technologies.⁸⁴ At a smaller scale, solar power (photovoltaic and thermal) and biomass can be viable and valuable both environmentally and financially. Biomass can generate economic opportunities, in particular as a diversification measure for farmers and rural communities. In addition, for example coppice willow supports soil recovery.⁸⁵

Larger organisations that are in a position to consider renewable energy generation can significantly help reduce the risks of climate change to health by integrating renewables. There may also be added benefits, as outlined in the Antrim Area Hospital wind energy project in section 3.7.

Building design also plays a major role in dealing with climate change. For example appropriate use of passive heating and natural cooling can significantly contribute to making a building comfortable for users in all temperatures, while improving energy efficiency.⁸⁶ The importance of design is now recognised in building standards, in particular the BREEAM (Building Research Establishment's Environmental Assessment Method) standard, described in more detail in the case study.

For existing buildings, **retrofitting** to improve energy efficiency and climate resilience may be

necessary to deal with climate change. The World Health Organization (WHO) outlines a number of key actions to 'climate proof' buildings, which include external shading, energy efficient construction and energy efficient cooling facilities.⁸⁷ The Sustainable Development Commission has also highlighted the importance of retrofitting energy efficiency measures, from improved insulation to renewable energy systems, as up to 60% of the existing building stock is projected to be in use 50 years from now.⁸⁸

Specific **flood defences** play a key role to protect communities and property level protection is also likely to be required for at risk buildings. In addition, however, resilience can be strengthened through other measures that can directly contribute to health and health equity and also have other benefits, which can make these measures particularly cost effective. For example, **trees and green space act as sustainable urban drainage**, which can significantly reduce localised flood risk. They also provide natural cooling and shade, absorb pollutants and create an attractive environment that encourages physical activity and social interaction.⁸⁹ **Maintaining existing and promoting new green space** can therefore significantly contribute both to improving health and wellbeing, and directly dealing with climate change. In addition, there is evidence that property values are higher in areas close to green space⁹⁰, while businesses may be keen to locate in pleasant environments that attract customers.⁹¹



Case study: BREEAM

BREEAM (Building Research Establishment's Environmental Assessment Method) is the leading and most widely used environmental assessment method for buildings. It sets the standard for best practice in sustainable design and has become the de facto measure used to describe a building's environmental performance.

BREEAM addresses wide-ranging environmental and sustainability issues and enables developers and designers to prove the environmental credentials of their buildings to planners and clients. It:

- uses a straightforward scoring system that is transparent, easy to understand and supported by evidence-based research
- has a positive influence on the design, construction and management of buildings
- sets and maintains a robust technical standard with rigorous quality assurance and certification

Since October 2008 the Department of Health, Social Services and Public Safety has required all new Health and Social Care facilities to have an Excellent BREEAM Healthcare rating as measured following one year in operation.

As with the all other BREEAM assessments, BREEAM Healthcare is based on a 100 credit assessment scale covering nine topic areas: management; health and wellbeing; energy; transport; water consumption; materials; waste; land use and ecology; and pollution. Over 70% of the credits are either directly or indirectly linked to climate change issues.

Case study: Social Care Facilities

The recently completed Portadown Community Care and Treatment Centre (CCTC) has addressed design issues linked to climate change such as pedestrian access, making the use of public transport more attractive and so reducing car use; using the building's orientation also allows for passive heating but with appropriate design features to minimize summer overheating; the use of extensive daylight penetration to reduce energy consumption through reducing the need for artificial lighting and the incorporation of natural ventilation as opposed to the use of electrically driven ventilation plant and the provision of a biomass boiler.

Other CTCCs have used active design elements including the use of both proven and innovative environmental technologies such as use of renewable energy sources such as geothermal heating, biomass boiler plant, solar hot water, rainwater recovery and wind power generation.



3.6 The natural environment

The natural environment will be fundamentally affected by climate change; for example many species may disappear, while the habitats of others change. A number of the impacts on biodiversity will also have a clear impact on health and wellbeing.

A changing climate is a **major threat to biodiversity** and may result in existing species disappearing and new ones settling in. For example, warmer seas around Northern Ireland may become an **unsuitable habitat for salmon**, which thrives in cold water. Crops may suffer from potential **greater pest activity**.⁹² For humans, increased activity by flies and rodents is likely to increase nuisance, although it is unlikely that it will affect the spread of disease, at least in the near future.⁹³

Warmer temperatures – win for food production, environmental quality at risk

On the positive side, warmer and longer summers can support **local food production**, by increasing yields and allowing new crops. This, in turn, can **improve food security** in Northern Ireland and **strengthen access to locally produced food**. However, as summers are also predicted to become drier, this may limit potential gains. For example the potato is sensitive to drought and yields may suffer. On the other hand, flooding and extreme rainfall can also harm crops and farmland⁹⁴; as discussed in the Local economy section.

Warmer and sunnier summers can also lead to **poorer air quality**. This is primarily because concentrations of **ozone increase on hot, sunny days**. This happens

because ozone is produced when other pollutants (volatile organic compounds and nitrogen oxides), so called ozone precursors, react with sunlight. A review of the likely health effects of climate change in England estimated that rising ozone concentrations will lead to a **15% increase in attributable deaths and hospital admissions due to respiratory disease**. Ozone concentrations are predicted to rise due to climate change itself, although concentrations are also affected by changes in emissions of precursors.⁹⁵

Apart from air quality, higher temperatures can affect the **quality of water**, including rivers and lakes as well as drinking water. For example **pathogens from sewage or animals may live longer**, and **algal blooms may occur more frequently**.⁹⁶ The latter is a particular risk in waterways experiencing eutrophication, due to high depositions of nitrogen and phosphorus – examples of waterways at risk include Lough Erne and Lough Neagh. Over longer dry spells, effluent and pathogen **concentrations in rivers can rise rapidly as flows fall**, especially in rivers that drain impermeable catchment areas, where natural groundwater inflows are limited. Groundwater quality can also be at risk, since during a drought 'short circuits' open in the ground, allowing surface water to reach down relatively unfiltered.⁹⁷ At the same time, **drought can limit the availability and quality of water**, as stocks in reservoirs start falling. Higher temperatures may **affect the purification process for drinking water**, which increases the need for close supervision of water treatment plants. Also in this case, private supplies are at greatest risk.⁹⁸

Water quality at risk from floods and storms

Floods and extreme weather events can also threaten water quality. The greatest risk is **contamination with sewage**, primarily through sewer overflows. Heavy rainfall can also lead to **contaminants leaching into surface water**, including drinking water reservoirs, although this will be diluted through the rain itself. This risk is greatest for private supplies, surface water supplies and groundwater wells, as heavy rainfall



can affect water flows: for example, it is possible that runoff from a cattle grazing field contaminates a nearby well.⁹⁹ The risk for infections from contaminated water therefore exists also in Northern Ireland.

What action can be taken to tackle inequalities?

Monitoring air and water quality and **water borne disease** will become particularly important in a changing climate. The Department of Health in England emphasises that effective implementation of existing measures and protocols to protect people is particularly important in acute phases of flooding and heatwaves.¹⁰¹ Meanwhile, **sustainable urban drainage systems** can help reduce flood risk, and also limit effluent runoff from impermeable surfaces. As noted above, **trees and green space** in general can effectively perform this function while also improving air quality.¹⁰²

Increased green space in urban areas can also support biodiversity, which in turn offers both recreation and job and economic opportunities. Where green space is allocated for **allotments or community gardens**, this can also support urban food production as well as offer opportunities for building social networks.¹⁰³ Active travel, as outlined in the previous section, can also help reduce risks related to the natural environment, by contributing to mitigating climate change.

The role of monitoring vector borne disease among humans has been referred to in the Physical health section. **Monitoring vector borne disease in farm animals and agricultural crops** can also support health, by contributing to viable domestic food production. Globally as well as locally, **climate monitoring and research** can help develop resilience in the agricultural and forestry sectors.¹⁰⁴





Case study: Demonstration Programme of Community Food Initiatives

This all Ireland project, funded by *safe food* and launched in January 2010, is specifically intended to tackle health inequalities and improve access to healthy, affordable food for people on low incomes. It is the first of its kind across the island.

The project provides funding to seven community food initiatives, all of which seek to end food poverty and improve access to healthy food in disadvantaged communities, including improving people's understanding of healthy food and eating healthily on a low budget. Among initiatives that are receiving funding is the East Belfast Healthy Eating Education Programme, which will provide health and diet sessions and cookery demonstrations to residents and ex residents on how to plan and prepare healthy food on a low budget. Other examples include Dundalk's 'The Food Garden Project' developing a community garden to support very marginalised and vulnerable individuals to grow, prepare and cook a range of healthy organic fruit and vegetables throughout the year; 'Limerick Seed to Plate Project', a community gardening project promoting healthy eating and organic home-gardening practices.

Three of the projects are located in Northern Ireland; East Belfast Healthy Eating Education Programme and Footsteps Women's Centre Building a Transition Community.

The projects will be managed at a local level by Healthy Food for All, an all-island multi-agency initiative seeking to promote healthy food for low-income groups. Each community food initiative will receive funding annually over a period of three years to set up, manage and sustain their project.

For further information, see Healthy Food for All at www.healthyfoodforall.com/demonstration_programme.htm and *safe food* at <http://www.safe food.eu/en/News1/20101/New-Funding-Awarded-to-Community-Food-Initiatives-across-the-island-of-Ireland-in-a-bid-to-help-tackle-Food-Poverty-/>.





3.7 The local impact of global climate change

Global changes related to climate change will affect health and wellbeing in Northern Ireland through higher living costs and potentially changed migration patterns. In addition, fossil fuel production is likely to have peaked, which will put pressure on energy prices, as remaining reserves become increasingly costly to extract.

Falling energy reserves increase risk of fuel poverty

Climate change can affect the demand for energy, but more importantly, fossil fuel production is likely to have peaked and **reserves will begin to dwindle**. At the same time, remaining reserves are in more difficult places, making them costlier to extract. This is very likely to lead to **rising energy prices**, which in turn increases the risk for **rising fuel poverty**, which is a significant health risk, in particular for older people, children and people with underlying health conditions. Cold and damp homes increase the risk of **respiratory tract infections**, especially among children. Cold can also lead to **complications in cardiovascular disease**, at worst increasing the risk of a heart attack.¹⁰⁵ As with heat, this is the most common reason for deaths related to cold. It is notable that climate change is likely to mean more unpredictable weather patterns and therefore cold spells will continue to occur. Wetter winters may also affect **damp in buildings**.

Fuel poverty also affects the lifetime opportunities for children. Most significantly, children living in cold homes often have limited access to a warm, quiet study environment and are therefore **less likely to do well at school**. Some children and young people may also choose to socialise outside, as they have no warm, private space at home.¹⁰⁶ As low income families are most likely to be fuel poor, these impacts can **compound health inequalities and risks associated with low income and poorer living conditions**.

The cost of energy is also likely to affect living costs in general, as manufacturing and transport are energy intensive and currently rely primarily on fossil fuels. Overall, **rising living costs** will have **a disproportionate impact on the lowest socioeconomic groups**, as they may already find it difficult to make ends meet. In addition, for example **more expensive transport** may mean that **job opportunities some distance away become less viable**, increasing **benefit dependence** and affecting the health and overall life opportunities for people on the lowest incomes.¹⁰⁷

Food production at risk – rising prices concern for lower income groups

A changing climate also affects food production. In particular **drought** is a threat to global food production, as it **reduces yields as well as available arable farmland**. This is a major issue, as drought also reduces the amount of water available for irrigation and food production, while food production is increasingly water and energy intensive.¹⁰⁸ For example, global as well as UK meat consumption has increased significantly, and this trend is expected to continue especially in countries like China and India. This is of concern, as the production chain for one 150 gram beefburger requires 2,400 litres of water¹⁰⁹, and it has been calculated that producing one kilogramme of beef has the same carbon footprint as driving a car for 240 kilometres.¹¹⁰



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Floods can also damage farmland for some considerable time, while storms and heavy rainfall can damage crops and even destroy harvests. This, especially when combined with droughts in key food producing areas, **threatens food security**, and also **creates price inflation**. For example, droughts in key grain producing regions in recent years have been one contributing factor in soaring global rice and wheat prices.¹¹¹ Although raw material prices only account for a small proportion of food prices, any longer term falls in crop yields are likely to increase price pressures.

Soaring food prices may **affect people's diets**, as fresh foods often are more expensive than other groceries, especially processed foods. This can lead to **poorer nutrition**, which is particularly problematic for children, as both their physical and intellectual development are affected.¹¹² As processed foods often are high in sugar, salt and/or fat, this may also **contribute to obesity**.¹¹³ However, as energy costs rise, also the cost of processed food is likely to rise.

People in lower socioeconomic groups are particularly **at risk from rising food prices due to lower disposable income**.¹¹⁴ In 2007, food accounted for 15% of total expenditure in households in the lowest (equivalised) income group in Britain, compared to six per cent in the top income group. People in lower socioeconomic groups are also less likely to eat a lot of fruit and vegetables.¹¹⁵ Food related issues may therefore be another way in which climate change can exacerbate existing health inequalities.

Migration – major but unpredictable issue

Finally, there is potential for changes in **global migration patterns**, resulting from **climate change impacts elsewhere in the world**. It is difficult to estimate potential numbers of people affected, but it can be noted that single storms can displace up to one million people, as Hurricane Katrina did in New Orleans in 2005. In many places, existing issues such as poverty and social inequality, limited investment in defences and adaptations, and limited capacity for

emergency planning **exacerbates the vulnerability of populations to climate shocks**. Population growth is likely to add further pressure to many of the most vulnerable regions. However, **economic circumstances may limit** many people's ability to migrate or prepare for climate related risks.¹¹⁶ Globally as well as locally, climate change is likely to hit those already the most vulnerable the hardest, by adding to their vulnerability and deprivation.

What action can be taken to tackle inequalities?

Improving energy efficiency can help tackle fuel poverty, by reducing the demand for fuel in a household. The impact at societal and global level is discussed in detail in the Built environment section, but it can be noted that energy efficiency can lower energy demand, which may help control price pressures. For larger organisations that manage estates and newbuild of facilities, **exploring renewable energy** sources may be a viable option to improving energy and resource efficiency.

A carbon footprint assessment of the NHS in England found that 60% of total carbon emissions were attributable to procurement of goods and services, while NHS England was responsible for 30% of carbon emissions across the public sector. This highlights that **procurement** can significantly contribute to tackling climate change in a number of ways. Utilising **local products** where possible can be particularly effective, not least because this reduces transport costs as well as emissions. Favouring local producers can also **increase the viability of local business**, including **local food production**.¹¹⁷ This, in turn, can contribute to food security.

Encouraging and supporting people and communities to establish gardens can also contribute to healthier, more affordable and sustainable food production. Gardening can, moreover, support health and wellbeing in other ways. For example, it

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can increase levels of physical activity. Community gardens offer important opportunities for social interaction as well as building social capital, which strengthens mental and social wellbeing.¹¹⁸ Growing food also requires and builds specific skills, which can help people access jobs. Indeed, increasing local food production can create new, environmentally and economically sustainable jobs that are open to people with varying skillsets.¹¹⁹

Finally, **encouraging and supporting healthy diets** can, in addition to supporting health, concretely help mitigate climate change. This is primarily because healthy diets contain more fresh produce, in particular fruit and vegetables, and less processed foods, which are energy intensive to manufacture. From a climate perspective, diets heavy on meat and dairy are at present particularly problematic, since current production methods mean that these are the most water and energy intensive foods to produce. In

addition, producing grain for animal feed reduces the amount of arable land and cereal available for human food production. Grass pasture has a lower impact, and cattle can also convert grass more efficiently than grain into energy.

Cows also emit considerable amounts of methane, which is a more potent greenhouse gas than carbon dioxide.¹²⁰ It has been estimated that the annual amount of methane emitted by a herd of 200 cows is the same as the carbon dioxide emissions of a car burning 21,400 litres of petrol, or being driven for over 100,000 miles.¹²¹

Action to mitigate climate change may contribute to limiting global forced migration related to climate change. While it is difficult to predict how migration may affect Northern Ireland, **monitoring international migration** and developing existing **services for migrants** can help prepare for potential new inflows.





Case study: Transition Towns

Transition Towns are a response to the joint challenges of climate change and the dwindling fossil fuel reserves, or 'peak oil' – and increasing economic volatility. The movement originated in Kinsale in the Republic of Ireland in 2005, but has been developed in England, specifically Totnes in Devon.

Transitioning builds on the idea that reconnecting with the local community, including people, places and the localised economy, can help find solutions to the current environmental and financial challenges. Areas for action vary, but typically include food, energy, transport, health, wellbeing and economics & livelihoods. Involved individuals are encouraged to self organise to take action, on projects ranging from offering gardening training and establishing community gardens, lobbying for improved active travel opportunities to novel economic development models. Awareness raising is a key part of the initiative, and a required first step for communities seeking to join the formal networks.

The core principle of transitioning is a grassroots, bottom-up approach; the idea is that the community takes responsibility and organises to take action, in collaboration with authorities but not dependent on their lead. Relocalisation involves building communities and their social capital, developing local services and skills and strengthening the local economy, including local food production. In relation to the latter, Totnes and Lewes have introduced a local currency as a demonstration project of how consumers can support the local economy (the notes work exactly like sterling except they can't be banked but must be used or exchanged locally).

Ultimately, Transition Towns aim for energy descent, or transitioning from dependence on fossil fuels to a society using substantially less energy in more efficient and sustainable ways, with people and communities more connected to each other, healthier and happier. This is to be realised through Energy Descent Action Plans, which are intended to provide a joined up, collaborative roadmap for how to gradually reduce dependence on fossil fuels over a 15-20 year timespan.

A Formal Transition Network has been established to link and support communities that are committed to taking action on this triple challenge; Ireland (on an all island basis) and the US also have its own networks. In Northern Ireland, Omagh and Holywood are formal Transition Towns. Many other communities, including Whitehead and Belfast, are developing their own initiatives.

Further information is available at <http://www.transitionnetwork.org/> or <http://transitiontownsireland.ning.com/>.



Case study: Antrim Area Hospital wind energy provision

Antrim Area Hospital is an acute trust of 450 beds and is part of Northern Health & Social Care Trust. Spurred on by the public sector building energy reduction target, the Hospital investigated installing a wind turbine on site to provide energy.

Following a feasibility study, a wind study and an environmental impact assessment (EIA), planning permission for the project was given. From idea conception to installation took 3 years. The civil work started in autumn 2004 and the turbine was delivered in January 2005.

It took only three days to install and has been fully operational since 7th February 2005. The 40 metre high 660 kW Vestas V47 wind turbine is the largest at any hospital in the UK. It will generate an average of 1.2 million units of electricity per annum, which is used as base load replacement. It has the potential to provide enough electricity for the hospital during the night, and two-thirds of the power needed during the day, which would otherwise cost £90,000 a year. Even in low wind conditions the turbine is cost effective and the money that would have been spent on power is freed up for improved services for patients.

The turbine cost £497,000, of which 80% was a grant from the Government Central Energy Efficiency Fund. Without a grant it would take five years for the initial cost to be repaid (at 2005 energy prices).

The wind turbine has been a success and other hospitals across the UK are taking an interest in replicating what has been achieved at Antrim.

Benefits:

As well as cutting Antrim Area Hospital's energy bill, the project has also reaped the following benefits:

- * Reduces power generation waste
- * Benefits air pollution and climate change
- * No impact on biodiversity
- * Easy to return the site to how it was before.



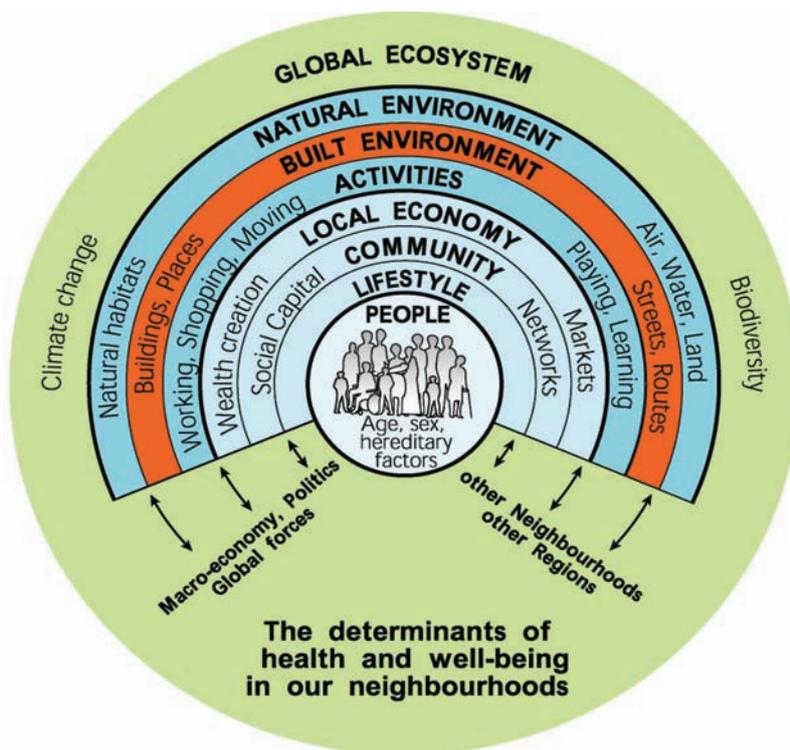
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Appendix 1

Figure 1 illustrates the major factors that determine health. The figure highlights that living conditions determine health, by shaping the choices people can make. In short, it illustrates that while lifestyle choices ultimately determine health, wider social factors crucially influence them. Climate change will influence these wider determinants, and therefore affect health indirectly as well as directly. The discussion in this publication is built broadly around the 'layers' of health determinants identified in this figure.

What the figure does not show is how differences in living conditions result in differential health outcomes. Health inequalities are defined as such differences in health, which are avoidable and therefore can be considered unjust. Striving for equity is not about ensuring that everyone has the same level of health, but about providing fair conditions that allow everyone to attain their full potential.¹²¹ As climate change is likely to have a considerable impact on living conditions, it will also become a major factor in relation to inequalities in health.

Figure 1. The determinants of health



Source: Barton & Grant 2006,¹²² drawing on Whitehead and Dahlgren 1990



Appendix 2

References

- ¹ WHO World Health Day 2008 key messages for health professionals, WHO Geneva. http://www.who.int/world-health-day/toolkit/whd2008_health_prof.pdf
- ² *Closing the gap in a generation* (2008). Geneva: World Health Organization, Commission on Social Determinants of Health. http://www.who.int/social_determinants/thecommission/en/
- ³ *Fair society, healthy lives: Marmot review* (2010). London: University College London. <http://www.ucl.ac.uk/gheg/marmotreview>
- ⁴ Met Office, www.metoffice.gov.uk
- ⁵ UK Climate Projections 2009 (UKCP09), <http://ukclimateprojections.defra.gov.uk/content/view/2225/528>.
- ⁶ *Climate change: dealing with the reality: Conference proceedings from a one day conference in January 2009*. Northern Ireland Environment Link, April 2009. www.nienvironmentlink.org/publications/conferenceproceedings.php
- ⁷ UK Climate Projections 2009 (UKCP09), <http://ukclimateprojections.defra.gov.uk/content/view/2225/528>
- ⁸ *Preparing for a changing climate in Northern Ireland*. SNIFFER, Edinburgh 2007. http://www.sniffer.org.uk/Resources/UKCC13/Layout_Default/0.aspx?backurl=http%3a%2f%2fwww.sniffer.org.uk%3a80%2fproject-search-results.aspx%3fsearchterm%3dukcc13&selectedtab=completed
- ⁹ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702
- ¹⁰ Few, R, M Ahern, F Matthies & S Kovats. *Flooding, health and climate change: A strategic review*. Tyndall Centre for Climate Change Research, November 2004. <http://www.tyndall.ac.uk/sites/default/files/wp63.pdf>
- ¹¹ *Addressing environmental inequalities: Flood risk* (2006). Environment Agency. http://geography.lancs.ac.uk/envjustice/downloads/SC020061_SR1%20report%20-%20inequalities%20%20flood%20risk.pdf
- ¹² *Living in fear of the rain: The impact of recent flooding in Greater Belfast* (2010). London: British Red Cross. www.informedprepared.eu/pages/multimedia/getdocument.aspx?id=3821
- ¹³ As above.
- ¹⁴ Zanstra YJ, Johnston DW. *Cardiovascular reactivity in real life settings: Measurement, mechanisms and meaning*. *Biological Psychology*. 2010, forthcoming, accessed at <http://www.ncbi.nlm.nih.gov/pubmed/20561941> 15 July 2010



Climate Change & Health: Impacts, Inequalities & Action

¹⁵ *Heatwave Plan for England*. Department for Health, London: June 2009 http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_099015

¹⁶ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

¹⁷ *Heatwave Plan for England 2009*, Department of Health.

¹⁸ *Heatwave Plan for England 2010*, Department of Health. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_116029.pdf

¹⁹ Crichton, B *Keep in a cool place: exposure of medicines to high temperatures in general practice during a British heatwave*. *Journal of the Royal Society of Medicine* 97(7): 328-329; <http://jrsm.rsmjournals.com/content/vol97/issue7/>

²⁰ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

²¹ See eg. *Heatwave Plan for England 2010*, Department of Health. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_116029.pdf

²² Smith A, & Gavin A. *Care of Patients with Malignant Melanoma of Skin in Northern Ireland 2006*. Northern Ireland Cancer Registry, Belfast 2008. <http://www.qub.ac.uk/research-centres/nicr/FileStore/PDF/Fileupload,119767,en.pdf>.

²³ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

²⁴ As above.

²⁵ Griffiths, J et al (eds). 2009. *The Health Practitioner's Guide to Climate Change*. Earthscan, London 2009.

²⁶ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702
neiphpressreleasenireportexpectsincreaseinfuelpovertyduringdownturn

²⁷ 'Report expects increase in fuel poverty during downturn'. Institute of Public Health in Ireland press release, 3 December 2009. www.publichealth.ie/news/iphpressreleasenireportexpectsincreaseinfuelpovertyduringdownturn

²⁸ Frey, J, J Brown & K Russell (2009) *Northern Ireland House Condition Survey 2006: main report*. Belfast: Northern Ireland Housing Executive. www.nihe.gov.uk/housing_conditions_survey_2006.pdf



²⁹ *A Draft Strategic Energy Framework for Northern Ireland 2009*, Department of Enterprise, Trade and Industry. http://www.detini.gov.uk/draft_strategic_energy_framework_2009-2.pdf

³⁰ See eg. DARD, Strategic flood mapping; Regional Flooding Improvements Group led by OFMDFM and Belfast Resilience Forum

³¹ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

³² Few, R, M Ahern, F Matthies & S Kovats (2004). *Flooding, health and climate change: A strategic review*. Tyndall Centre for Climate Change Research, November 2004. <http://www.tyndall.ac.uk/sites/default/files/wp63.pdf>

³³ See eg. Heatwave Plan for England, also Kovats RS, Hajat S. *Heat stress and public health: a critical review*. *Annual Review of Public Health*. 2008;29:41-55.

³⁴ Bassil KL & Cole DC. *Effectiveness of public health interventions in reducing morbidity and mortality during heat episodes: a structured review*. *International Journal of Environmental Research and Public Health*. 2010 Mar;7(3):991-1001.

³⁵ *Climate change, public health and health inequalities* (2008). London: Chartered Institute of Environmental Health. http://www.cieh.org/policy/climate_change_publication.html

³⁶ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

³⁷ *Climate change, public health and health inequalities* (2008). London: Chartered Institute of Environmental Health. http://www.cieh.org/policy/climate_change_publication.html

³⁸ Few, R, M Ahern, F Matthies & S Kovats. *Flooding, health and climate change: A strategic review*. Tyndall Centre for Climate Change Research, November 2004. <http://www.tyndall.ac.uk/sites/default/files/wp63.pdf>

³⁹ See eg. 'Flooded Cockermouth to get new health centre', *The Guardian* 24 Nov 2009 <http://www.guardian.co.uk/society/2009/nov/24/cockermouth-floods-health-centre>

⁴⁰ See eg. 'Homelessness and ruined livelihoods', *Irish Times* 27 Nov 2009, <http://www.irishtimes.com/newspaper/ireland/2009/11/27/1224259546619.html>

⁴¹ See eg. Tapsell SM, Tunstall SM. "I wish I'd never heard of Banbury": the relationship between 'place' and the health impacts from flooding. *Health and Place*. 2008 Jun;14(2):133-54

⁴² Few, R, M Ahern, F Matthies & S Kovats. *Flooding, health and climate change: A strategic review*. Tyndall Centre for Climate Change Research, November 2004. <http://www.tyndall.ac.uk/sites/default/files/wp63.pdf>



Climate Change
Health: Impacts,
Inequalities & Action

⁴³ *Preparing for a changing climate in Northern Ireland (2007)*. Edinburgh: Scotland and Northern Ireland Forum for Environmental Research (SNIFFER). http://www.sniffer.org.uk/Resources/UKCC13/Layout_Default/0.aspx?backurl=http%3a%2f%2fwww.sniffer.org.uk%3a80%2fproject-search-results.aspx%3fsearchterm%3dukcc13&selectedtab=completed

⁴⁴ As above.

⁴⁵ *A Green New Deal (2008)*. London: new economics foundation. <http://www.neweconomics.org/publications/green-new-deal>.

⁴⁶ *Preparing for a changing climate in Northern Ireland (2007)*. Edinburgh: Scotland and Northern Ireland Forum for Environmental Research (SNIFFER). http://www.sniffer.org.uk/Resources/UKCC13/Layout_Default/0.aspx?backurl=http%3a%2f%2fwww.sniffer.org.uk%3a80%2fproject-search-results.aspx%3fsearchterm%3dukcc13&selectedtab=completed

⁴⁷ 'Rural Recovery Group' – help to flood hit Cumbrian farmers', Cumbria County Council press release 4 December 2009. http://www.cumbria.gov.uk/news/2009/december/04_12_2009-141209.asp

⁴⁸ 'Homelessness and ruined livelihoods', *Irish Times* 27 November 2009 <http://www.irishtimes.com/newspaper/ireland/2009/1127/1224259546619.html>

⁴⁹ BBC news 28 December 2009, http://news.bbc.co.uk/1/hi/northern_ireland/8411904.stm.

⁵⁰ *Living in fear of the rain: The impact of recent flooding in Greater Belfast (2010)*. London: British Red Cross. www.informedprepared.eu/pages/multimedia/getdocument.aspx?id=3821

⁵¹ *Differential social impact of climate change in the UK (2009)*. Edinburgh: SNIFFER. http://www.sniffer.org.uk/Resources/UKCC22/Layout_Default/0.aspx?backurl=http%3a%2f%2fwww.sniffer.org.uk%3a80%2fproject-search-results.aspx%3fsearchterm%3dUKCC22&selectedtab=completed

⁵² *Addressing environmental inequalities: Flood risk (2006)*. Environment Agency. http://geography.lancs.ac.uk/envjustice/downloads/SCO20061_SR1%20report%20-%20inequalities%20%20flood%20risk.pdf

⁵³ Association of British Insurers/Government statement on flooding and insurance for England, 2008 <http://www.defra.gov.uk/environment/flooding/policy/insurance/jointstatement.htm>

⁵⁴ *PPS15: Planning and flood risk (2006)*. Belfast: Department of the Environment. http://www.planningni.gov.uk/index/policy/policy_publications/planning_statements/pps15.htm

⁵⁵ *The cuts won't work – the second report of the Green New Deal group (2009)*. London: new economics foundation. <http://www.neweconomics.org/publications/cuts-wont-work#download-buy>

⁵⁶ British Council Challenge Europe project survey report, unpublished.

Climate Change & Health: Impacts, Inequalities & Action



⁵⁷ <http://www.qub.ac.uk/sites/isw/>, accessed 16 July 2010.

⁵⁸ 'NIE faces compensation calls', Belfast Telegraph 3 April 2010 <http://www.belfasttelegraph.co.uk/news/local-national/nie-faces-compensation-calls-14753708.html#>

⁵⁹ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

⁶⁰ RTE news 20 November 2009, <http://www.rte.ie/news/2009/1120/weather.html>

⁶¹ *Addressing environmental inequalities: Flood risk* (2006). Environment Agency. http://geography.lancs.ac.uk/envjustice/downloads/SC020061_SR1%20report%20-%20inequalities%20%20flood%20risk.pdf

⁶² *Addressing environmental inequalities: Flood risk* (2006). Environment Agency. http://geography.lancs.ac.uk/envjustice/downloads/SC020061_SR1%20report%20-%20inequalities%20%20flood%20risk.pdf

⁶³ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

⁶⁴ *Heatwave Plan for England 2010*, Department of Health. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_116029.pdf

⁶⁵ Fisk, WJ & Seppänen, O (2007). *Providing Better Indoor Environmental Quality Brings Economic Benefits. Proceedings of the REHVA World Congress CLIMA 2007 Wellbeing Indoors, 10-14 June 2007, Helsinki, Finland.* http://www.osti.gov/bridge/product.biblio.jsp?query_id=1&page=0&osti_id=924794

⁶⁶ The Foresight programme (2007) *Tackling obesities: future choices*. London: Government Office for Science. <http://www.foresight.gov.uk/OurWork/ActiveProjects/Obesity/KeyInfo/Index.asp>.

⁶⁷ *Northern Ireland Travel Survey 2006-08*. Belfast: Department for Regional Development. http://www.drndi.gov.uk/index/statistics/stats-catagories/stats-catagories-travel_survey.htm

⁶⁸ *Reducing greenhouse gas emissions from road transport: Paper One: Baseline report 1990-2006*. Department for Regional Development, Belfast: July 2009. www.drndi.gov.uk/reducing_greenhouse_gas_emissions_from_road_transport_-_baseline_report.pdf

⁶⁹ Goodwin, P (2004). *The economic costs of road traffic congestion. A discussion paper published by the Rail Freight Group*. London: University College London. http://eprints.ucl.ac.uk/1259/1/2004_25.pdf

⁷⁰ *Living in fear of the rain: The impact of recent flooding in Greater Belfast* (2010). London: British Red Cross. www.informedprepared.eu/pages/multimedia/getdocument.aspx?id=3821

⁷¹ <http://www.travelwiseni.co.uk/>, accessed 16 July 2010.



Climate Change & Health: Impacts, Inequalities & Action

⁷² Smarter Moves: how information communications technology can support sustainable mobility (201). London: Sustainable Development Commission. <http://www.sd-commission.org.uk/publications.php?id=1050>

⁷³ Barton, H (2009) 'Land use planning and health and wellbeing'. *Land Use Policy* 26S (2009) S115–S123

⁷⁴ *Grey to green: how we shift funding and skills to green our cities* (2009). London: CABE (Commission for Architecture and the Built Environment). <http://www.cabe.org.uk/files/grey-to-green.pdf>

⁷⁵ Bell, S, V Hamilton, A Montarzino et al (2008). *Greenspace and quality of life: a critical literature review*. Stirling: Greenspace Scotland, available at http://www.openspace.eca.ac.uk/pdf/greenspace_and_quality_of_life_literature_review_aug2008.pdf

⁷⁶ *Heatwave Plan for England 2010*, Department of Health. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_116029.pdf

⁷⁷ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

⁷⁸ UK Climate Projections 2009 (UKCP09), <http://ukclimateprojections.defra.gov.uk/content/view/2225/528>

⁷⁹ Bowker, P (2007). *Flood resistance and resilience solutions: An R&D scoping study*. London: DEFRA. <http://www.defra.gov.uk/environment/flooding/documents/manage/frs-scope.pdf>

⁸⁰ *Living in fear of the rain: The impact of recent flooding in Greater Belfast* (2010). London: British Red Cross. www.informedprepared.eu/pages/multimedia/getdocument.aspx?id=3821

⁸¹ As above.

⁸² *Differential social impact of climate change in the UK* (2009). Edinburgh: SNIFFER. http://www.sniffer.org.uk/Resources/UKCC22/Layout_Default/0.aspx?backurl=http%3a%2f%2fwww.sniffer.org.uk%3a80%2fproject-search-results.aspx%3fsearchterm%3dUKCC22&selectedtab=completed

⁸³ *All Ireland Grid Study project overview* (2008). Belfast & Dublin: Department of Enterprise, Trade and Investment and Department of Communications, Energy and Natural Resources (RoI). <http://www.dcenr.gov.ie/Energy/North-South+Co-operation+in+the+Energy+Sector/All+Island+Electricity+Grid+Study.htm>

⁸⁴ *Climate change: dealing with the reality: Conference proceedings from a one day conference in January 2009*. Northern Ireland Environment Link, April 2009. www.nienvironmentlink.org/publications/conferenceproceedings.php

⁸⁵ *All Ireland Grid Study project overview* (2008). Belfast & Dublin: Department of Enterprise, Trade and Investment and Department of Communications, Energy and Natural Resources (RoI). <http://www.dcenr.gov.ie/Energy/North-South+Co-operation+in+the+Energy+Sector/All+Island+Electricity+Grid+Study.htm>

Climate Change & Health: Impacts, Inequalities & Action



- ⁸⁶ Fisk, WJ & Seppänen, O (2007). *Providing Better Indoor Environmental Quality Brings Economic Benefits. Proceedings of the REHVA World Congress CLIMA 2007 Wellbeing Indoors, 10-14 June 2007, Helsinki, Finland.* http://www.osti.gov/bridge/product.biblio.jsp?query_id=1&page=0&osti_id=924794
- ⁸⁷ Menne, B, F Apfel et al (eds). *Protecting health in Europe from climate change.* Copenhagen: World Health Organization Regional Office for Europe. <http://www.euro.who.int/en/what-we-do/health-topics/environmental-health/Climate-change/publications>
- ⁸⁸ *Building houses or creating communities* (2007). London: Sustainable Development Commission. <http://www.sd-commission.org.uk/pages/636-building-houses-or-creating-communities.html>
- ⁸⁹ *Grey to green: how we shift funding and skills to green our cities* (2009). London: CABE (Commission for Architecture and the Built Environment). <http://www.cabe.org.uk/files/grey-to-green.pdf>
- ⁹⁰ Mayor, K, S Lyons et al (2009). *A hedonic analysis of the value of parks and green spaces in the Dublin area.* ESRI Working Paper 331. Dublin: ESRI. <http://www.esri.ie/UserFiles/publications/20091130105730/WP331.pdf>
- ⁹¹ *Grey to green: how we shift funding and skills to green our cities* (2009). London: CABE (Commission for Architecture and the Built Environment). <http://www.cabe.org.uk/files/grey-to-green.pdf>
- ⁹² McAdam, J (2008) *Farming in a changing climate.* In *Food, farming and the environment: environmental fact sheet.* Belfast: Northern Ireland Environment Link. <http://www.nienvironmentlink.org/cmsfiles/files/Publications/FactSheet-for-Website-Updated.pdf>
- ⁹³ Kovats, S (ed). *Health effects of climate change in the UK 2008.* Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702
- ⁹⁴ McAdam, J (2008) *Farming in a changing climate.* In *Food, farming and the environment: environmental fact sheet.* Belfast: Northern Ireland Environment Link. <http://www.nienvironmentlink.org/cmsfiles/files/Publications/FactSheet-for-Website-Updated.pdf>
- ⁹⁵ Kovats, S (ed). *Health effects of climate change in the UK 2008.* Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702
- ⁹⁶ *Climate change, public health and health inequalities* (2008). London: Chartered Institute of Environmental Health. http://www.cieh.org/policy/climate_change_publication.html
- ⁹⁷ Kovats, S (ed). *Health effects of climate change in the UK 2008.* Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702
- ⁹⁸ *Climate change, public health and health inequalities* (2008). London: Chartered Institute of Environmental Health. http://www.cieh.org/policy/climate_change_publication.html



Climate Change & Health: Impacts, Inequalities & Action

⁹⁹ Kovats, S (ed). *Health effects of climate change in the UK 2008*. Department of Health, London: February 2008. www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsPolicyAndGuidance/DH_080702

¹⁰⁰ As above.

¹⁰¹ *Heatwave Plan for England 2010*, Department of Health. http://www.dh.gov.uk/prod_consum_dh/groups/dh_digitalassets/@dh/@en/documents/digitalasset/dh_116029.pdf

¹⁰² *Grey to green: how we shift funding and skills to green our cities* (2009). London: CABI (Commission for Architecture and the Built Environment). <http://www.cabi.org.uk/files/grey-to-green.pdf>

¹⁰³ Barton, H (2009) 'Land use planning and health and wellbeing'. *Land Use Policy* 26S (2009) S115–S123

¹⁰⁴ *Food, farming and the environment: environmental fact sheet*. Belfast: Northern Ireland Environment Link. <http://www.nienvironmentlink.org/cmsfiles/files/Publications/FactSheet-for-Website-Updated.pdf>

¹⁰⁵ Press, V. *Fuel poverty and health* (2003). London: National Heart Forum. <http://www.heartforum.org.uk/downloads/FPbook.pdf>

¹⁰⁶ Liddell, C (2008). *The impact of Fuel Poverty on Children*. Belfast: Save the Children Fund.

¹⁰⁷ Barton, H & Grant, M (2006) 'A health map for the human habitat'. *The Journal of the Royal Society for the Promotion of Health* 2006, 126 p 252-253

¹⁰⁸ Cairns, K (2008). Food Production: The Need for Self-Sufficiency. In *Food, farming and the environment: environmental fact sheet*. Belfast: Northern Ireland Environment Link. <http://www.nienvironmentlink.org/cmsfiles/files/Publications/FactSheet-for-Website-Updated.pdf>

¹⁰⁹ McAdam, J (2008) *Farming in a changing climate*. In *Food, farming and the environment: environmental fact sheet*. Belfast: Northern Ireland Environment Link. <http://www.nienvironmentlink.org/cmsfiles/files/Publications/FactSheet-for-Website-Updated.pdf>

¹¹⁰ Kitchen, J (2008) *Who's for a low-carb diet?* In *Food, farming and the environment: environmental fact sheet*. Belfast: Northern Ireland Environment Link. <http://www.nienvironmentlink.org/cmsfiles/files/Publications/FactSheet-for-Website-Updated.pdf>

¹¹¹ *Rising agricultural prices: causes, consequences and responses*. OECD policy brief, OECD, Paris: August 2008. <http://www.oecd.org/dataoecd/1/36/41227216.pdf>

¹¹² *Closing the gap in a generation* (2008). Geneva: World Health Organization, Commission on Social Determinants of Health. http://www.who.int/social_determinants/thecommission/en/

¹¹³ The Foresight programme (2007) *Tackling obesities: future choices*. London: Government Office for Science. <http://www.foresight.gov.uk/OurWork/ActiveProjects/Obesity/KeyInfo/Index.asp>

Climate Change & Health: Impacts, Inequalities & Action



¹¹⁴ UK Food Security Assessment, DEFRA, London: January 2010.
<http://www.defra.gov.uk/foodfarm/food/pdf/food-assess100105.pdf>

¹¹⁵ Skentelbery, R (ed). *Family Spending: a report on the 2007 Expenditure and Food Survey*. Office for National Statistics, London 2008. www.statistics.gov.uk/downloads/theme_social/Family_Spending_2007/FamilySpending2008_web.pdf

¹¹⁶ *Human Development Report 2007-08: Fighting climate change: human solidarity in a divided world* (2008). New York: United Nations Development Programme. <http://hdr.undp.org/en/reports/global/hdr2007-2008/>

¹¹⁷ *NHS England carbon emissions: carbon footprinting report* (2008). London: Sustainable Development Commission. http://www.sd-commission.org.uk/publications/downloads/NHS_Carbon_Emissions_modelling1.pdf

¹¹⁸ Bell, S, V Hamilton, A Montarino et al (2008). *Greenspace and quality of life: a critical literature review*. Stirling: Greenspace Scotland, available at http://www.openspace.eca.ac.uk/pdf/greenspace_and_quality_of_life_literature_review_aug2008.pdf

¹¹⁹ *A Green New Deal* (2008). London: new economics foundation. <http://www.neweconomics.org/publications/green-new-deal>.

¹²⁰ Cairns, K (2008). Food Production: The Need for Self-Sufficiency. In *Food, farming and the environment: environmental fact sheet*. Belfast: Northern Ireland Environment Link. <http://www.nienvironmentlink.org/cmsfiles/files/Publications/FactSheet-for-Website-Updated.pdf>

¹²¹ 'Emissions from burping cows "higher than family car"', *The Independent* 21 October 2008, <http://www.independent.co.uk/environment/climate-change/emissions-from-burping-cows-higher-than-family-car-967995.html>

¹²² Barton, H & Grant, M (2006) 'A health map for the human habitat'. *The Journal of the Royal Society for the Promotion of Health* 2006, 126 p 252-253

¹²³ Commission on the Social Determinants of Health. *Closing the gap in a generation: health equity through action on the social determinants of health*. WHO, Geneva 2008., http://www.who.int/social_determinants/thecommission/en/



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Climate Change and Health Group Members

Name	Organisation
Elizabeth Mitchell (chair)	DHSSPS
Ruth Fleming (facilitator)	Belfast Healthy Cities
Alistair Curran	Belfast City Council
Barbara Porter	Public Health Agency
Claire McKee	Department of Health, Social Services and Public Safety (DHSSPS)
Des Loughridge	Northern Ireland Housing Executive
Gary McFarlane	Chartered Institute of Environmental Health
Gerry Waldron	Public Health Agency
Iain Deboys	Regional HSC Board
Jo Marley	Bryson Charitable Group
John Bradley	Office of the First Minister and Deputy First Minister
John McMullan	Bryson Charitable Group
John Wylie	Met Office
Keith Miller	DHSSPS
Leslie Boydell	Belfast HSC Trust
Maria Jennings	Food Standards Agency
Marie Vaganay	Ulster University Jordanstown
Mary O'Neill	Northern HSC Trust
Maura O'Neill	Western HSC Trust
Melanie McClements	Southern HSC Trust
Nigel McMahon	DHSSPS
Patricia Mackey	Sustainable NI
Peter Wilson	Business Services Organisation
Raymond Smyth	Chief Environmental Health Officers Group
Robert Spence	South Eastern HSC Trust
Seamus Camplisson	DHSSPS
Sean MacIntyre	University of Ulster Jordanstown
Sue Christie	Northern Ireland Environment Link
Teresa Lavin	Institute of Public Health in Ireland

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**Belfast Healthy Cities
22/24 Lombard Street
BELFAST BT1 1RD**

**Tel +44 (0) 28 9032 8811
Fax +44 (0) 28 9032 8333**

www.belfasthealthycities.com

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