

Vulnerability to heatwaves and drought

Case studies of adaptation to climate change in south-west England

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This report explores what it means to be vulnerable to climate change. It considers how early examples of climate change adaptation may impact or protect vulnerable groups in society.

The government has repeatedly highlighted the need for UK society to adapt to climate change. Climate change will, among other impacts, bring increased risks to health and well-being from more frequent and intense heatwaves, as well as increased droughts threatening the security of affordable water supplies in the UK. This report suggests that the social nature of vulnerability to climate change should lie at the heart of planned responses to climate change. The findings highlight the need for a more systematic consideration of current and future vulnerabilities in local, sectoral and national adaptation planning.

The report:

- introduces the concept of vulnerability to climate change within the context of social justice;
- examines two early case studies of adaptation in the south-west of England: the implementation of the national Heatwave Plan; and the trend towards differential water pricing based on usage (including the trial of a rising block tariff for water).

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Background to the study

There is a growing realisation among researchers and policy-makers that the impacts of climate change may be unevenly experienced by different social groups in the UK. Adaptation policies and mechanisms therefore need to be designed with an understanding of the difference in vulnerability of individuals and groups to the projected impacts of a changing climate, and with a consideration of the social impacts of the adaptation measures themselves.

Aims and objectives

This project aims to improve our understanding of adaptation to climate change by focusing on current adaptations to heatwave and drought in the UK. It explores two high level questions about climate change and social justice:

- What does adaptation to climate change mean in practice?
- How is social vulnerability to climate change currently understood?

The study looks at two early case studies of what might be considered climate change adaptation in the south-west of England. The first focuses on water management and the second on heatwave planning, and they consider the following questions:

- How are vulnerable people protected from differential water charging?
- How are decision-makers equipped to protect people who are vulnerable to heat stress?

Approach

An initial literature review explored the concepts of ‘vulnerability’ and ‘resilience’, and their relation to social justice. The empirical research considers measures to help society deal with heatwaves and drought. These measures are not explicitly designed to tackle climate change but they address existing problems that are projected to become more acute in future. The study looks at:

- water metering and differential charging (i.e. charging that is linked to water usage) as a system to incentivise more efficient consumption of water and thereby mitigate drought risk;
- the implementation of the national Heatwave Plan for England (DoH, 2010c) as a planned response to heatwave risks.

The case studies were developed using primary and secondary research. Primary research involved semi-structured telephone interviews with public officials and stakeholders – at national, regional and local levels

– involved in the implementation of the Heatwave Plan and in water pricing in the south-west. Secondary research included reviews of key policy documents such as the Heatwave Plan, The Independent Review of Charging for Household Water and Sewerage Services (Walker, 2009b) and a small selection of academic and grey literature on vulnerability, water pricing and heatwaves.

Differential water charging

Climate change is projected to reduce summer rainfall in most of the UK. This is likely to increase the risk of drought, especially when exacerbated by higher average and occasional extreme temperatures. Population increases will also have a significant effect on the social impacts of drought because they will increase the amount of water needed to meet domestic demand. In the south-west of England, the drying and warming effects of climate change and changes in population are projected to be as extreme as anywhere in the UK. The region therefore needs to prepare for managing drought risk.

People will be vulnerable to drought to the extent that they do not have a sufficient supply of affordable water to meet their needs. Household requirements for water vary, depending on the number of residents and the age and health of the occupants. Water requirements may also change as the climate changes: for example, if people use water to stay cool or if health problems increase as a result of new weather patterns.

Water as a resource

Water is currently an undervalued resource; people have grown used to a plentiful and cheap supply of water and most people in the UK still pay a flat rate for their water consumption, irrespective of how much they use. As a result, some people waste water or use large amounts for discretionary purposes such as watering gardens. Water companies therefore need to implement measures to increase the efficient use of water and ensure that the water utility system is sustainable. One solution is to install water meters, which give customers and water companies data on the volume of water each household uses. Instead of paying a flat rate for their water supply, irrespective of how much they consume, customers on water meters pay per unit. It was estimated that 37 per cent of households would be metered by March 2010.¹ Universal water metering is to be introduced by 2020 and it is therefore important to consider how this shift will affect different social groups.

While water metering is fair in one sense (it means that people pay for what they use), it has the potential to create vulnerability where households cannot afford to pay for an adequate water supply. Households are also vulnerable if they cannot reduce their household water usage for health or other reasons. This tends to mean that low income groups, single-occupier households,² pensioners and large families are more likely to be vulnerable to affordability problems, as are people who need more water for health reasons (e.g. to support additional clothes washing or bathing).

Water affordability is already a big problem in the south-west of England where bills are higher than anywhere else in the UK. As a result, South West Water has introduced schemes to protect households from the negative impacts of water charging and to support customers in debt. This research explored how affordability problems are currently dealt with and looked briefly at three initiatives that seek to address affordability issues:

- the rising block tariff (RBT): a trial of a new tariff that aims to incentivise efficiency without creating affordability problems;
- WaterSure, a national scheme to cap bills for certain qualifying households (those on low incomes or with special medical requirements);
- WaterCare, a scheme to improve water efficiency and provide support to households in debt.

Although these initiatives are not explicitly motivated by climate change, they are examples of how water charging may evolve to meet the challenges posed by climate change in relation to increased drought risk. The key findings are as follows.

How are vulnerable people protected from differential water charging?

- The trial of the rising block tariff and the WaterSure and WaterCare schemes all provide some form of assistance to protect qualifying households from the potentially negative effects of water charging. However, it is uncertain what role these schemes may play in future water charging regimes in the UK.
- There is nothing inherently regressive about water metering and differential charging linked to usage. Under existing schemes, installing a water meter qualifies a household for support schemes such as WaterSure and can therefore have a positive impact on affordability and water efficiency.
- Households that are currently defined as vulnerable are able to benefit from the rising block tariff and the support schemes in the south-west, namely WaterSure and WaterCare.
- However, water metering without support schemes may create new affordability problems for groups that cannot easily reduce their water consumption.
- A rising block tariff provides everyone with the chance of lower water bills, irrespective of income, and therefore does not specifically address priority groups. It could in theory create new forms of water poverty or affordability problems for groups that currently fall through the net: for example, low income households that are narrowly above benefit thresholds, or large families. However, it is too early to understand fully the effect of the tariff on different social groups.
- ‘Water poverty’ has been defined as a concern for households that spend 3 per cent or more of their income on water. It is seen as an equivalent to ‘fuel poverty’ but is not as widely accepted or as often used in policy discourse. Stakeholders in the sector have not yet engaged significantly with the longer term potential for new forms of water poverty to emerge as a result of climate change and differential charging for water (which is itself partly a response to climate change).
- However, stakeholders from across the water industry, regulatory bodies and consumer organisations are aware of social vulnerability and see this largely in terms of affordability issues, particularly for low income households. They generally understand affordability issues well and see them as highly important.
- There was no demand expressed by interviewees from key organisations in the water industry and consumer bodies for changes to the overall governance structure of the water sector in order to better represent the interests of vulnerable households. This research suggests that stakeholders with different interests are already working together on the affordability agenda.
- To achieve joined-up affordability support and effective debt recovery programmes for burdened households, it is important that there are links between organisations that support households with water affordability problems and utilities companies, banks and other debt management organisations. Initiatives are needed that link water debt management with other utility debt schemes.

The evidence therefore suggests that the current support schemes protect at least some vulnerable people from any adverse effects of differential water charging. This explorative study indicates that the challenge

for the future is to improve the coverage of existing support schemes and ensure that pricing and efficiency measures reflect the true value of water yet protect consumers from water poverty. Whilst the structure of the water sector is currently conducive to achieving a balance between environmental, supply and consumer interests, the challenge is particularly acute given climate change projections that increase the need for effective water management now and in future.

Water is an essential resource for life; it is imperative to ensure that customers' access is not determined by their ability to pay. Meeting this challenge requires socially just efficiency measures and long term planning. The case of water charging in the south-west suggests that this balance should be achievable, but greater attention could be paid to the longer term issues for water consumers at both regional and national level as a result of climate change.

Heatwaves

Climate change is expected to increase the frequency and intensity of heatwaves in summer. The factors that make people vulnerable to high temperatures are complex and dynamic. Traditional perspectives of vulnerability to heatwaves tend to focus on health factors, for example existing respiratory or heart conditions, and on age (older people and infants being most vulnerable).

Whilst research has confirmed the relationship between determinants such as age and mortality during heatwaves, there are a number of more fundamental and complex social processes that influence whether someone is likely to suffer from high temperatures. This research suggests that these include factors such as the quality of housing and the built environment, local urban geography, people's lifestyles, income, employment, tenure, social networks and self-perception of risk. These factors influence an individual's exposure and sensitivity to high temperatures, as well as their ability to anticipate, respond and adapt to conditions to avoid heat stress. Many of the factors tend to overlap, such that people on low incomes who live in high rise social housing in central urban areas, for example, may be very vulnerable to high temperatures. However, not all residents of the same building will be equally vulnerable, or vulnerable at all. The processes that create vulnerability are complex and it is difficult to assess from a 'top-down' perspective who will experience harm during heatwaves. This makes it difficult to plan for heatwaves and identify vulnerable people.

The Heatwave Plan for England is coordinated by the Department of Health and is the key national policy instrument for managing heatwave risks. It has been in place since 2004 and is in part a response to the significant socio-economic impacts of the 2003 heatwave. The Heatwave Plan is essentially an emergency response plan, although it is evolving to attempt a more proactive approach to reducing vulnerability to heatwaves. Given the social processes that influence vulnerability to high temperatures, it is important that evolving strategies take a more holistic approach to understanding vulnerability and a longer term, more preventative approach to improving community resilience to heatwaves in the UK. The key findings are as follows.

How are decision-makers equipped to protect people who are vulnerable to heat stress?

- The Heatwave Plan offers a clear structure for implementing response measures during a heatwave. Having it in place presents a significant opportunity to reduce vulnerability and protect vulnerable people from high temperatures.
- However, improvements are needed to current arrangements. The Heatwave Plan is seen primarily as a health sector document and this limits engagement from the broader range of agencies and service providers who could improve and support preparedness for heatwaves.

- Stakeholders from health, emergency planning and other relevant local agencies have a varied understanding of vulnerability to heat and there is a tendency to rely on the Department of Health's perspective, which is limited to health factors rather than the wider social processes and broader identity, place and tenure factors that may cause vulnerability.
- There are limited data, tools and methodologies available to local decision-makers to help them identify vulnerable people. Stakeholders who may have a greater understanding of how to identify vulnerable people (such as the research community, social services and local government climate change or sustainability teams) may not currently be informing local responses to heat risks.
- Heatwave preparedness does not appear to be linked into other related central and local government plans, especially outside the health sector. This may prevent the non-health (i.e. wider social) context of vulnerability from being recognised and acted upon.
- The overall findings suggest that, nationally, a longer term and more holistic approach may be needed that engages a broader set of stakeholders and has an increased focus on preventative measures rather than emergency response planning.

This explorative study suggests that decision-makers are ill prepared to identify accurately and therefore protect people who are vulnerable to heat stress, despite the clear framework and successes achieved by the Heatwave Plan. This is partly a result of the complexity of the problem and the lack of simple decision-support tools for use at local level. Also, heatwave risks are relatively new for the UK and heat stress does not have a salient political profile. The technical understanding of heat-related issues, which is needed to protect vulnerable people, is also therefore less than is required. This contrasts with other extreme weather issues, such as flooding, where the UK has more experience and the threat therefore has a higher profile.

An improved understanding of the issues relating to high temperatures and closer working between stakeholders should help to build capacity within the various agencies, communities and government departments whose cooperation is needed to build resilience. In particular, a more strategic and proactive approach is needed (such as a cross-sectoral 'heat strategy') to complement the emergency response processes covered by the Heatwave Plan, particularly as vulnerability to high temperatures is influenced by wider social processes. Better top-down and bottom-up decision-support tools and a stronger understanding of how to link the two are also needed to improve the identification of vulnerable people at local level.

What does 'adaptation' to climate change mean in practice?

This brief exploration of adaptation in practice has revealed that adaptations are rarely defined or seen by stakeholders as linked to climate change. This is even the case when awareness of climate change is impressively high, as with many of the interviewees. In other words, measures that will help to mitigate existing or future climate risk, such as water efficiency and heatwave planning, are seen at the implementation scale as specific measures to deliver sector-specific objectives. This should come as no surprise. The difficulty of linking everyday practical delivery of services to the more abstract concept of climate change means a focus on affordability, health and measures that have tangible current benefits may provide the best way forward.

This is often stated as the ultimate objective of adaptation policy in any case: to 'mainstream' climate considerations in existing processes. In addition, the current revival of climate scepticism, combined with budget cuts, means that focusing on existing problems on which there is consensus (e.g. protecting health and providing affordable services) is likely to give the most acceptable strategy for just advancing climate change adaptation.

However, there is a danger that policy responses underestimate the magnifying effect of climate change on existing problems such as drought and heat stress, or that the increased risk renders current approaches inadequate if they do not consider climate change explicitly and strategically. This should be of interest to those concerned with social justice. There is a chance that the effect of climate change on inequality will be amplified if adaptation in practice fails to consider its impact on vulnerable groups over time, or to build resilience among the most vulnerable.

Though necessarily limited in scope and depth, this research suggests that an explicit consideration of social justice issues, coupled with clearly defined roles for participants and effective stakeholder working, is likely to improve outcomes for vulnerable people.

Stakeholder collaboration

Affordability is a key concern in the water sector and customer interests are represented at decision-making level by the Consumer Council for Water, regulators and even the industry itself. The nature of the water sector, as a privatised and heavily regulated utility, lends itself to this kind of clear definition of roles and reliance on stakeholder collaboration. The independent Walker Review demonstrated the level of political interest in affordability issues and helped to build capacity and strengthen communication channels between stakeholders. Further, in a sector that is infrastructure-dependent, there are inherent delays in effecting any change. Decision-makers are therefore engaged in long term planning and better prepared to deal with future issues such as climate change and drought.

The health sector is more complex, less cohesive and open to constant reform and numerous public pressures. It is also more of a 'reactive' sector, predominantly aiming to cope with the demands placed on it by the population rather than to tackle the underlying social causes of illness and wider well-being, which has generally been seen as the role of other government departments. However, this situation is changing gradually. Stakeholders do not have a clear forum or history of engagement in managing heatwaves and there is no consumer representative body equivalent to the Consumer Council for Water to promote public concerns about heatwaves. However, in time, there is no reason why a similarly strong multi-stakeholder governance structure cannot be established for heatwave planning.

How is social vulnerability to climate change currently understood?

The nature of vulnerability to drought differs notably from vulnerability to high temperatures. First, the hazards themselves are very different. Drought develops relatively slowly in response to incremental changes in rainfall and abstraction. Responses can therefore be considered, gradual and carefully assessed. Heatwaves, however, are extreme events that frequently require emergency responses. Their impacts are more sudden and potentially more complex.

Second, the way in which these hazards are experienced by individuals and groups differs significantly. People who are vulnerable to water charging are not necessarily vulnerable to high temperatures. For drought, this research was interested in how customers experience planned responses to drought, namely water charging. In practice, therefore, the issue of vulnerability is largely about affordability. We characterise this kind of vulnerability as 'one-dimensional': a person is somewhere on a line between 'can easily afford' and 'cannot afford' (although the reality of who actually pays water bills is not strictly determined by income or ability to pay).³ Vulnerability to water charging is therefore largely about income and poverty at household level. As a result, stakeholders' understanding of vulnerability and affordability in this research was consistent and strong.

However, there is an additional aspect to vulnerability to water charging, which is that households that require a large volume of water are less able to reduce their demand and therefore more likely to be exposed to high bills. This is a separate issue from ability to pay. High water requirements may stem from medical conditions (for example, the need for frequent washing or cleaning, or behavioural conditions that

increase water use) or from household size (for example, large families or houses of multiple occupancy require high volumes, as do some single-occupier households where income is limited and water use is inefficient).⁴ There may be other legitimate requirements for high water consumption for self-employed people (such as home-based caterers or small construction businesses) or to provide cooling in response to high temperatures in poorly adapted buildings. Most stakeholders also recognised that people who need a high volume of water could be vulnerable, and existing support schemes, such as WaterSure, provide for some of these high use groups. In general, stakeholders in the water sector understand the social basis to vulnerability.

There is less agreement regarding vulnerability to high temperatures. Stakeholders' definitions of vulnerability varied but many demonstrated a sophisticated personal understanding of the multiple layers that characterise vulnerability to high temperatures. However, in relation to implementing the Heatwave Plan, they tended to rely on 'official' health-focused perspectives of vulnerability. Whilst the academic attempt to define vulnerability is complex and inconclusive, it is important that the very real social aspects of vulnerability are recognised and that they inform heatwave planning. In order to achieve this, local level decision-making needs to be better linked with the complexities of the academic discussion on vulnerability to high temperatures (and vulnerability to other climate impacts) and with locally held expertise that may reside in a range of agencies.

Despite the differences, there may also be links between vulnerability to drought and vulnerability to high temperatures. Understandings of vulnerability to both hazards draw attention to the ways in which people on low incomes, people in particular locations and people with particular medical conditions or mobility restrictions may be hardest hit. We might expect some of the same people to suffer most in heatwaves and struggle to afford sufficient water but there are also times when both of these situations may impact upon the same groups concurrently.

Summary of recommendations

The results of this exploratory research suggest a number of recommendations for each group of stakeholders involved in the areas of water supply and heatwave planning.

Recommendations	Water charging	Heatwaves
National policy	Assessments of climate change, including the first national Climate Change Risk Assessment and related Adaptation Economic Assessment, should explicitly consider the distribution of risks across different social groups and the distribution of benefits from adaptation measures. 'Social justice' should be a guiding principle for the forthcoming National Adaptation Programme.	
	The recommendations of the Walker Review on water charging should be formally considered at national level.	The UK requires a broader 'heat strategy' to build resilience in preparation for heatwaves. This should go beyond the emergency response focus of the current Department of Health national Heatwave Plan.
Evidence base on vulnerability	The evidence base on how households' water use will react to conditions of climate change (e.g. during heatwaves and droughts) needs to be developed to support future planning on sustainable and socially just water management.	Better guidance is needed for local level decision-makers on data sources, tools and methodologies to identify vulnerable people. More effective liaison is needed between local level participants to support more locally nuanced understandings of vulnerability to high temperatures.
Addressing vulnerability in practice	Future social tariffs and measures to mitigate the potentially negative effects of universal water metering should be designed with full multi-stakeholder involvement.	Broad coalitions of local decision-makers and stakeholders need to be involved in proactive, preventative strategies to reduce social vulnerability to high temperatures. Further thought is needed on how the implementation of the Heatwave Plan is monitored at local level to ensure that preparedness becomes embedded across relevant areas of responsibility.
Governance	Stakeholders from inside and beyond the water sector need to work together to consolidate debt initiatives for households, including water debt.	Social care providers, spatial planners, non-governmental organisations, communities, public health officials and local government departments should liaise effectively with the wider health sector to support long term preparedness for heatwaves.

Climate change is increasingly becoming a priority for policy-makers. The coalition government, with its focus on tackling record levels of debt, called it one of the ‘gravest threats’ the country faces (HM Government, 2010). Much of the existing research on climate change has looked at how policies can be designed to reduce carbon emissions. Analysts, researchers and advocates of social justice have asked how carbon mitigation policies and the ‘green economy’ will affect different social groups. Relatedly, social research has begun to focus on how the original problem – that of physical changes in climate – will have a differential impact across society.

This exploratory study looks at the policy response to physical climate change, termed ‘adaptation’. Society wishes to adapt to changes in climate because it is more or less vulnerable to those changes, or because there are opportunities to be seized through adaptation. However, this vulnerability is unevenly distributed throughout society. It is therefore important to look at whether planned adaptation will reduce the vulnerability of those who are most vulnerable.

This project aims to explore two high level questions about climate change and social justice:

- What does ‘adaptation’ to climate change mean in practice?
- How is social vulnerability to climate change currently understood?

The study begins to examine these issues by looking at two early case studies of adaptation in the south-west of England. In doing so, it seeks to answer two specific questions:

- How are vulnerable people protected from differential water charging?
- How are decision-makers equipped to protect people who are vulnerable to heat stress?

Uneven sharing of costs and benefits

The observation that the costs and benefits of climate change are not equally shared is most commonly made at international level. While rich countries are responsible for the bulk of historic greenhouse gas emissions resulting from carbon-intensive lifestyles, it is poor countries that bear the brunt of climate-related disasters. Christian Aid (2000) suggests that we should refer to extreme weather events as ‘un-natural’ disasters and Oxfam has described climate change as a ‘triple whammy’ for the world’s poorest people: ‘They didn’t cause it, they are most affected by it, and they are least able to afford even simple measures that could help protect them from those damaging impacts that are already unavoidable.’ (Oxfam, 2008:2)

There is also growing realisation that the impacts of climate change are likely to be unevenly experienced even within the UK, with a clear relationship emerging between some forms of deprivation and vulnerability (CAG Consultants, 2009). Research on coastal flooding, for example, highlights the variety of ways in which those living in deprived neighbourhoods may be most vulnerable in terms of high exposure, low awareness and low adaptive capacity. Oxfam’s ‘triple whammy’ can be applied directly to climate injustice within the UK. The Trades Union Congress (TUC, 2009:51) identified the ‘triple injustice of climate change’ in the UK, which mirrors Oxfam’s analysis. To this we may add a fourth layer of injustice to create the ‘quadruple whammy’: lower income groups may also be disproportionately affected by planned and

autonomous responses to climate change, including mitigation and adaptation policies, as well as market reactions to the impacts of a changing climate (e.g. insurance and price effects).

Similarly, international debates about the need for high emitters to pay for carbon reduction and adaptation in low emitting countries might be applied in appropriate national mitigation and adaptation policies. For example, should domestic climate change policies seek to transfer resources from high emitters to the highly vulnerable?

The existing evidence and results of early research indicate that climate impacts have the potential to create new forms of inequality and increase the gap between high and low income groups. However, there remain gaps in our understanding of how concepts such as vulnerability can be applied in a policy and practical context. The extent to which this inequality is realised depends on the response from policy-makers, markets and communities in adaptation. The UK government's approach to adaptation is still in development, and strategic responses from local and regional government, the private sector and influential voluntary and community sector organisations are in their infancy. There are therefore opportunities to synergise social and climate policies in order to achieve a truly sustainable future. The outcomes of the Joseph Rowntree Foundation's Climate Change and Social Justice Programme, through which this project was funded, will provide useful messages for decision-makers contemplating this goal.

Case studies

The case studies in this exploratory study are examples of attempts to help society adapt to two of the potentially most damaging impacts of climate change in the UK: heatwaves and drought.

The adaptation measures that we look at are:

- water metering and differential charging as a system to incentivise more efficient consumption of water and thereby mitigate drought risk;
- the implementation of the Heatwave Plan as a planned response to risks associated with high temperatures.

The measures themselves are not explicitly designed to tackle climate change; they aim to address existing problems that are projected to become more acute in future.

We look at these issues in the south-west of England because it is the region projected to suffer most acutely from heatwaves and drought in future, according to the UK Climate Projections, and because there are a number of contextual factors that make water charging and heatwave planning salient issues for people in the south-west. Key terms used in the case studies are explained in Box 1.

Box 1: Key terms used in the study

Climate change

Climate is the term used to describe average weather conditions, usually over a period of at least 30 years. The global climate has changed many times in response to natural stimuli, but the term climate change refers to recent changes, typically those within the last century, often referred to as global warming. Climate scientists attribute this change to the increased concentration of greenhouse gases in the atmosphere, most of which are the result of human industrial activity and land use changes.

In this project we use the term climate change to refer to the recent and projected changes in climate.

Drought

There is no universally accepted definition of drought but it describes a situation where demand for water outstrips supply, leaving a shortage. Drought can be caused by long periods of abnormally low rainfall

(or snow). This kind of meteorological drought can be exacerbated by high temperatures (which increase evapo-transpiration) but can equally occur during cool periods. Drought can also be caused by significant increases in water use and abstraction, even under normal rainfall conditions. Droughts can last for long periods (seasons, even years).

In this project we use the term drought generally to refer to a state of water shortage. This may be caused by reductions in rainfall (as a result of climate change) but also by increases in demand for water (as a result of socio-economic change).

Heatwave

There is no universally accepted definition of a heatwave but it refers to a period of days where the temperature is abnormally high. The threshold above which temperatures may be considered abnormal depends on the baseline climate and is therefore peculiarly local. In the UK, the Met Office defines temperature thresholds for different regions of England: Level 2 of the Heatwave Plan is triggered if three days or more are forecast to be above the threshold. Heatwaves are generally short periods of high temperatures (days).

In this project we use the term heatwave to refer to prolonged periods of abnormally high temperatures, above the Met Office thresholds. Thresholds by region are set out in Table 1.

Table 1: Heatwave temperature thresholds

Region	Day (°C)	Night (°C)
London	32	18
South East	31	16
South West	30	15
East of England	30	15
West Midlands	30	15
East Midlands	30	15
North West	30	15
Yorkshire & Humber	29	15
North East	28	15

Source: Met Office

Adaptation

Adaptation is the general term used to describe actions taken in response to climate change. Individuals and societies adapt constantly to changes but the climate change community usually uses adaptation to refer to planned actions in the face of a changing climate. The Intergovernmental Panel on Climate Change (IPCC, 2007) defines adaptation as the ‘adjustment in natural or human systems in response to actual or expected climatic stimuli or their effects, which moderates harm or exploits beneficial opportunities’.

Alongside planned adaptation by governments and organisations such as healthcare or utility providers, the term autonomous adaptation can be used to describe actions taken without central planning or strategy, for example by households or private companies. There is therefore no strict definition of what adaptation means. Many actions may be termed adaptation without explicitly being intended to address climate change.

In this project we understand adaptation in the broadest sense to incorporate any action, whether intentional or not, that will help to address the negative or positive impacts of climate change.

Approach to the research

The objective of this case study research was to explore the relationship between early adaptation measures and vulnerable people. It also set out to explore interviewees' understanding of the links between climate change, social justice and the adaptation measures with which they were involved.

This is an exploratory study and has only begun to identify the issues and messages that are relevant to ensuring socially just adaptation policies. The sample size for the research was very limited and the case studies were focused on two discrete examples, the lessons from which may not be directly applicable to other contexts. Nevertheless, these case studies highlight some important issues for further consideration by policy-makers and stakeholders when planning adaptation.

Why heatwaves and drought?

Climate change will have a number of negative effects on people in the UK, including increased river flooding, sea level rise, storminess, higher temperatures and drought. Some of the early research into the social effects of these impacts has been focused on flooding, both fluvial and coastal (e.g. Walker, *et al.*, 2006, Tapsell, *et al.*, 2002, Thrush, *et al.*, 2005). These are the climate change impacts with which we are most familiar in the UK, given our historical and current climate.

Less is known about the social impacts of hot weather and it is important to understand how the relatively 'new' threats from heat will affect society. Furthermore, the research team's previous work on vulnerability and climate change has shown that understanding vulnerability to climate hazards can be highly complex, especially for non- or partially-spatial impacts such as heat stress (Harvey, *et al.*, 2009). Conscious of the devastating impact of the 2003 heatwave in western Europe, this study considered how an early attempt to mitigate the impacts of heat stress, namely the Department of Health's Heatwave Plan, was able to cope with this complexity and offer protection to those who most need it.

Another relatively new but strategically important climate challenge for the UK is that of drought. Water is essential for life and everyone needs access to water at a reasonable price. The water sector is one of the most climate aware sectors in the UK and is already taking steps to address the risks posed by a changing climate. This includes measures to improve water efficiency, both in terms of water supply and managing demand. Demand management measures, such as the use of water meters to charge per unit of water consumed, represent some of the earliest practical measures that may be termed 'adaptation' to climate change⁵. It is of particular interest to this study that water metering and differential charging (charging that is linked to water usage) has the potential to affect social groups differently, depending on their ability to pay. In other words, it is a big challenge to balance the competing demands of water efficiency and security of supply with the demands of providing an affordable water supply to all members of society. This study therefore examines the way in which differential water charging may affect social justice concerns.

Heatwaves and droughts are hazards that already threaten social justice and equality in the UK and both are projected to worsen as a result of climate change. The core purpose of this study is to examine early attempts to deal with these hazards because these responses are likely to become more common and more important in future. Both heatwave planning and differential water charging are relatively new policy initiatives in the UK. Both are likely to be rolled out across the country or more frequently relied upon to mitigate future risks. It is therefore imperative that these measures are designed, implemented and monitored in ways that do not impact disproportionately on particular sectors of the population.

Why a focus on the south-west of England?

While adaptation policy is set at national level, there is regional variation in the way climate change will be experienced and the governance structures that will implement adaptation measures. The south-west of England provides a rich combination of climatic context (in terms of significant future climate challenges),

adaptation context (in terms of early initiatives to adapt) and socio-economic context (in terms of existing affordability issues, mix of urban and rural population, rapidly changing economy and demography).

The south-west is projected to become significantly hotter and drier in the summer throughout this century (Murphy, *et al.*, 2009) and is within the area of England projected to experience the most extreme summer temperatures, according to the UK Climate Projections (known as UKCP09). This makes it an obvious location to examine the implementation of the Heatwave Plan.

Residents in the south-west of England already suffer affordability problems relating to water. As a result, the region has begun to experiment with new tariffs and schemes to improve water efficiency while limiting the negative impact of water charging on low income and other vulnerable consumers. It is therefore also an appropriate region in which to consider the effects of adaptation measures to mitigate drought risk from a social justice perspective.

Methodology

The case studies have been developed using primary and secondary research. Primary research included semi-structured interviews with public officials and stakeholders involved at national, regional and local levels in the implementation of the Heatwave Plan, and at regional and local levels in water pricing in the south west.

Each case study included a set of questions on climate change, vulnerability and social justice, with a second tier of questions targeted more specifically at each group of interviewees and relating either to heatwave or water policy responses. In addition to the main interview partners, conversations were held with government officials to help identify the most appropriate interviewees within the region.

Water case study

Full interviews were held with representatives of the following organisations:

- South West Water;
- Ofwat (The Water Services Regulation Authority);
- Consumer Council for Water;
- Environment Agency;
- Walker Review Team;
- Citizens Advice.

Heatwave case study

Full interviews were held with representatives of the following organisations:

- South West Climate Change Impact Partnerships;
- Government Office for the South West (GOSW);
- NHS Somerset Primary Care Trust;
- South West Strategic Health Authority;

- South Gloucestershire Council (Unitary Authority);
- Gloucestershire County Council.

An attempt was made to include a wide spread of stakeholders. In the implementation of the Heatwave Plan this meant engaging with organisations at each tier of implementation, from the strategic health authority (which has a duty to distribute Department of Health advice to the local level) to local government. Short interviews were held with Bristol City Council and a local council. Telephone conversations with possible interview candidates revealed a number of people, especially at local government level, who were unwilling to contribute to the research because of a perceived lack of understanding of climate change or of the Heatwave Plan, and because of concerns about the lack of fit between their own job descriptions and the plan. None of the potential interviewees from the tier for care homes, hospitals and social services felt able to contribute to the research so there are no interviews representing this tier. Stakeholders from the water sector and consumer protection community were relatively easy to identify and willing to take part in the research.

Secondary research included reviews of key policy documents (e.g. the Heatwave Plan, The Walker Review) and a small selection of academic and grey literature on vulnerability, water pricing and heatwaves.

Outline of the report

This report begins with an exploration of the concepts of vulnerability and resilience and their relationship with social justice. It then presents the findings and analysis from the two case studies (water charging and heatwave planning), based on reviewed literature and the outcomes of a small number of stakeholder interviews. It concludes with some thoughts on how the findings of these discrete case studies relate to each other and to wider issues about how planned adaptation could be undertaken to improve social justice and reduce the vulnerability of the most vulnerable.

1 Climate change vulnerability and social justice

This section sets out the context for the study. It begins by exploring the concepts of vulnerability and resilience to climate change and looks at how they can be assessed. It then briefly explores the links between these climate change concepts and social justice and inequality.

The concepts of vulnerability and resilience

The term vulnerability has important communicative value and people tend to have an intuitive understanding of what it means; it captures notions of possible loss, damage and impact and of being prone or susceptible to injury. It is a central concept within numerous fields of research and policy, including natural hazards and disasters, poverty, development, food security and climate change. In general, exploring vulnerability to climate change is about trying to determine who and what will be negatively affected by climate change in the future. In this context, vulnerability is about potential future harm.

The most widely quoted definition of vulnerability to climate change is that developed by the Intergovernmental Panel on Climate Change (IPCC):

Vulnerability is the degree to which a system is susceptible to, and unable to cope with, adverse effects of climate change, including climate variability and extremes. Vulnerability is a function of the character, magnitude, and rate of climate change and variation to which a system is exposed, its sensitivity, and its adaptive capacity.

IPCC, Fourth Assessment Report, 2007:883

This definition draws on three main concepts; namely, exposure, sensitivity and adaptive capacity:

- Exposure is the degree to which a system is exposed to significant climatic variations such as sea level rise, temperature or precipitation.
- Sensitivity is the degree to which a system is affected, either adversely or beneficially, by changes in climate. A climate change impact is therefore a combination of the degree to which a system is exposed and sensitive to changes in climate, and the consequences of these changes. For example, in a city that is exposed to sea level rise, urban and built-up areas will be more sensitive than areas such as parkland that are used for recreation.
- Adaptive capacity refers to the ability of the system to adjust to such changes, to 'moderate potential damages, to take advantage of opportunities, or to cope with the consequences' (IPCC, 2007).

While the IPCC definition of vulnerability to climate change is widely quoted, practitioners have found it difficult to apply in the field, particularly to assess or measure vulnerability (e.g. Patt, *et al.*, 2009, Schröter, *et al.*, 2005).

Resilience is a closely related concept, which the IPCC (2007:880) defines as 'the ability of a social or ecological system to absorb disturbances while retaining the same basic structure and ways of

functioning, the capacity for self-organisation, and the capacity to adapt to stress and change'. Resilience is often framed as the opposite of vulnerability and it could be argued that the ultimate aim for adaptation policy is to progress from vulnerability (potential for loss or harm) to resilience (potential to recover).

Vulnerability, then, is the key concept when considering how people will be affected by climate change. It is complex and loosely defined, although the factors that determine it (exposure, sensitivity and adaptive capacity) have been identified. In order to make and inform policy, it is necessary to be able to assess vulnerability and to consider how it varies between different places and people.

Assessing vulnerability

There is considerable material available in the academic literature on defining vulnerability to climate change and identifying conceptual frameworks (e.g. Brooks, *et al.*, 2005, Eriksen and Kelly, 2006, Füssel, 2007, Füssel and Klein 2006). However, these provide little guidance on how to assess vulnerability in practice and the experience of practitioners suggests that the method should be based on the specific policy or research question at hand. Given the variety of approaches in the literature, it is important that the shape and form of a vulnerability assessment is determined case by case. A meta-analysis of literature on vulnerability concluded that the following questions should be used to specify the purpose of a vulnerability assessment or analysis (Hinkel, 2010):

- Who (or what) is vulnerable (e.g. individual, household, social group, ecosystem)?
- What are they (or it) vulnerable to (e.g. hazard, stimulus, impact)?
- What is the relevant policy objective or research question (e.g. do we want to rank places based on a measure of vulnerability or identify 'hot-spots' for more detailed analysis)?

Approaches to climate change vulnerability assessment can be described as 'top-down' or 'bottom-up' (Dessai and Hulme, 2004).

Top-down assessment

Top-down approaches start with a range of emission scenarios that are used to drive complex models of the global climate, whose outputs are then fed into an impact model. The emphasis is generally on impacts on the biophysical system and therefore on the exposure elements of vulnerability. This approach has also been termed 'end-point' (Kelly and Adger, 2000) or 'outcome' (O'Brien, *et al.*, 2007) vulnerability because the focus is often on residual consequences at the end of the analysis after adaptation has occurred.

Top-down methodologies for assessing and understanding vulnerability involve the creation of inventories (Hearn Morrow, 1999) or indices (Cutter, Boruff and Shirley, 2003) for specific areas using quantitative indicators of various dimensions of social vulnerability. These can be mapped with geographical risk data to identify areas where vulnerable people are, or to compare the social vulnerability of different places. Such approaches play an important role in understanding the relationship between social vulnerability and exposure (when combined with spatial climate data) and provide critical information for disaster planning and design of adaptation strategies. They are problematic, however. When looked at in isolation, they can imply a static model of vulnerability, they are not able to capture the full extent of heterogeneity of resources and experience within broad dimensions of vulnerability (e.g. age, ethnicity, income) and may contribute to the stigmatisation of places as 'poor' and 'high risk'.

Bottom-up assessment

Bottom-up approaches tend to focus on current climate variability to understand societal vulnerability and so explore the underlying causes and processes that lead to vulnerability. In so doing, such approaches place a greater emphasis on the adaptive capacity elements of vulnerability to climate change.

In the social science literature, bottom-up approaches to assessing social vulnerability typically employ more qualitative techniques to understand the lived experience and everyday social construction of vulnerability (Brown and Walker, 2008) and avoid regarding vulnerability as an inevitable consequence of certain demographic or social characteristics (Spiers, 2000). The dynamic and situational character of vulnerability is highlighted by this approach and it can enable a better understanding of people's self-perceptions of and responsiveness to risk. In developing responses to vulnerability, the emphasis is on understanding how specific aspects of everyday life within particular places may contribute to vulnerability and on working with local people to develop appropriate adaptation strategies.

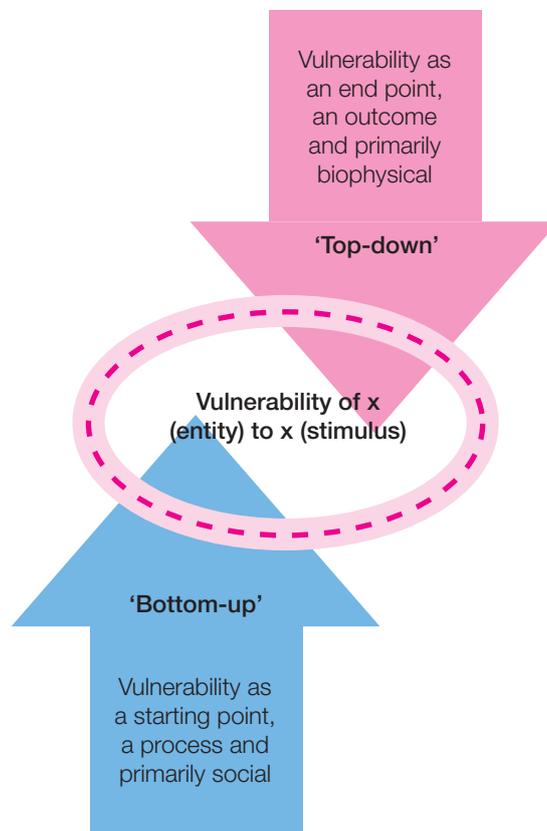
Comparing and combining the two approaches

We might also conceptualise the top-down and bottom-up approaches as differing in terms of viewpoints, with the top-down approach providing an outsider perspective while the bottom-up approach provides an insider view (Spiers, 2000).

Top-down and bottom-up approaches are not mutually exclusive and a combination may be most useful (see Figure 1).

For a particular group (e.g. older people), a particular stimulus (e.g. future incidences of heatwaves) and a policy measure (e.g. heatwave plans), different approaches and methods would provide a different

Figure 1: Approaches to vulnerability assessment



Source: adapted from Dessai and Hulme, 2004

understanding of vulnerability. A starting point for a top-down analysis might be to use the output from climate change models to explore scenarios of future summer temperatures and, in particular, extreme temperature events. This would provide a useful understanding of how different regions may experience different degrees of exposure based on different scenarios of climate change. From high level demographic data, it might go a step further and explore how, over time, changes in the population age structure may increase the number of people who are usually considered sensitive to heatwaves, and explore the capacity of the system to respond to future events.

A bottom-up analysis might start with the location of populations that a top-down assessment considers to be 'at risk', and explore the more complex and context-specific experience of vulnerability within that location. For example, a top-down approach may highlight the existence of an 'urban heat island'. A bottom-up approach could then assess the systems that are in place to deal with such events (e.g. emergency services planning, planning within residential care homes, communication between the various organisations and individuals involved) to see how adequate these would be for various populations. Capacity for action may also be best understood from a bottom-up approach (see Box 2 below).

To summarise, choosing an approach to assessing vulnerability is important and should take account of the context at hand because there is no objective measure of vulnerability that can be applied meaningfully across contexts. As the case studies in this project demonstrate, the complexity and practical difficulties of assessing vulnerability make effective, just and fair adaptation challenging.

Vulnerability and dimensions of social inequality

The climate change literature focuses on the vulnerability of ecological and, to a lesser extent, social systems. The concept of vulnerability is also widely used by social scientists when considering the distribution and experience of environmental risks and hazards, but here the focus is usually on the vulnerability of individuals or groups of people. There is considerable knowledge about the social distribution and experience of flooding in particular, which provides a useful starting point for thinking about vulnerability to the impacts of climate change. Blaikie, *et al.* offer a useful working definition of vulnerability from this approach which (while not addressing exposure) clearly resonates with the sensitivity and adaptive capacity elements of the IPCC definition:

By vulnerability we mean the characteristics of a person or group in terms of their capacity to anticipate, cope with, resist and recover from the impact of a natural hazard. It involves a combination of factors that determine the degree to which someone's life and livelihood is put at risk by a discrete and identifiable event in nature or in society.

Blaikie, *et al.*, 1994:9

Box 2: Understanding adaptive capacity – capacity and action

Most studies that have tried to measure adaptive capacity have used broad-brush economic or demographic proxies such as gross domestic product (GDP), levels of education and access to resources. Adaptive capacity is often seen in terms of economic development on the basis that greater economic resources enable people to adapt more easily.

Grothmann and Patt (2005) make a useful distinction between 'objective' adaptive capacity (e.g. time, money, knowledge, entitlements, relevant support) and 'perceived' adaptive capacity which acknowledges that motivation and perceived abilities are important determinants of decision-making and subsequent action. So while a region or area may score highly on an objective measure of adaptive capacity, socio-cognitive variables are an important factor that may influence the actual degree of vulnerability.

Factors that affect risk

The 'combination of factors that (may) determine the degree to which someone's life and livelihood is put at risk' by climate change is diverse, including:

- demographic factors (e.g. age, gender, race, ethnicity, class);
- levels of health and education;
- access to resources (i.e. poverty), information and knowledge;
- access to political power and representation;
- levels of social capital and access to social networks, aspects of neighbourhood infrastructure and housing quality.

Thus thinking about the vulnerability of people to climate change (whether as individuals, households, or members of neighbourhoods or communities) draws attention to various dimensions of disadvantage and difference within society.

There is a potentially complex relationship between poverty, social deprivation and vulnerability. While many forms of vulnerability may be correlated with poverty (e.g. vulnerability to coastal flood risk), other forms of vulnerability may be less directly associated with it, or associated in a more complex way, such as vulnerability to pluvial or fluvial flooding. Taking the IPCC definition as a starting point, we can see that the different components of exposure, sensitivity and adaptive capacity may all interact with poverty and social deprivation.

In terms of exposure, more disadvantaged people may be disproportionately likely to live in areas at risk. For instance, Walker, *et al.* (2006) found disproportionate concentrations of deprived populations in zones at risk from sea flooding. Social deprivation was measured using the English Index of Multiple Deprivation (IMD) (ODPM, 2004), which is based on seven separate domains:

- income deprivation;
- employment deprivation;
- health deprivation and disability;
- education, skills and training deprivation;
- barriers to housing and services;
- living environment deprivation;
- crime.

Research in the US indicates that poorer communities are particularly vulnerable to increased frequency of heatwaves and higher temperatures because they are often segregated in areas of the inner city more likely to experience the heat island effect (Morello-Frosch, *et al.*, 2009). People on low incomes are also more likely to occupy housing that is less resilient. For instance, mobile homes and caravans are particularly at risk from storms and flooding, large social housing blocks often suffer from poor ventilation and street

homeless people are particularly vulnerable to exposure. However, climate change may introduce new forms of vulnerability that do not (only) affect the poorest in society. For example, newer social housing may perform to higher standards than older low grade private property in terms of thermal insulation, insurance schemes or the speed and quality of repairs to weather-related damage. Likewise, desirable higher value property in urban centres may be particularly exposed to heat impacts. In these and other ways, climate change may produce new forms of vulnerability.

When considering vulnerability to the impacts of climate change, attention is often drawn to the characteristics of individuals. Older people and the very young, especially those who are ill, frail or disabled, have a disproportionate vulnerability to the effect of natural hazards. This has been systematically demonstrated in relation both to the impact of flooding (Tapsell, *et al.*, 2002, Thrush, *et al.*, 2005) and heatwaves (Brown and Walker, 2008).

Those on low incomes are less likely to be able to invest in measures to make their homes more resilient to extreme weather and often lack insurance to cover their losses in the event of damage. This constitutes low adaptive capacity. The Association of British Insurers (ABI, 2002) found that 50 per cent of households in the lowest income deciles do not have contents insurance and those on low incomes also find it hard to cover the immediate incidental expenses often associated with the disruption caused by natural hazards (Walker, *et al.*, 2006). Those without access to private transport may be unable to heed evacuation warnings in areas of poor public transport.

It is not only lack of financial resources that can render people vulnerable, however. Research in developing countries demonstrates that social capital is critical in fostering coping strategies at various phases of the hazard cycle (Pelling, 1988, Cannon, 2000, Sanderson, 2000, Wong and Zhao, 2001). While research in the UK indicates a relationship between levels of deprivation and social capital (Coulthard, *et al.*, 2002), this is not straightforward. More deprived communities might be expected to lack some of the social organisation and integration that increase resilience but levels of deprivation do not map straightforwardly onto levels of social capital (Walker, *et al.*, 2006:30). For example, local family and neighbour networks are stronger in some more disadvantaged neighbourhoods and among some minority populations than in areas with more transient or newly resident populations (e.g. new housing estates populated by commuters or between communities of migrant workers, travellers or gypsies and their neighbouring/ local groups). New residents of various kinds (recent immigrants, tourists) are often vulnerable during hazards because they lack local networks (Hearn Morrow, 1999). However, even where there are high levels of social capital, this does not always increase resilience. For instance, recent UK research by Wolf, *et al.* (2009) suggests that 'strong bonding networks could potentially exacerbate rather than reduce the vulnerability of elderly people to the effects of heatwaves' (2009:1).

To date, most of the work on vulnerability to natural hazards has focused on characteristics of individuals and households; there is less understanding of how the characteristics of different places⁶ offset or exacerbate vulnerability or how places may change after extreme weather events. The results of the Joseph Rowntree Foundation (JRF) Climate Change and Social Justice Programme may help to address this gap.

Awareness of risk and knowledge of how best to respond in the event of a flood or heatwave can play an important role in minimising the impact of such events. Research indicates that risk awareness is often unequally distributed among the population. For instance, in relation to flood awareness, Fielding, *et al.* (2005) found that awareness varied by socio-economic group and that people in groups C2, D and E had lower awareness of risk than those in higher groups. Culture and ethnicity may also influence adaptive capacity in terms of whether information is equally accessible to all groups. New and transient residents may be vulnerable in this regard too, being less likely to have local risk awareness and knowledge.

Summary

While a recent review of the differential social impacts of climate change in the UK concluded that 'deprivation often increases vulnerability to climate change, and climate change increases deprivation' (CAG Consultants, 2009:iii), it is important to note that the relationship between deprivation and vulnerability is complex and not always direct. Not all poor people are especially vulnerable to the impacts of climate change and not all vulnerable people are socially deprived. While dimensions of vulnerability often coincide (for instance, those with disabilities are often poor), this is not always the case. Groups typically identified as vulnerable are heterogeneous: even in locations where levels of deprivation and exposure to risk coincide, not all residents will be equally vulnerable. Likewise, climate impacts will create new kinds of vulnerability and new vulnerable groups, not all of whom will be on low incomes or living in deprivation (e.g. riverside properties tend to have high economic value but face increasing flood risks). Perhaps most importantly, vulnerability should be understood as dynamic: people can move in and out of being vulnerable to particular hazards and their own responsiveness to risk will affect outcomes. This suggests a need to go beyond relatively static identifications of vulnerable groups to focus on the circumstances in which people are rendered more or less vulnerable.

It is clear that vulnerability to climate change may often have a social dimension. Climate change is projected to accelerate in future and so it is important to consider how the planned response to climate change (i.e. adaptation) addresses the social elements of vulnerability and the social disadvantages that are exacerbated by changes in climate.

2 Water affordability

This chapter outlines the relationship between climate change and drought, and looks at possible trends in the future of water supply in the UK. It introduces the landscape of differential water charging in the south-west and describes this as an adaptation to climate change. The chapter considers who may be vulnerable to differential water charging and presents findings from an engagement with key stakeholders in the water sector. Finally, some recommendations are offered, based on this assessment.

Water scarcity is an emerging issue for UK policy because of pressures from growing populations and worsening climate change. We have traditionally treated water as if it were limitless but future supply will periodically be very limited and demand is likely to increase. Water clearly needs to be properly valued so that it can be conserved. However, charging consumers differentially for water, based on the amount they use, may create affordability problems and limit people's access to an essential resource. It is therefore important to understand how water suppliers can balance the priorities for increasing water efficiency with affordability. The current structure of water charging in the UK is explained in Box 3 on page 27.

In the event of water scarcity, people will be impacted unequally to the extent that consumption of water is dependent on the ability to pay. One demand management instrument to incentivise greater efficiency is to use water meters to price water per unit. It is stated government policy to work towards universal water metering by 2020.

The south west of England has the highest number of water customers struggling to pay their water bills, and has been granted permission to run trials of a new tariff system, the rising block tariff (RBT). This tariff would charge a low rate for essential water use (below the standard unit rate for metered water) but would charge steadily higher rates for households that consume large amounts of water. The rising block tariff may offer a payment structure that incentivises efficiency while protecting low income (and other) households from the potentially regressive impacts of differential water charging.

Climate change and drought

The UK periodically experiences droughts, particularly in the drier southern regions. One of the most devastating droughts was in 1975/6 and the most recent were in 1995, 2003 and 2006. Water companies can apply for Drought Orders when their supplies run short, allowing them to implement measures to ban non-essential water use. This often means that households and businesses are restricted in their use of hosepipes, sprinklers and external taps.⁷

Drought causes major problems to millions of people globally by affecting crops and food production and people's individual access to water.⁸ In the UK, there are both minor and severe impacts. Drought spoils gardens and degrades recreational areas, such as sports pitches and areas of natural beauty. At the more severe end of the scale, there are health risks associated with the increased concentration of pollution in waterways and sewers. Some businesses lose money when their water consumption is restricted: farmers, fisheries and biodiversity are often worst hit, but children and people who are particularly sensitive to high temperatures often rely on paddling pools and showers to cool down, especially when drought coincides with a heatwave, which is often the case.

Current evidence suggests that water use increases during heatwaves. A report by Consumer Focus (2009) cites evidence from Ofwat that shows a spike in water use in England and Wales during the heatwave of summer 2003. Likewise, data provided by Bristol Water to the project team show a correlation

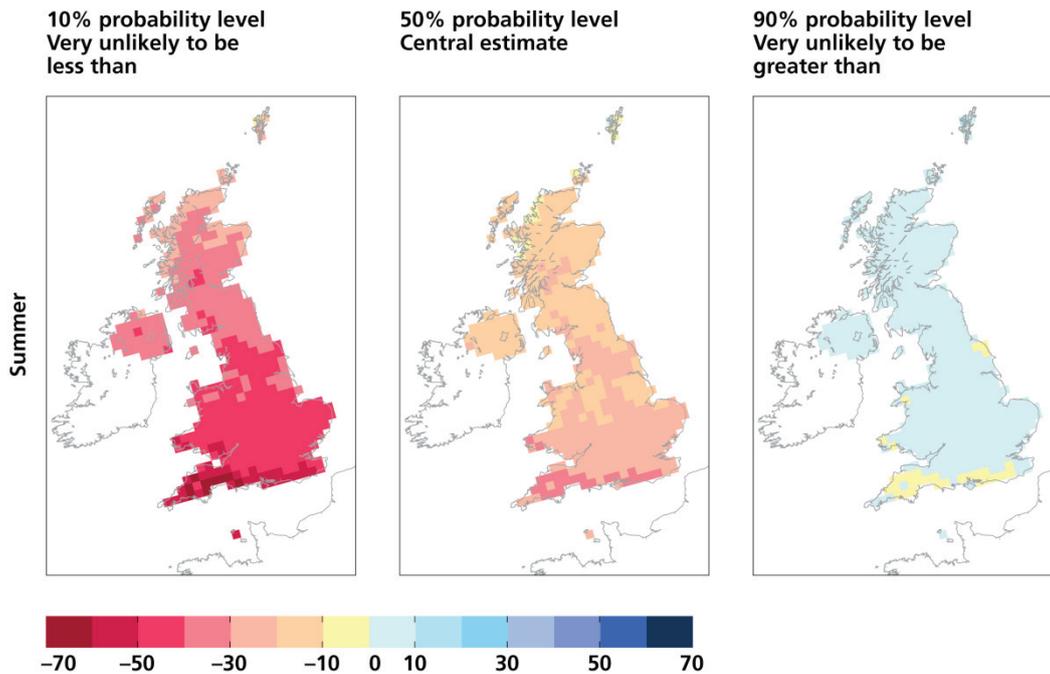
Box 3: Current water charging structure in the UK

- The water sector in the UK is privatised. There are over 20 companies supplying water in England and Wales, one in Scotland and one in Northern Ireland. Some companies provide both water and sewerage services, others supply only water.
- Water charges vary between regions. Charges reflect the cost of collecting, treating and supplying water (as well as the costs of treating sewage) and the investment required to maintain and improve water infrastructure.
- In England and Wales, Ofwat agrees water prices with each water company. In Scotland, it is the Water Industry Commission that agrees prices and in Northern Ireland the Utility Regulator.
- The price that most households pay for water charges is linked to the rateable value of the property. Residents of more expensive properties are charged proportionally more than residents of lower value properties.
- Around two-thirds of households pay standard water charges (i.e. a fixed sum), irrespective of how much water they use.
- Around one-third of households have a water meter, which generally means that they pay a fixed price per unit of water consumed. The size of a household's water bill therefore depends on how much water it uses.
- It is stated national policy to move towards universal water metering by 2020 (e.g. EA, 2009).
- It is generally accepted that charging people for the amount of water they use (differential water charging) creates an incentive for them to use it more efficiently. Water companies are beginning to experiment with new, more flexible ways of charging their customers for water in order to improve efficiency.
- Some households fall into arrears with their water bills and there are a number of schemes to recover debts and prevent arrears. It is in the interest of the water company to prevent customer debt because debt means losing revenue and incurring expensive recovery costs, which are then transferred to bill payers. As a result, the industry and its regulators clearly recognise the need to manage affordability issues.

between water supply volume and temperature, with a corresponding spike during the 2003 heatwave (Bristol Water, 2010).

Drought can also cause forest and grassland fires, which damage property, cause economic disruption and bring their own health and injury risks. Drought in soil leads to subsidence, which can cause structural damage to properties and infrastructure. Extreme drought, which has rarely been experienced in the UK, could lead to absolute shortages and recurrent rationing of water. This would cause intense political and social competition over water resources. Extreme drought can also have a huge impact on local economies, leading to the closure of businesses, schools and leisure facilities. Persistent drought may have long term impacts on the economy, rendering some sectors unsustainable (e.g. water intensive agriculture).

Figure 2: UK climate projections: precipitation



Source: UK Climate Projections (Murphy, *et al.*, 2009)

Recent observations of climate trends in the UK show that summers have become hotter and drier in recent years, around +2°C in summer in the south of England during the period 1961–2006 (Jenkins, *et al.*, 2007), increasing the risk of drought. This pattern is projected to continue as a result of climate change, with longer, hotter, drier summers becoming more common. This will lead to higher incidences of drought, especially during summer.

Figure 2 above shows the summer precipitation trend in the UK for the 2080s and indicates that the south-west is in the region projected to experience the highest levels of drying throughout the century. The extreme events are of more concern than the average changes. Drought can also be exacerbated when it coincides with periods of extreme heat and this sort of extreme event is increasingly likely to occur in the south-west of England in coming decades.

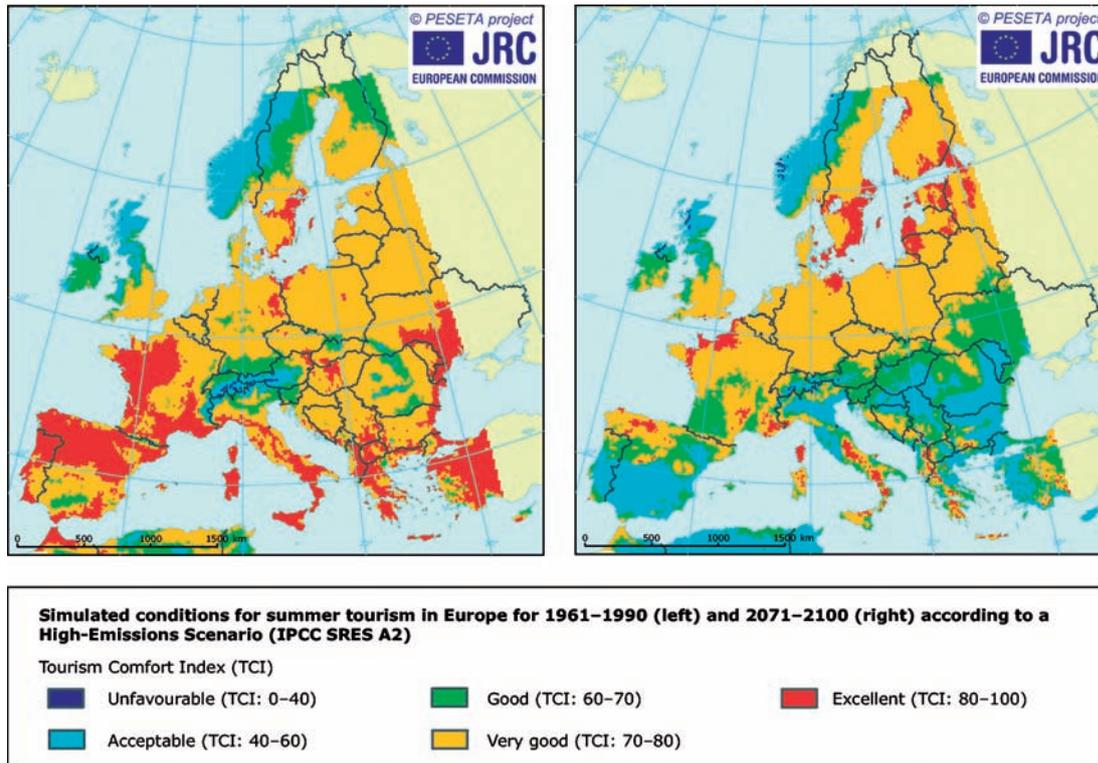
Future water supply

Maintaining a steady supply of water is becoming more expensive. The UK has a moderately wet climate and water has traditionally been seen as an abundant and near-free resource. As a result, people use water liberally – around 150 litres per person per day for domestic use,⁹ plus leisure and business purposes. There is also significant wastage both as a result of user behaviour and because of the ageing water supply infrastructure.

As well as being old and prone to leaks, the water supply infrastructure will be affected by changes in climate. More intense and frequent flooding may impact sewage and waste water treatment works: for example, by increasing pollution from urban and agricultural run-off and by damaging treatment infrastructure. This is already leading to increases in the cost of providing clean water, requiring investment from water companies and therefore higher prices for water customers.

Against this background of climate change, the population of the south-west is projected to increase, which will also increase demand for water. The 2001 Census (ONS, 2003) showed the region to be the fastest growing in the UK and the number of households is expected to grow by 36 per cent by 2030 (DCLG, 2009). This means that water abstraction and consumption will rise unless there is a dramatic and rapid improvement in water efficiency among households, farmers and businesses.

Figure 3: Projected changes in European tourism patterns (EEA, 2008)¹⁰



Source: JRC PESETA projects (<http://peseta.jrc.ec.europa.eu/docs/Tourism.htm>).

The south-west is also host to high volumes of tourists during the summer – over 21 million visits per year (South West Tourism) – which has a significant impact on water consumption. Tourism facilities and services consume large amounts of water, but tourists from outside the region do not pay water charges in the south-west. The cost of supplying tourism therefore falls on south-west residents.¹¹ Climate change projections for the whole of Europe suggest that tourism patterns will change dramatically in the next few decades (EEA, 2008) as conditions in traditional summer destinations such as the Mediterranean and Adriatic seas become unbearably hot and dry.¹² This leads to predictions of increased domestic tourism in the UK, especially in mid-summer (see Figure 3 above).

This presents an additional difficulty for water managers in the south-west. In future the region is likely to face a far higher demand for water (from new residents, businesses and increased numbers of tourists) but is likely to have less water available in summer to ensure supply.

Drought is therefore a serious issue for livelihoods and the economy in the south-west. Water companies are aware of these threats and are planning measures to ensure the sustainability of water resources, motivated by a number of factors including climate change. These measures include increasing differential water charging as a way of incentivising more efficient consumption. It is imperative to ensure that these strategies and other measures designed to adapt to climate change do not worsen existing inequalities and produce new forms of disadvantage.

Differential water charging as climate change adaptation

Differential water charging could be justified purely on efficiency grounds without the threat posed by climate change. However, universal water metering and differential charging linked to usage are considered necessary and desirable in the UK in part because of future stresses on water resources wrought by climate change. This approach is a demand management instrument to achieve water efficiency; increasing the efficiency with which water resources are used is an adaptation to climate change.

Given that climate change is projected to worsen and accelerate over time, differential water charging should be seen as an emerging policy issue of increasing importance. In response, the previous government commissioned the Independent Review of Charging and Metering for Water and Sewerage Services (referred to here as the Walker Review) in August 2008.¹³ The Walker Review (see Box 4 below) explicitly recognises the influence of climate change on current and future water supply, and provides an analysis of water charging with recommendations that emphasise affordability concerns. While a Water Tariffs Bill was proposed to take this forward early in 2010, it was not completed prior to the election and future policy directions on water management are therefore in flux.

However, water efficiency is seen as an important issue. Ofwat (The Water Services Regulation Authority) recognises the link between water charging to incentivise more efficient consumption and the need to increase water efficiency in the long term as a way of adapting to climate change. In its recent report on climate change, Ofwat (2010) also explains the need for higher water bills today in order to ensure the sustainability of water supply in future. For example, it identifies the need to address the resilience of water treatment and supply infrastructure to flood risk.

Box 4: The Walker Review and Water Tariffs Bill

The Independent Review of Charging and Metering for Water and Sewerage Services (the Walker Review) was led by Anna Walker and was received by government in December 2009 following consultation on the interim report of June 2009. The review was concerned with charges for domestic users of water and sewerage services.

The report concluded that there is a strong case for metering where:

- water is scarce and the benefits therefore outweigh the costs;
- there are high numbers of discretionary users (who may not currently pay for the amount they use);
- there is a change of occupancy at a property.

The case for metering is less compelling when water is not in short supply.

With metering becoming more widespread, the transition from one charging system to another is already underway. This cannot be achieved successfully without strong leadership within the sector. The report recommended that Ofwat, working with others including the Environment Agency, should provide sector leadership and that a working group should be set up to ensure that any synergies with the smart metering programme in the energy sector are fully exploited.

The report suggested that, if these and its other recommendations are adopted, about 80 per cent of households in England will be metered by 2020.

Walker also concluded that affordability is already a real issue for some groups of customers and in high cost areas such as the south-west. The review therefore recommends a package of help closely targeted at customers with low incomes, to include water efficiency schemes alongside similar energy schemes and help with bills. Decisions will be needed on whether government or water customers will fund this package.

The report noted that bad debt is clearly placing too much of a burden on water customers who pay their bills; bill-paying customers pay about £12 extra each year to cover the costs of managing non-paying customers' debts. This is considered to be unfair. Debt in the water industry is three times higher than in the energy sector, although water bills are about one-third of energy bills. This suggests that something is fundamentally wrong. The report recommended urgent legislative changes to allow water companies to bill named customers, thereby allowing them to pursue debts through the courts if necessary.

The report also looked at who should pay for the different elements of the current bill and concluded that:

- Prices should continue to be regional, reflecting water costs.
- It is appropriate for water customers to pay for improvements to the quality of water and the disposal of sewage as they will benefit from the improvements.
- If water customers are to pay for these improvements, it is vitally important that they are consulted on the additional costs before government agrees to them. Otherwise, water prices will begin to be seen as a 'stealth tax' and face real opposition, as has already occurred in the south-west.

The report looked at issues relating to the south-west where bills are on average 43 per cent higher than in other areas. Local people feel that this is unfair and it raises questions of affordability. The report concluded that high prices have been caused by the need to install new sewerage systems since 1989 and by the demands of tourism. It sets out some potential remedies including a corrective adjustment, paid for either by government or by other water customers, and a package of measures to help customers in the south-west, including the possible use of a seasonal tariff.

Some of the final recommendations were taken forward into a Water Tariffs Bill.

The Water Tariffs Bill

The Water Tariffs Bill had its first reading in the House of Commons in February 2010 and contained many elements that could be considered positive for households with affordability problems. It required the Secretary of State to review and report to Parliament on the current level of water affordability (termed 'water poverty') by local government area, and required:

- water and sewerage companies to offer a social tariff to all customers below the water poverty threshold;
- a new definition of water poverty to be set, based on existing definitions of fuel poverty;
- Ofwat to set common tariff levels for all water and sewerage companies so that tariffs are averaged throughout the UK;
- water and sewerage companies to contribute to an infrastructure investment fund.

The bill included the following recommendations from the Walker Review:

- greater use of social tariffs;
- the possibility of a contribution to South West Water from the Treasury to recognise the extra costs it has faced;
- a levy on other regional water companies to help meet South West Water's extra costs.

It has now become clear that the Water Tariffs Bill will not be read for a second time in Parliament and will therefore not become legislation in its current form.¹⁴ Without the bill, the vehicle for taking forward recommendations in the Walker Review is not clear.

Likewise, the Environment Agency (EA, 2010) explicitly recognises the link between water metering and charging, and climate change adaptation. It welcomes the results of the Walker Review and explains that climate change requires the kind of demand management that metering and charging can help to bring about. Like Ofwat, the Environment Agency also recognises the need for safeguards to protect vulnerable groups, for example through progressive or social tariffs that protect households from the regressive impacts of differential charging. Water companies, including South West Water, also explicitly recognise the importance of improving water efficiency (of which metering and charging is a key element) as a way of adapting to climate change.

It is therefore appropriate to consider water charging in the context of climate change and to examine whether there are social justice implications to differential charging that, unattended, may become more pronounced in future or lead to new forms of disadvantage.

Summary

Climate and socio-economic changes in the south-west clearly pose a threat to the secure supply of affordable water. Demand management measures are necessary from both an environmental and a long term socio-economic perspective in order to improve efficiency. Differential water charging is emerging as one of the key tenets of demand management and will become more widespread in the years to come. However, differential water charging threatens to create new forms of inequality between people who use significant amounts of water and will also create a new pressure on low income households.

Who is vulnerable to differential water charging?

There are four ways in which differential water charging based on usage patterns has the potential to cause harm and create inequalities in society:

- **Affordability:** households may be unable to afford their bills because of low income or other reasons.
- **High use:** households may have legitimate reasons for using large quantities of water but be penalised for doing so.
- **Absolute availability:** some regions may have insufficient water while others are better resourced because of supply and distribution arrangements.
- **Approaches to water charging:** water poverty may result from interventions by water companies or authorities.

Affordability

As water becomes more expensive (because of the additional costs of collecting, distributing and treating a scarce resource), people may be unable to pay for the level of consumption that gives them a safe and comfortable life. Water bills are already set to rise by 5 per cent per year, according to the Walker Review. As climate conditions change, the threshold of what is needed to provide a 'safe and comfortable life' may also increase (e.g. because of increased demands for personal cooling during heatwaves), which would exacerbate the problem of water affordability.

Whenever access to a resource is determined by a consumer's ability to pay, there is a danger that low income groups will suffer a shortage of that resource. On public health grounds, no household can be legally occupied without a supply of mains water; even where households fail to pay their water bills, water

companies cannot switch off the supply of water to the property. While that remains the case, the question of vulnerability to drought remains largely (but not entirely) a question of affordability.

We therefore offer the following definition of vulnerability to drought: 'Drought affects individuals to the extent that they do not have access to an 'adequate supply'¹⁵ of affordable water.' In practice, because water companies are currently obliged to supply water to all homes (i.e. some supply is guaranteed), the issue is focused on a household's ability to pay for a 'sufficient supply' of water.

It is important that affordability concerns are central to future water regulations. Otherwise, new forms of social disadvantage may be created by such adaptation measures, increasing deprivation in certain vulnerable households. The current economic context of recession and rising unemployment makes the study of debt issues more salient.

Where households have problems with affordability there is a risk of water poverty developing. A study in the UK (Fitch and Price, 2002) defines water poverty as a subset of general poverty: that is, water poverty will occur among those with low incomes. Water poverty is an extension of the familiar concept of fuel poverty, meaning broadly the inability to keep a household 'comfortably warm' (e.g. between 18 and 21°C) at reasonable cost. 'Reasonable cost' is often defined as a proportion of household income after tax and in the UK the fuel poverty threshold is usually set at 10 per cent. The water poverty threshold in the UK has been defined as 3 per cent of household annual expenditure, by which definition there may be up to 4 million households in the UK that are water poor (based on data from Fitch and Price, 2002).

Vulnerability to drought is potentially more complex. In addition to the pure affordability dimension, legitimately high consumption of water (for medical or other reasons) may make certain people more exposed and sensitive to price increases, causing affordability problems even where incomes are not considered low.

The important contribution of the concept of water poverty is to show that, if absolute consumption is dependent on ability to pay, some households may not be able to afford their 'essential use' requirements, or payment for water will take up a disproportionate percentage of household expenditure.

High use groups

Certain groups may have a legitimate higher-than-average demand for water, making them more sensitive to increases in its price or to thresholds imposed by definitions of essential and non-essential use. These may include individuals and groups not currently thought of as being vulnerable. For these purposes, households with high water consumption for recreational purposes (including discretionary use for pets or other animals) are not considered vulnerable; water requirements are understood here as maintaining an adequate standard of living for human members of the household. Water efficiency measures may be designed to actively discourage recreational uses such as keeping pets or pursuing water-intensive hobbies.

Some households require large volumes of water. This can be because:

- An individual in the household has a medical condition that increases the need for water (e.g. needs to bathe frequently or to wash bedding and clothing).
- The household is susceptible to overheating as a result of its design, location or materials, and water is the only available means to provide direct cooling for inhabitants during intense high temperatures.
- The household has a large number of inhabitants.
- A householder is self-employed and uses large amounts of water to clean, maintain or service equipment or products.

- The household cannot afford water-efficient models of household appliances, such as washing machines, toilets or showers.
- The household is rented, reducing the tenant's ability to improve the water efficiency of the property and its appliances.¹⁶

In summary, people's vulnerability to differential water charging is determined in part by their ability to reduce their own water use.

There is potentially an overlap between people's vulnerability to high temperatures and their requirements for water consumption where their only option for reducing heat stress in hot weather is to use water. This might be because the home is poorly insulated or located in an urban heat island with no access to cool space, or an occupant is housebound or restricted for cultural or domestic reasons from attending public spaces that offer a cooling environment.

Absolute availability

Vulnerability as a result of absolute availability only applies between regions, where one regional water company is able to supply its customers and a neighbouring company is not. This would create inter-regional inequalities in access to water and is an issue of national level supply and demand. Water is currently managed within basin catchment areas, there is no 'national grid' for water and water transfers are underused. The Environment Agency and Ofwat are contemplating the potential to trade water resources between regions via inter-basin transfers (Cave, 2009). This is common practice in drought prone countries such as the USA and Australia where it helps to improve the efficient allocation of water resources to those who value it, but is much less common in the UK (Harou, 2009).

This study is concerned with the potential impact of water charging policies within a particular region and therefore does not consider national level vulnerability issues relating to absolute availability. However, it is conceivable that this may become an issue for a regional debate on justice at some point in the future.

Restricting flow to non-paying households

There is potential for a very serious new form of vulnerability to arise. Water companies have expressed qualified support for changes to the rules that would enable the installation of 'trickle valves', which restrict the flow of water to a bare minimum for households that persistently do not pay water charges (Walker, 2009a, 2009b).

At present these suggestions are accompanied by caveats: for example, that they would only apply to persistent 'won't pay' rather than 'can't pay' customers and would only be administered after meeting 'rigorous independent safeguard conditions' (Walker, 2009a). However, any removal of the obligation to provide mains water supply to all households may eventually lead to an acute situation of water poverty in the UK for more people. Households that become unable to afford their water charges could be cut off from mains supply apart from a trickle-flow that is sufficient only to meet the most urgent human hydration requirements.

The factors that might create such a scenario include a combination of rapid and dangerous climate change with significant social disruption or increases in inequality (perhaps caused in part by climate change itself). This may lead to competition between social groups for a limited supply of safe water. In these conditions, water companies faced with an absolute shortage of water may be encouraged to restrict flow to households in arrears and to use their limited water supply to generate income from paying customers. These conditions are far off and extreme, though not inconceivable long term, given the predictions of extreme climate change under high emissions scenarios.

Summary

Policy-makers recognise the potential for water metering and charging to create new water affordability problems (e.g. Ekins and Dresner, 2004). Vulnerability to drought is largely an issue of affordability relating to people's income or ability to pay. Additionally, households that have a large water requirement, for health or other essential reasons, are more vulnerable to the potential negative effects of differential water charging because they cannot reduce their household demand. A household that does not have a high requirement for water stands to benefit from a rising block tariff or other differential water charging initiatives. A household with a legitimately high requirement for water is much more likely to be disadvantaged by water metering and charging if it does not qualify for any support schemes (such as WaterSure and WaterCare).

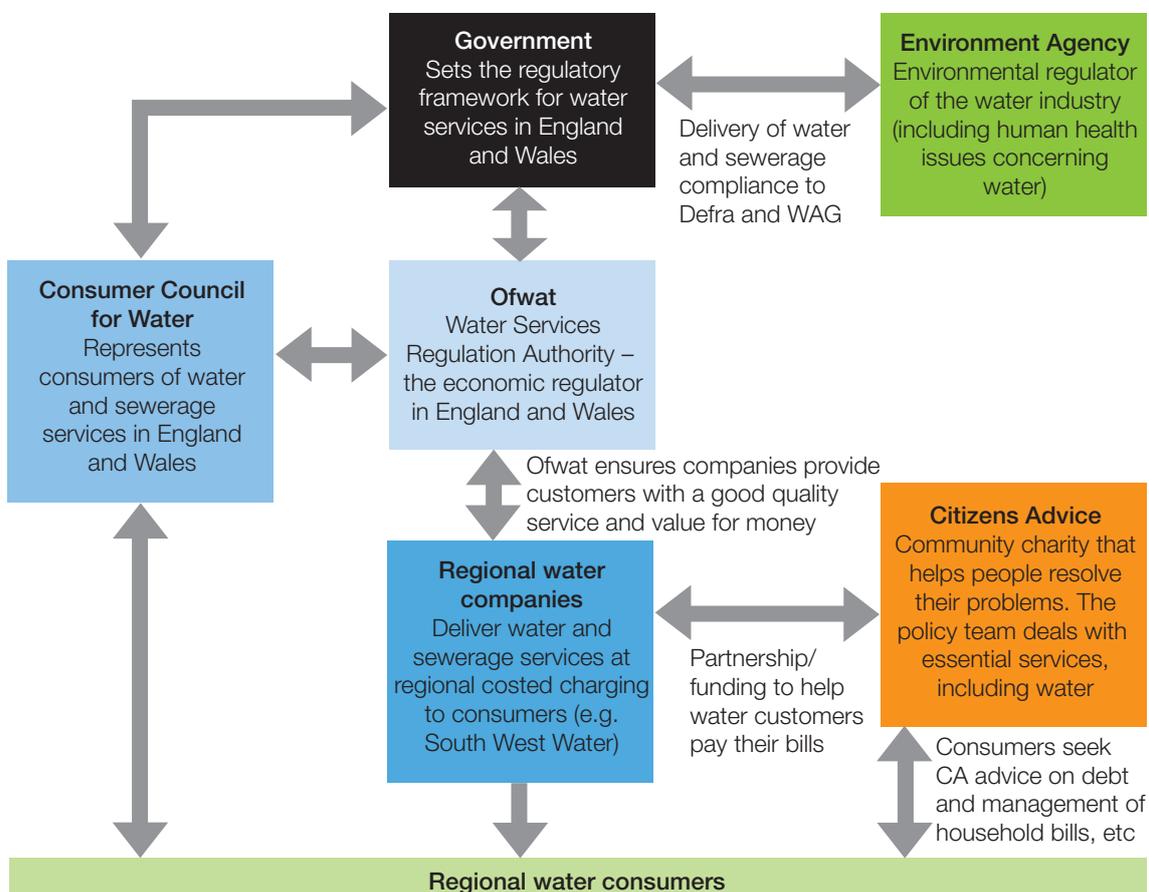
Water poverty is currently a concern in the south-west, where a number of households struggle to afford their water bills. Acute water poverty, including vulnerability to absolute shortages of water among low income households, is a possibility in future if the water market is not made more sustainable.

Water affordability in the south-west: stakeholder views

This section is based on interviews with key stakeholders involved in governing the water sector in the south-west, including the regional water company (South West Water), water sector regulators (Ofwat and the Environment Agency), consumer interest groups (Consumer Council for Water and Citizens Advice) and the author of the Walker Review. The governance of water charging is set out in Figure 4 below.

The sample size for the case studies was small and the results must be treated appropriately as exploratory findings. The interviews discussed vulnerability and relate the case studies to the wider context of climate change. They were not intended to carry out indepth research on the measures in question or to

Figure 4: Governance of water charging in the UK water sector



constitute sociological perspectives of vulnerability. We set out to answer the question: how are vulnerable people protected from differential water charging based on usage?

We found a strong awareness among stakeholders of existing affordability issues and of the support schemes and trials to address them. The role and remit of each stakeholder is well defined and understood across the sector, partly as a result of the Walker Review which brought stakeholders together to consider future water charging issues at national and regional level.

The case of the rising block tariff trial in the south-west shows that suitable policy measures can be designed to achieve sector priorities without having a significant negative effect on vulnerable people. However, affordability concerns have to be explicitly recognised and there needs to be adequate representation of vulnerable groups' interests at the decision-making level for this to be the case. This case study sets out to demonstrate how stakeholders understand affordability and vulnerability issues in relation to water charging and how current schemes are able to protect vulnerable groups.

Analysis of the interviewees' responses is arranged in three sections:

- understanding vulnerability and water charging;
- implementation of water efficiency and affordability schemes;
- roles, governance and recommendations for the future.

Understanding vulnerability and water charging

Interviewees shared a fairly consistent interpretation of what it means to be vulnerable to differential water charging, despite representing different sets of interest in the water sector. One commented that 'everybody believes that, because water is essential for life ... everybody has to have access to the water they need at reasonable prices. The question of how you do that ... is much more debatable'.

The Walker Review team defined vulnerable groups in this context as 'people who may not have a sufficient supply of water at a price that they can afford' and explained that people were more likely to be vulnerable if they lived in a region with high water rates. Ms Walker recognised the injustice of the situation in the south-west where there is plentiful water but high prices, but also commented that 'it may however be more serious than that', if human abstraction and climate change fundamentally change the ecology and hydrology of our ecosystems and create absolute water shortages. The emphasis here on population change was at least as great as that on climate change.

South West Water acknowledged that 'there is a great multiplicity of [vulnerable] people – there isn't really an homogenous group' and that the concept of vulnerability applied to people who struggle with all bills and payments, not just water charges. This broad definition included: households that were in poverty and therefore had a range of affordability problems; households that were not in poverty but may be 'tipped' into debt if new outgoings are required; and 'poor money managers' who may have sufficient income but struggled to manage their income, expenditure and debt.

South West Water's data on its customer base revealed an often overlooked group of vulnerable consumers: young, single people living on their own, often on Jobseeker's Allowance or very low income. These customers were unable to benefit from efficiencies in sharing water use and splitting water bills with other working adults. Smaller families (fewer than four people) in the south-west, who made up 94 per cent of South West Water's customers, may also struggle with water affordability as more properties become metered. Presently, there was no national or regional scheme or tariff to support these groups, which was partly why South West Water was currently trialling a rising block tariff. The water company also recognised a range of medical conditions as reasons for high water use,¹⁷ and these were now included in the criteria for the WaterSure support scheme.

Ofwat and the Environment Agency – two organisations that regulate the water sector – offered a similar interpretation. The Environment Agency defined vulnerable groups to include any household with a high need for water but limited ability to pay. It believed that water pricing by volume ensured customers paid according to how much they used and that some low income households benefited from this. However, high water users were likely to see bills rise. The Agency comprehended that impacts should be supported by appropriate pricing structures and other mechanisms to support individuals or family outgoings. Acknowledging that vulnerability stemmed from the fact that water was essential for life and society's basic need, the Environment Agency suggested that, as metering increases, appropriate tariffs can be developed to play a major role in protecting households with affordability problems.

Ofwat understood vulnerability to have two facets, affordability and access to sufficient water: 'Can they afford to pay the bills that they are being faced with or will be faced with, and will they actually get the resource that they need?' Water pricing was not explicitly perceived as a mechanism either for responding to climate change or delivering social objectives, but as a means to 'recover the economic costs of providing the water service and the costs that are faced directly by water companies'. The Ofwat interviewees emphasised, however, that strategic decisions about improving water efficiency were informed by climate change considerations. 'Historically, up to this point, you couldn't really say water pricing is really reflecting climate change challenges but that isn't saying we're not thinking about it. That's a really important point, I think.'

Ofwat acknowledged the benefits of a phased approach and believed the five-year regulatory cycle meant that any plans to deal with vulnerability and affordability were set out over a longer timeframe and could remain on the agenda rather than being dropped or restarted annually, or limited by the short perspective of a financial year.

Citizens Advice (formerly the Citizens Advice Bureau) was aware that current, traditional water pricing was starting to unravel and felt that metering would need supplementary action to protect those whom it disadvantaged if it was to continue. Vulnerability was understood as affordability and was seen to be based on the relationship between income and bills. Low income households in high water bill areas (e.g. the south-west) were understood to be vulnerable. Citizens Advice, like South West Water, identified low income single people as being particularly vulnerable.

Citizens Advice was in the initial set-up phase of a project to define vulnerability, initiated at a workshop at its Social Policy Conference in February 2010. It acknowledged the difficulties in identifying vulnerable people and called for 'smarter' ways of signalling this information. Citizens Advice did not currently see a connection arising between climate change and water needs, but acknowledged the immediate need for efficient water management.

The Consumer Council for Water suggested that those with high discretionary use of water may be considered vulnerable in drought conditions, but emphasised that 'real vulnerability' was experienced by customers who could not help but have high use of water. Within this category they included people with large families, those with certain medical conditions and commercial customers who used water as part of their work.

The Consumer Council had looked into water use behaviour in drought areas and had 'real evidence of how people react, and how they behave and what they respond to'. A key finding from its work was that people reacted positively to messages about water scarcity and many felt a social responsibility to cut usage, but only if they perceived the water companies to be taking action too, for example to address leaks in the supply infrastructure.

In drought conditions, people were more affected by high prices or water use restrictions if discretionary use for non-vulnerable customers was high in the region. For example, if wealthy consumers could afford to pay a high water bill, and therefore used large volumes of water in their gardens during a drought, the costs of meeting that area's water demand would be high. Average bills would also be high as water companies transferred the costs of meeting demand onto customers via water charges. Likewise, if wealthy residents used high volumes of water during a dry period (even if metered and charged per unit for

this water), this would increase the likelihood of water restrictions and thus affect low income households that used little water.

This suggests that high discretionary water use by wealthy households could indirectly increase overall costs for low income households that use little water. Overall, regional consumption would remain high, pushing up prices for all (including unit prices within rising block tariffs). This situation is more likely to arise in areas of high income inequality. If valid, this suggestion adds an additional layer of injustice to the current affordability situation.

Similarly, the Walker Review team pointed out the knock-on effect for unmetered low income bill payers if the 'thoughtful classes' moved on to meters to save money. Households left on standard rates could find their bills increased to pay for the continuing water supply.

Overall, the interviews indicated a general consensus that those who are vulnerable to water pricing are also vulnerable to other policies or hazards. For example, they are unable to pay other bills or may be more susceptible to heat stress, compounding their vulnerability to drought. It was understood that where metering is encouraged in high bill areas, such as the south-west, supplementary tariffs were needed to set incentives as well as to protect vulnerable households.

One observation from the interviews was that there is a justifiable focus on the short term implications of water affordability and emerging policy. The Walker Review team noted that the vulnerability and affordability issues relating to water charging were not simply future issues but immediate concerns. Unmetered prices were expected to rise by 5 per cent each year and affordability problems were therefore expected, both for metered and unmetered customers who may face bill inflation of 25 per cent by 2014. The situation was described as a 'crisis happening now'. Stakeholders therefore focused on the current and near term issue of affordability rather than the longer term implications of how water charging will evolve, which may have more profound justice repercussions for people over the long term. Interviewees did not discuss the possibility of new vulnerable groups emerging as a result of climate change.

The views of the water industry and regulators were well developed and consistent, suggesting the benefits of a sector where collaboration is common and agencies have explicit remits to consider the affordability dimension in their business plans. As a result, their interpretation of vulnerability and justice issues in relation to differential water charging aligned with the consumer interest groups. Consumer groups put more emphasis on ensuring that social tariffs and other initiatives were easy to use and effective at household level. Perhaps surprisingly, there was no strong association (even among consumer groups) between patterns of affordability or water poverty and the effects of climate change. This again highlights that current affordability is seen to be the key issue rather than the social impacts of differential water charging as an adaptation to long term climate change.

Implementation of water efficiency and affordability schemes

Interviewees gave their thoughts on the implementation of the three key initiatives to support water affordability in the south-west: the trial of the rising block tariff, the national WaterSure scheme and South West Water's WaterCare scheme.

The rising block tariff

Various of the organisations interviewed had been involved in the conception, design and implementation or monitoring of the rising block tariff trial in the south-west. The core features of the scheme are set out in Box 5 on page 39.

Interviews revealed that the trial was currently struggling to recruit customers to the scheme, especially larger families,¹⁸ because fewer customers were currently moving house (a criterion for recruitment to the scheme) as a result of the downturn in the housing market. A low recruitment rate means it will take longer to gather data from which statistically robust conclusions can be drawn and there is a

Box 5: The rising block tariff trial in south-west England

The trial started in April 2009 and is overseen by a working group that includes Ofwat, South West Water and the Consumer Council for Water.

Consumers are charged higher rates per unit, the more they consume.

The tariff includes three 'blocks' of water usage, each priced differently:

- Block 1, essential: £1.227 (73 per cent of standard rate).
- Block 2, standard: £1.6795 (the current price).
- Block 3, premium: £3.0359 (181 per cent of standard). Non-essential use. Price is as high as Ofwat would allow.

The rising block tariff has the potential to reward customers who use less water, by giving cheaper per unit charges, and to penalise households for non-essential use.

The scheme automatically recruits customers moving from one metered property to another without a change in family situation. Currently around two-thirds of households in the south-west are metered.

South West Water calculated the blocks using data for household size and personal use in the south-west. As there is no definition of essential water use, SWW estimated individual usage volumes for toilet flushing and personal hygiene. Scalable items (e.g. clothes washing, washing up) – which are considered to be more consistent across different household sizes – were then calculated to establish the overall threshold for essential use for the region. South West Water proposed the prices and consulted with the Consumer Council for Water; Ofwat approved the tariff trial and prices.

The trial seeks to assess the effect of differential water pricing on water usage. South West Water would like to know how prices influence consumer behaviour: for example, what is the price point at which consumers will actively reduce their water use in order to avoid paying higher bills? It is hoped that the rising block tariff trial will produce a reliably large set of data that can be used to undertake this sort of analysis. The trial also provides experience of designing and implementing such a scheme which would be useful for a potential roll out of similar schemes elsewhere in the UK.

risk that the trial will not be extended so no usable data will be produced. South West Water considered imposing the trial on a range of households but felt the potential social impacts were inappropriate.

Ofwat interviewees emphasised that their role was to ensure tariff schemes 'are sound from an economic perspective, rather than from a social policy perspective'. The existing legislative framework prevented 'blatant social support for some groups of customers', thus tariffs needed to be based on cost characteristics (water use of classes of customers), not on income characteristics. If the rising block tariff has 'a social spin off then that would be all well and good, but it couldn't be driven by the social objective'. The rationale for the trial was to 'see whether in fact people curtail their discretionary use because of the banding structure ... we don't know the answer yet'.

The Consumer Council for Water noted that the tariff trials were explicitly driven by sustainability and future water scarcity but they were also important in addressing affordability issues. The average water customer is in the lower (first) block usage and will therefore receive a lower bill, but the Consumer Council for Water was waiting to see whether the trial would really address affordability for vulnerable people. There was a chance that it could create new affordability problems for high consuming households (including larger families) that had low incomes but were not in receipt of benefits.

The trial was expected to provide water companies with data that indicated where consumption behaviour can be influenced by pricing. It would be the first time that companies had access to these data. This information could be used to deliver water efficiency measures more effectively through domestic tariffs. Regulators revealed that water companies beyond the south-west were closely watching the rising block tariff trial because of the industry's interest in learning more about the price point at which consumer behaviour begins to change.

Results that indicated the optimal price for water would have a profound impact on tariff structures across the UK and could have serious affordability implications if that optimal price were very high. In practice, the optimal price of water would be different for different groups; ability to pay affects consumers' definition of what they consider 'too much' for an extra cubic metre of water. It is important to follow developments in this area to ensure that the interests of efficiency (and therefore water conservation) are balanced with the interests of justice and affordability.

It is clearly too early in the trial to draw conclusions about the effect of rising block tariffs on vulnerable households or in creating new affordability problems. Despite the enthusiasm of various stakeholders and onlookers, the low recruitment rate should guard against reading too much into the results unless a full sample size is achieved (though the close supervision of the trial by regulators and others makes this sort of mistreatment of findings highly unlikely). There is a chance that rising block tariffs will not be rolled out on the scale initially envisaged if the trial fails to recruit enough households so that the data is not useful. The Walker Review concluded that rising block tariffs were no panacea; they may reduce payment from all low usage households, irrespective of income, thus transferring the burden of investment in water infrastructure to high usage groups (including those with low ability to pay). This may also contribute to the demise of the rising block tariff before it has really begun to be deployed by water companies.

WaterSure

The national WaterSure scheme also aims to help households with water meters that struggle to pay their water bills, but is specifically focused on qualifying households with low income or specific medical needs related to water use. The scheme caps water charges for households on water meters and its key features are set out in Box 6 on page 41.

WaterSure has tightly defined eligibility criteria that affect overall take-up. There is an annual re-application process and interviewees suggested that this increases dropout rates as the forms can be difficult to complete. Not all eligible low income customers therefore received help in the longer term or consistently from year to year. Interviewees said that the possibility of initial visits from trained helpers had been raised in order to increase uptake, especially if combined with a household energy efficiency review. For example, Southern Water was planning to visit customers who were about to go onto a meter in order to explore ways to make household savings, but this would be an expensive initiative to maintain.

WaterSure does not provide for the instance of a single person with an illness relevant to water use. South West Water interviewees suggested giving such customers an element of their water free and the Walker Review interviewees recommended extending this scheme to all people on a low income, whether or not they had children. Importantly, they also recommended that the cap on household water charges should be the national average water charge (roughly £1 a day) rather than the regional average in order to help more vulnerable people in high price areas such as the south-west.

Ofwat interviewees noted that the scheme only capped eligible households' bills at an average for their water company's zone and thus did not help all poor customers because of the variability of charging between zones. They also suggested there was a 'reticence for some customers to want to switch to a meter for fear that they might become ineligible for the WaterSure scheme but then be saddled with meter charges'. One interviewee estimated that 'perhaps only a fifth of the eligible people are on the WaterSure tariff'.

Another disadvantage of the scheme as currently configured is that WaterSure is only for metered properties and therefore leaves out many customers. In Wales, there is a devolved responsibility for

Box 6: The national WaterSure scheme

WaterSure is a national scheme that is available to some customers with a water meter. It caps their bills to ensure they do not cut back on water use because they are worried about paying their bill. Those who qualify for WaterSure pay no more than the average household bill for the region, even if they use more than the average amount of water.

Qualifying households must meet the following criteria:¹⁹

- Supply is metered.
- The person who pays the water bill or someone else in the household receives a qualifying benefit or tax credit.
- There are either:
 - o three or more children under the age of 19 living in the household for whom the person receiving the above benefit also claims Child Benefit; or
 - o the bill payer or someone living in the household has a medical condition that means they use a lot of extra water.

Those who do not have a meter, and single person households on low income but not on benefits, are therefore excluded from the scheme.

Of UK water companies, South West Water has the highest number of customers participating in the WaterSure scheme. This indicates that affordability and water consumption are already problems in the region and could worsen as the climate changes and water metering becomes more widespread.

setting up water financial support schemes. Welsh Water's equivalent to WaterSure covers unmetered households and has a much lower cap (around £250 a year instead of around £400 a year in England).

In summary, the WaterSure scheme is considered to be a worthwhile initiative but could be improved by:

- making it easier for participants to join and stay in the scheme;
- improving retention rates and coverage;
- perhaps widening the scope of the scheme, e.g. to cover single people, all low income groups, unmetered customers;
- reducing the cap on water bills to the national average rather than the water company zone average.

While these improvements would raise the cost of the scheme (and therefore have an impact on water bills in the region), there would be a transfer of costs away from those on lower incomes who are potentially vulnerable to differential water charging.

WaterCare

South West Water's WaterCare scheme targets customers who are in arrears with their water bills. Its main features are explained in Box 7 on page 42.

Box 7: South West Water's WaterCare programme

South West Water launched its WaterCare programme in April 2007. It is designed for customers who are in arrears with their water bills and helps them to manage their water use better.

This is the first scheme of its kind to be funded entirely by a utility company. Trained advisors (coordinated by the Eaga Partnership) aim to meet a total of around 7,500 qualifying customers over three years in their homes and offer a range of free measures including:

- Installing simple water saving devices such as trigger nozzles on hosepipes, tap flow restrictors and 'hippos' in toilets.
- Carrying out simple repairs, including fixing dripping taps and stopping cistern overflows.
- Assessing whether a water meter would help reduce bills if the household is not already metered.
- Ensuring customers are receiving all possible existing financial support and benefits.
- Moving customers to more affordable payment plans, tailored to their particular circumstances.

The WaterCare scheme seeks to encourage uptake of other support programmes, targeting people who are unwilling or unable to complete the forms required by the schemes. For example, it identifies people who are not capable of dealing with the annual renewal process for the national WaterSure programme or of getting the help they need.

WaterCare mirrors the government's Warm Front grant scheme for energy. It works with Eaga, which carries out visits and tariff assessments to check eligibility for WaterSure.

WaterCare is a very successful programme and was singled out as such in the Walker Review report and in the case study interview with the review team. It works especially well if customers are keen to help themselves because it provides practical solutions and free advice that households can act on. Results show that participants are paying three times as much as they were before the scheme started, and twice as much as in the second year of operation. However, overall it does not cover a high percentage of customers in the south west and has a high dropout rate.

In response to the Walker Review, South West Water suggested compulsory metering for those in debt. This would bring these households onto the WaterCare scheme (and would increase the number that are eligible for the WaterSure scheme). Such a move would benefit many households in the south-west, especially those that have high water requirements. Where support schemes such as WaterCare are in place, moves towards universal metering may be beneficial. There are many households that could benefit from these support schemes and a water meter is a necessary qualification.

Overall, the interviews suggested that the WaterSure and WaterCare programmes are effective in protecting some of the most vulnerable households from the regressive effects of water charging and from debt. There are gaps that could be plugged in terms of groups that are not eligible, and the administration of the schemes could be improved to reduce dropout rates and ensure the most efficient way of retaining households on the schemes.

The combination of the three different schemes currently seems to be necessary. Where these schemes are in place, installing a water meter is more likely to help a household struggling with affordability issues than to make life worse. Water metering without such schemes is dangerous and more likely to be regressive. With affordability at the centre of water companies' strategies, and with the necessary support

from consumer groups and oversight from regulators, addressing affordability concerns is possible and can be advantageous to all concerned.

Roles, governance and recommendations for the future

This section presents a summary of the interviewees' views on their roles, the governance structure of water charging and their recommendations for the future. In general, the governance landscape in this sector is clearly set out and stakeholders seem to work effectively together. This may be the result of recent initiatives such as the Walker Review, which have brought stakeholders together, but may also result from the clearly defined roles in the water sector and the need for communication and networking between industry, regulators and consumer groups. If so, it shows the benefits of multi-stakeholder working on issues as complex as affordability and vulnerability within an emerging policy issue such as differential water charging. Asked about social vulnerability, South West Water commented: 'Are we aware of it? Yes. Even if we weren't socially aware of it, we have enough stakeholders who are pushing the affordability issue: if not every day then every week.'

Consumer interest groups such as Citizens Advice also play a key role in linking water affordability to other affordability issues and to support through utility schemes and non-utility debt recovery initiatives.

Industry

Water companies have both direct and indirect responsibilities for protecting households from water affordability problems. South West Water saw its role in water charging governance as making commercial decisions about water pricing while also supporting social decisions. It had long term plans to avoid water shortages and recognised the need to ensure these do not create unmanageable affordability problems. Its view was that it is the role of government to set out the affordability framework and its rationale in terms of who should pay more. Water companies tended to be uncomfortable with cross-subsidies, where one group of customers paid more to fund allowances for other customers, and saw these essentially as political decisions. One interviewee cited the Boston Tea Party in reference to companies making such decisions: 'no taxation without representation'.

The Walker Review identified that water companies have a role to consider low income customers (as in any other sector) and that companies should help to identify vulnerable customers and refer them to Citizens Advice or elsewhere for support.

Regulators

Regulators set the framework within which prices and tariff structures are designed, and thereby had significant influence over the context and implementation of water affordability and assistance schemes. Ofwat's role was to ensure that water companies operate within legislation when they address affordability issues. In the past, some companies had suggested implementing 'social support for some groups of their customers at the expense of other groups', which Ofwat had prevented since it was not within the legislative remit. The draft Water Tariffs Bill put the onus on water companies to decide their approach to affordability support and social tariffs, and to seek the approval of the customers whose bills would be affected. The effect had to be broadly acceptable. Ofwat suggested that 'it's actually a bit of a see-saw game ... you can have a few people jumping on one end and benefiting but the effect on the others who have to pay has to be acceptable, broadly, to those who are going to have to pay'.

Speaking about the tension that regulators face in steering 'political' decisions about cross-subsidies, Ms Walker commented 'I am very sympathetic to the point that Ofwat makes, which is that if affordability [issues] are to be paid for by cross-subsidy between different groups of customers, it isn't for a non-elected body to take a decision on what level of cross-subsidy [is appropriate] and who benefits ... that really is a political decision'. The implication is that government must take these decisions.

Water charges are still small in comparison with other household utility bills. Ofwat concluded that the benefits system is a better way to solve poverty than a piecemeal approach targeting only water, which is often only a small fraction of the debt burden of poor households. On reflection, it is clearly also important that water bills do not add unfairly to this existing debt burden.

The Environment Agency defined its role as an environmental regulator concerned with the sustainable use of water. It administered the water abstraction licensing system and regulated and worked with the water industry and other organisations. The Environment Agency believed rising block tariffs had a great potential for all water companies to help manage demand and establish the value of water. The Agency also expected that other appropriate tariffs would be developed as metering levels increased, which could play a major role in incentivising the efficient use of water while protecting vulnerable and low income households.

Consumer groups

Within the water sector, the interests of consumers were represented by the Consumer Council for Water, while Citizens Advice offered direct support to customers who needed help with household water bills or other utilities. These agencies have an important role to ensure that households do not suffer unduly from the complexities of spending plans or changes in the way that water is supplied and charged for.

Citizens Advice defined its role as ensuring affordability and an available supply of water for everyone. Its remit covered more than just water and included all essential services (e.g. gas, electricity, and communications). There was scope for joining up the support networks for vulnerable households on all utility debt and billing issues, and Citizens Advice would be able to play a key role in such a consolidation.

The Consumer Council for Water's priority was water affordability, especially in the south-west region, but it insisted that all key stakeholders had the responsibility for considering affordability and needed to fulfil their different roles to help implement more affordable demand management strategies.

The Walker Review highlighted that a rising block tariff gave all consumers cheaper water, irrespective of income, and therefore failed to address priority groups. The Review's position was therefore that the rising block tariff was not the way forward for vulnerable people. Given the high seasonal demand from tourism in the south-west, the Walker Review suggested charging more for water during the summer so that tourists would pay for their use. Currently, the tariff had fixed prices per block throughout the year.²⁰

The review team recommended that water companies should include social responsibility in their annual reports, providing details of their initiatives to protect vulnerable consumers. There was also a wider debate about whether government should play a more active role in subsidising water bills for consumers, for example by supporting investments in infrastructure without passing costs on to consumers. This was especially relevant in the south-west, where infrastructure investment had played a large part in pushing up bills for consumers.

All stakeholders identified the need for a national campaign and education in schools on water efficiency. The consensus among interviewees was that it should be run by an independent trusted body that had no financial interest. Suggestions included WaterWise, Eaga and Citizens Advice or integration with the Energy Savings Trust. Interviewees envisaged that this would be on the scale of government campaigns to encourage people to stop smoking or reduce energy, though applied to the regional context in which water companies operate.

Summary

We asked the question: how are vulnerable people protected from water charging?

The rising block tariff trial and the WaterSure and WaterCare assistance schemes are three current measures in place to protect qualifying households from the potentially negative effects of water charging. We discussed these measures with some of the stakeholders involved in the design, regulation and implementation of the schemes and identified initial messages.

Affordability

Stakeholders understood affordability issues well and saw them as highly important to their responsibilities, partly because their roles are clearly defined and the sector is well structured. Affordability was already seen as a key issue within the south-west. Its focus was on implementing new measures in the near term and on existing schemes to reduce consumer debt, unpaid bills and affordability problems linked to water costs.

Theoretically, metering and differential charging bring the risks of creating serious water poverty and access issues in the future if legislation and governance systems fail to protect consumer interests. This longer term potential to create new forms of water poverty has not received significant attention from stakeholders in the sector.

There is also a national dimension to water affordability that was not covered explicitly by this research. As one interviewee put it, 'how reasonable is it to have one part of the country with a completely different charging system to another, which is, I think, quite an interesting long term debate'. Regional differences in water prices and charging models will therefore pose a justice question.

Approaches to charging in practice

The south-west is probably ahead of other regions when it comes to addressing affordability concerns through social tariffs and support schemes because there are already problems with high bills and affordability concerns.

There is nothing inherently regressive about water metering and differential charging. They do not, by themselves, create affordability problems for low income groups because these groups may be able to reduce their water use and therefore save money. Indeed, installing water meters qualifies households for support schemes such as WaterSure and WaterCare and therefore usually has a positive impact on affordability and water efficiency.

The rising block tariff itself is potentially transferable to other regions.²¹ Although it is too early to comment on the specific transferability of the south-west scheme or lessons learned from the trial, water companies and regulators are watching closely to see how the trial progresses. The success of existing schemes (WaterSure and WaterCare) and new initiatives (the tariff trial) will have a significant influence on how companies address affordability concerns in future.

The rising block tariff is essentially a tool to help water companies to balance demand and supply, not a device to help consumers. Some consumers benefit as a result, but crucially this depends on their ability to reduce their own demand. Some households require more water than others and may therefore be less able to reduce their consumption; such households could end up paying more if their property is metered, especially under a rising block tariff. It is very important that assistance schemes are in place to prevent households from falling into water poverty as a result of changes in water charging, while trying to achieve the societal goal of reducing drought risk through more sustainable water use. Everyone has an interest in avoiding severe drought, including the most disadvantaged and low income groups in society, and it is therefore important to achieve water efficiency improvements in just and equitable ways.

Many of the households that are currently defined as vulnerable are able to benefit from the schemes examined in this project. However, some households may be 'falling through the net': for example, single-occupier households on benefits, households with a low income or households with residents who have medical conditions that require high water consumption.

The planned water tariff legislation would have raised the profile and importance of these issues at national level. As the Water Tariffs Bill did not progress to the new parliament, it is unclear whether any new legislation on this subject is now planned. Close analysis of the rising block tariff trial from a social justice perspective should inform measures taken elsewhere in the UK and inform the development of future legislation.

Governance

There was no demand or clear support from the interviewees for changes to the overall governance structure of the water sector in order to represent the interests of vulnerable households more effectively. This research suggests that current arrangements have enabled collective discussion of the issues.

Links via Citizens Advice to other utility companies, other debt stakeholders and banks are important to achieve joined-up affordability support and effective debt recovery programmes for burdened households.

Affordability concerns are currently well considered within the water sector in the south-west. The absence of a formal legislative vehicle for taking forward the recommendations of the Walker Review means that some of the remaining weaknesses of the current system may remain and opportunities for improvements may be missed. Given the projections of climate change and socio-economic change that underlie concerns about water availability and affordability, these concerns are unlikely to disappear. The challenge of improving water efficiency, for example via universal metering and differential charging, must be supported with policies that balance sustainable supply with fairness for vulnerable households.

If competition for an increasingly expensive, variable and unreliable supply of water is allowed to intensify without a considered strategy for ensuring affordability, vulnerable households are likely to lose out to more powerful consumers, with drastic consequences for social cohesion and justice.

Recommendations

Analyse and take forward the findings of the Walker Review and the outcomes of the rising block trial

Policy-makers should consider the wider use of social tariffs, combined with support schemes to protect current vulnerable beneficiaries and consumers who are not currently eligible but may nevertheless face water affordability concerns. This would include consumers with medical needs for water, single-occupancy households and low income groups not on benefits (with and without children).

Improve the evidence base for vulnerable households and climate change

Better customer profiling would help water companies to match water efficiency advice, technologies and tariffs to the right customers. In order to achieve this profiling and inform wider initiatives on affordability in future, better evidence is needed on various issues, including:

- new groups that will struggle with affordability (e.g. those whose use may increase with extreme heat, households that currently fall outside affordability schemes but may find it difficult to pay future bills);
- how different consumers respond to heatwaves, drought warnings and drought conditions in terms of water use (e.g. by analysing data from Heatwave Level 2 periods);
- how different consumers respond to campaigns to change behaviour, including smart metering. Specifically, research is needed into whether alternative ways to monitor water use (e.g. by web or digital television) and smart metering have the potential to change behaviour in more benign ways than price mechanisms, especially in low income households;
- how the costs and benefits of a seasonal tariff might be distributed across households or tourism service providers.

Design future social tariffs and measures with full multi-stakeholder involvement

The growing momentum of social tariffs places great importance on the way in which they are designed, implemented and monitored. Both the price of the different blocks and the communication and support systems for households will benefit from the involvement of a variety of stakeholders, especially customer interest groups such as the Consumer Council for Water and Citizens Advice.

Consolidate water debt initiatives with other utilities and stakeholders

There is likely to be an increase in water metering and differential charging based on usage over the coming years, which needs to be complemented by an improvement in support for household debt, particularly debt relating to utility bills. This requires a multi-sector stakeholder forum that includes Citizens Advice, banks, employers, central government (i.e. Department for Work and Pensions), welfare organisations, utilities and consumer groups.

Examine further the social justice benefits and rationale for corrective adjustment for the south-west from government or other water companies

The Walker Review recognised the special case of the south-west where investment in infrastructure has necessarily been very high. This has added a significant burden to bill payers in a region where bills are already affected by the seasonal flow of tourists. A corrective adjustment for the region would help to relieve households of their exceptionally high bills and could be made either directly from central government or via water companies outside the south-west. This blanket adjustment would not directly address vulnerable households, but may reduce the number of households struggling to afford their bills.

3 Heatwaves

This chapter discusses the nature of heatwaves in relation to climate change and describes the likely future trends. It defines the Department of Health's Heatwave Plan as an adaptation to climate change and then explores who is vulnerable to high temperatures. It presents findings from the case study, which explores heatwave planning in the south-west. Some initial recommendations are offered.

As well as concerns about drought, the projected physical impacts of climate change for the south-west of England include an increase in the frequency and intensity of very hot summers, which in turn may lead to more frequent, more intense or longer heatwaves.

It is not always clear who is vulnerable to high temperatures, although medical professionals and the research community have correlated various factors, including age, with increased mortality and morbidity during heatwaves. The extent to which observable factors (such as health condition and age) interact with other factors (such as where people live, their social connections, behaviours, economic circumstances and attitudes) is complex and not properly understood at present. This makes it difficult for decision-makers to plan their response to heatwaves. Nevertheless, as heatwaves become more common it is necessary to put strategies and plans in place to prevent and reduce vulnerability, and to offer protection during extreme events.

Climate change and high temperatures

The UK already experiences occasional disruption from intense, prolonged summer temperatures, as the 2003 heatwave demonstrated. On the European scale, it was termed the 'biggest natural disaster in 50 years': it was estimated that over 30,000 premature deaths occurred as a result of the high temperatures, over 2,000 of them in the UK (Metroeconomica, 2006). Temperatures in the UK reached a record breaking high of 38°C²², yet this occurred during a summer when average UK temperatures were only 2°C above the 1961 to 1990 average (Defra, 2009). Maximum temperature records were also broken for individual countries within the UK (England, Scotland and Wales). Further heatwaves have occurred in July 2006 and April 2007. A Level 3 heatwave was declared for London and south-east England in July 2009.²³ The first heatwave warning of 2010 was issued on 9 July for East Anglia and the south-east.²⁴

Hot weather causes disruption to the economy, society and the environment in multiple ways:

- increased hospital admissions and pressure on care services;
- psychological impacts, increased violence and social unrest (Simister and Cooper, 2004)
- failure of transport networks due to buckling rails and overheating of train and tram power sources, leaving travellers marooned en-route;
- failure of power supplies due to overheating of electricity sub-stations and lack of cooling water;
- impaired water quality, caused by evaporation leading to concentration of water pollution and low flows in water courses;

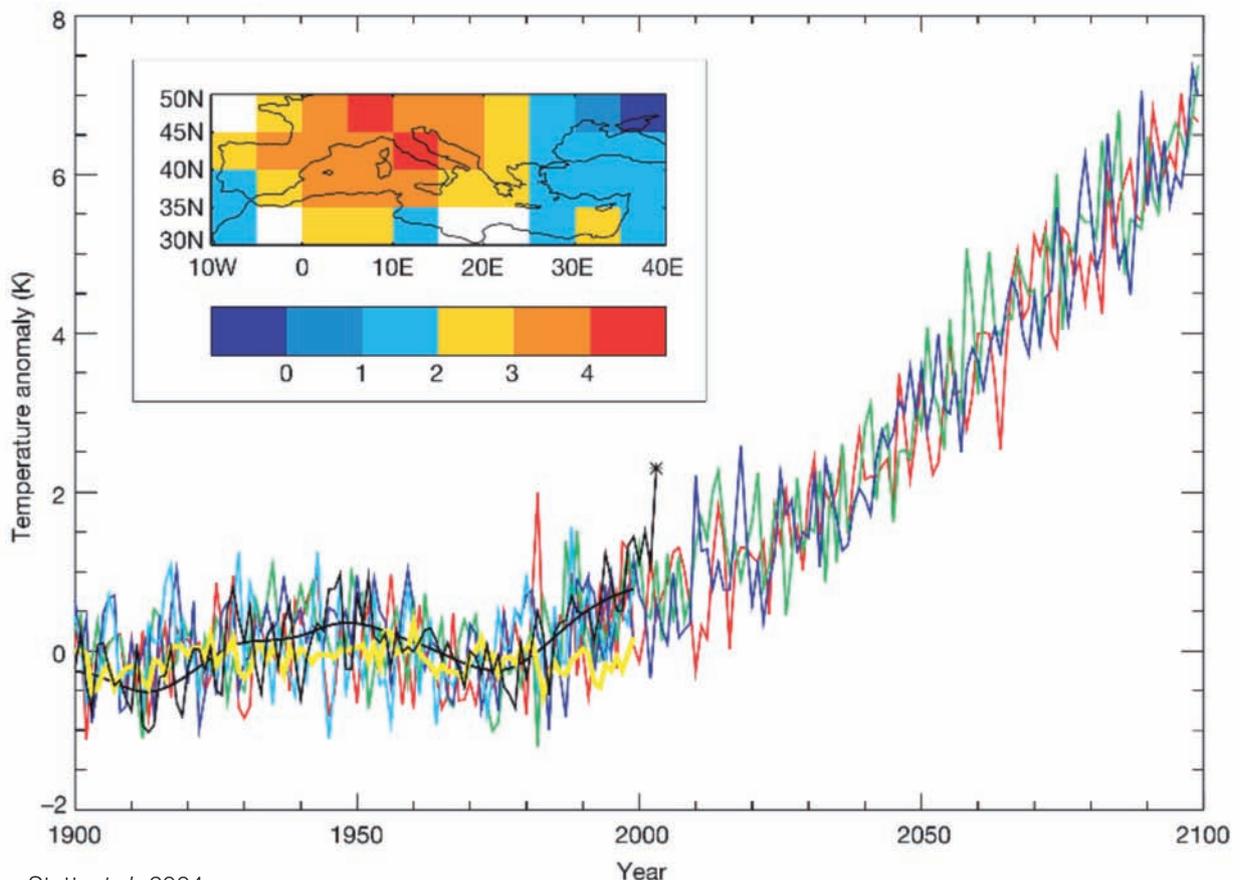
- water shortages (domestic, agriculture, industry, fire and rescue) when combined with low precipitation and high water use;
- increase in number and severity of wildfires (grassland and forest) and fires more generally (EPS, 2009);
- effects on biodiversity, farming and forests: around €13 billion was lost during the 2003 heatwave in the agriculture sector alone (COPA COGECA, 2003).

A study into the economic impacts of the 2003 hot weather event across key sectors in the UK (including health, energy, agriculture and transport) identified a number of significant economic costs but also illustrated the methodological and empirical difficulties associated with monetising the impact of events related to climate change (Metroeconomica, 2006).

In addition to the Metroeconomica study, which focused on economic impacts in the UK, some sectors commissioned reviews into the impacts of the 2003 heatwave, most notably the agriculture and forestry sector (COPA COGECA, 2003). However, analyses of the social impacts are lacking. Only one study, by the Environment Agency (McGregor, *et al.*, 2007), has tackled the subject of social impacts from heat and this report concentrates on identifying gaps in research rather than analysing the nature of social vulnerability or developing evidence or tools to assist decision-making.

While the heatwave of 2003 was an extreme event, it represents the kind of conditions that are projected to become more frequent in future as a result of climate change. Figure 5 below shows temperature anomalies (relative to the 1961 to 1990 mean) for the European region shown on the inset map. The black line shows observations (i.e. actual temperatures recorded in the past). The coloured lines show a range of climate projections according to the IPCC's SRES A2 scenario to 2100. Note that the model projections match quite closely the actual observed temperatures for the recent past.

Figure 5: Summer 2003 heatwave in the context of future climate projections



Source: Stott, *et al.*, 2004

The summer heatwave of 2003 is shown as a star. The temperature peak of that heatwave is clearly an anomaly compared with previous temperatures. However, the projections show that the 2003 conditions would become about average by 2040 and even represent a relatively cooler than average summer in 2060 under this scenario. Furthermore, anomalies of this kind are just as likely to occur in future, meaning that an extreme event in 2050 (i.e. an event that lies as far away from the mean as the 2003 event did) could be 6°C above the current seasonal baseline, rather than around 2°C above, as was the case in 2003. This sort of event is unprecedented and would be likely to cause severe social and economic disruption as well as a healthcare disaster. Clearly society needs to prepare better for coping with heatwaves in future.

Future trends in heat stress

The extent to which people will be affected by high temperatures in future will be determined by socio-economic and planning developments as well as by changes in climate. The south-west has one of the fastest growing populations in the UK. This will lead to increased population density and potentially to more intense urban development, which could exacerbate the urban heat island effect and expose more people to heat stress.

In the south-west, 22.5 per cent of people are above retirement age (SWR, 2010), which is the highest proportion in the UK. The proportion of older people in the south-west is forecast to increase to 29 per cent by 2031, according to the Government Office for the South West. An older population is more likely to be vulnerable to heat stress so that, from a demographic perspective, the region is likely to become more vulnerable in future.

The south-west is also a key tourism destination and is likely to be visited by increasing numbers of tourists, especially in mid-summer. This seasonal influx of a highly transient, non-resident population is also likely to expose more people to heat risks.

People's actual experience of high temperatures will also be affected by future spatial development in towns and cities in the south-west. Population growth, urbanisation and the trend towards decarbonising transport may increase pressure on planners to create higher density living spaces that may exacerbate urban heat islands, despite the efforts of green urban planning. Plans to avoid and cope with heatwaves, of which the Heatwave Plan is the first example, are therefore important to the well-being of the region.

The Heatwave Plan

There are no overarching cross-departmental government strategies to deal with hot weather. Building codes regulate the built infrastructure in ways that affect their ability to keep occupants cool, for example by providing standards for insulation (but not for shading or other passive cooling designs). Despite attempts by trade unions to create one, there is no upper temperature limit for working conditions, although there is a minimum limit below which people cannot be expected to perform their obligations as employees (TUC, 2009). The dangers of hot weather are expected to be managed on a private and individual basis.

The first UK national Heatwave Plan was developed with the expectation that 'an event similar to that experienced in England in 2003 will happen every year' by the 2080s (DoH 2004:3). The first plan, *The Heatwave Plan for England: Protecting Health and Reducing Harm from Extreme Heat and Heatwaves*, was issued by the Department of Health in 2004 and is summarised in Box 8 on page 51.

Aside from the Department of Health's plan, heatwaves are also considered in community risk registers (CRRs). These are developed by Local Resilience Forums (LRFs) and are regularly updated registers of key risks for a specific location. In the south-west, for example, there are five community risk registers broadly covering one or more counties. Box 9 on page 53 gives three examples of how the risk registers in the south-west rank heatwaves. Perhaps as a result of historic climate patterns, heatwaves are

Box 8: The Heatwave Plan

The Heatwave Plan for England: Protecting Health and Reducing Harm from Extreme Heat and Heatwaves was issued by the Department of Health in 2004. An updated and revised version was issued by the Department of Health in May 2007, and in each subsequent year the NHS has issued a revised document that provides guidance to government authorities on dealing with the impacts of extreme weather in the summer months. The plan was updated for 2010 (DoH, 2010c) to include information from the UK Climate Projections (UKCP09).

The stated purpose of the 2010 plan is to:

- outline the nature of the threat;
- detail the responsibilities of health and social care services and other bodies to raise awareness of the risks relating to severe hot weather and what preparations both individuals and organisations should make to reduce those risks;
- explain the responsibilities at national and local level for alerting people once a heatwave has been forecast, and for advising them how to respond and what to do during a heatwave.

Figure 6: Governance of the Heatwave Plan

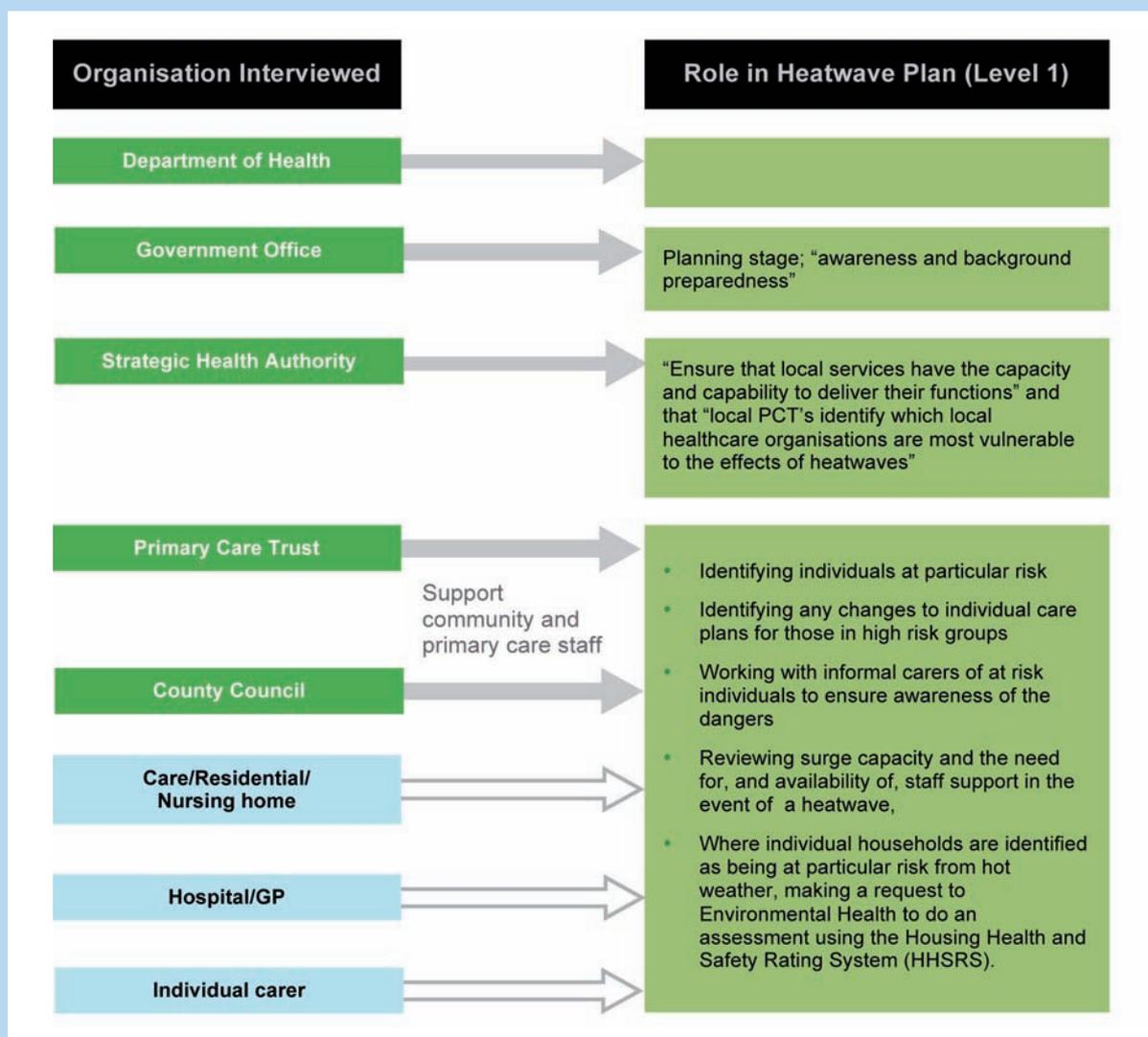


Figure 6 shows the governance tiers involved with the Heatwave Plan (those in dark green are organisations that were interviewed as part of this study). The Heatwave Plan is a centrally led strategy that is designed to make use of local knowledge and to be implemented by local agencies. Its implementation has a hierarchical structure, with warnings issued by the Department in response to weather forecasts by the Met Office. The government office for the region and strategic health authority have a statutory responsibility to ensure implementation and preparedness in their regions. At the next level, primary care trusts and local authorities are responsible for coordinating the identification and delivery of care to vulnerable people, which involves working in partnership with the most local tier of care providers: hospitals, GP surgeries, care homes and other care delivery agencies (both public and third sector).

A key element of the plan is the Heat Health Watch system that operates from 1 June to 15 September and is based on Met Office forecasts. Thresholds for both day and night temperatures trigger a response and make the plan operational. It is worth noting that the temperature thresholds vary across the country; so while a daytime temperature of 28°C triggers the Heatwave Plan in the north-east, the threshold for London is 32°C. In the south-west the threshold has been set at 30°C for daytime forecasts and 15°C at night.

The forecasts trigger a range of Heatwave Plan levels and actions:

- **Level 1: summer preparedness and long term planning**

During the summer months, social and healthcare services need to ensure that awareness and background preparedness are maintained by the measures set out in the Heatwave Plan. Long term planning includes year round joint working to reduce the impact of climate change and ensure maximum adaptation to reduce harm from heatwaves. This involves influencing urban planning to keep housing, workplaces, transport systems and the built environment cool and energy efficient.

- **Level 2: alert and readiness**

Level 2 is triggered by Met Office forecasts that there is a 60 per cent chance of temperatures being high enough on at least two consecutive days to have significant effects on health. Forecasts are normally received two to three days before the event is expected. As death rates rise soon after temperature increases, with many deaths occurring in the first two days, this is an important stage to ensure readiness and swift action to reduce harm from a potential heatwave.

- **Level 3: heatwave action**

Level 3 is triggered as soon as the Met Office confirms that threshold temperatures have been reached in at least one region. This stage requires specific actions targeted at high risk groups.

- **Level 4: emergency**

Level 4 is reached when a heatwave is so severe and/or prolonged that its effects extend outside health and social care (e.g. to power or water shortages) and/or where the integrity of health and social care systems is threatened. At this level, illness and death may occur among the fit and healthy, and not just in high risk groups. Level 4 requires a multi-sector response at national and regional levels.

See the 2010 Heatwave Plan for a full breakdown of the roles of different agencies at different levels (DoH, 2010c).

Box 9: Community risk registers in the south-west

The 2009 Avon and Somerset CRR (Avon & Somerset LRF, 2009) and the 2008 Wiltshire and Swindon CRR (Wiltshire & Swindon LRF, 2008) rate heatwaves as a 'medium' risk:

These risks are less significant, but may cause upset and inconvenience in the short term. These risks should be monitored to ensure that they are being appropriately managed and consideration given to their being managed under generic emergency planning arrangements.

(Wiltshire & Swindon, 2008:36)

The Devon and Cornwall CRR (August 2008) rates heatwaves as a 'low' risk:

These risks are both unlikely to occur and not significant in their impact. They should be managed using normal or generic planning arrangements and require minimal monitoring and control unless subsequent risk assessments show a substantial change, prompting a move to another risk category.

(Devon, Cornwall and Isles of Scilly, 2008:33)

generally not seen as posing a significant threat to people in the south-west. There is a danger that lessons from 2003 are not learned and that attention is distracted until another such event, or series of events, re-engages decision-makers on the topic.

The Heatwave Plan as climate change adaptation

The UK national Heatwave Plan is seen as a key adaptive measure by the Department of Health and the NHS. Box 10 (see below) gives an excerpt from the Department of Health's *Climate Change Plan* in which the link between heatwave planning and adaptation to climate change is made explicit.

In terms of adaptation, the role of the Heatwave Plan is expected to evolve over time. It is an important means of building and strengthening local resilience to severe weather (e.g. EPS, 2009) and 'will become increasingly relevant in adapting to the impact of climate change' according to the Department of Health (DoH, 2010d).

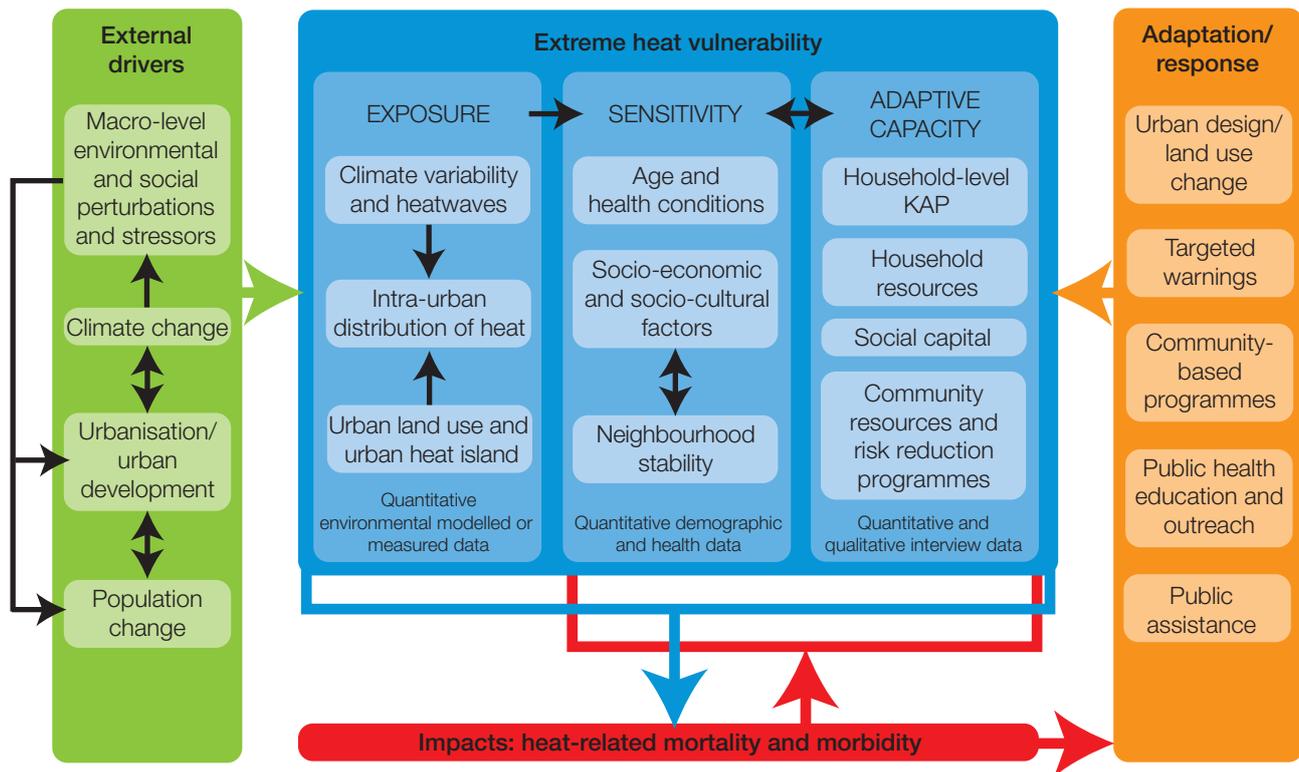
The 2010 Heatwave Plan outlines how climate change may affect the timing and magnitude of heatwave events in the future and identifies a number of implications over different timeframes. This includes the need to think strategically in the short term about the longer term implications of planning and decision-making, for example in the planning of new hospitals and the development of temperature resistant drugs. These additions to the plan are new, however, and it is unclear to what extent they have

Box 10: Climate Change Plan

Some of the effects of climate change already encountered in the UK are the increased frequency of heatwaves and flooding. Key areas for the NHS in adapting to climate change include: adapting the health and social care infrastructure (hospitals, nursing homes) to be more resilient to the effects of heat ...; development of local 'heatwave'... plans for coping with disasters; and increasing awareness of how people can adapt to changes in climate.

DoH, 2010b:47

Figure 7: Vulnerability to extreme heat



(KAP stands for 'knowledge, attitudes and practices')

already begun to influence action at local level. Currently the Heatwave Plan could be characterised as a 'reactive adaptation': it is essentially seen as an emergency response initiative to limit the damage caused by heatwaves when they occur, led by one particular sector (health). It is not primarily seen as an initiative to reduce the vulnerability of society to high temperatures through a more preventative multi-agency approach.

Who is vulnerable to extreme heat?

This section first looks at existing definitions and determinants of vulnerability to heat. Gaps in these existing definitions are explored and an alternative list of determinants is offered, which seeks to address the wider social context and dynamism of vulnerability.

This report earlier identified two broad approaches to vulnerability assessment: top-down and bottom-up. In reality these two approaches may be considered as occurring at different ends of a spectrum but the distinction is useful in terms of understanding how vulnerability has been conceptualised in relation to heatwaves. The current Heatwave Plan, for example, draws heavily on past events and physiological studies to identify in demographic and social terms who is vulnerable (Brown and Walker, 2008). There has been less research that unpicks how this vulnerability is constructed or maintained. Increasingly, there are calls for a more integrated approach to understanding social vulnerability to heatwaves that goes beyond the aggregation of demographic information to include a greater understanding of process. For example, Wilhelmi and Hayden (2010) propose a framework for analysing vulnerability to extreme heat (see Figure 7 above).

The Heatwave Plan identifies a number of factors that increase the risk of harm from heatwave events (see Box 11 on page 55). Whilst long (and potentially comprehensive), the Department of Health's outline of who may be at risk from extreme heat takes a conventional physiological (or health-centric) perspective of vulnerability. It fails to highlight the relationships or links between any of the determinants given, or of the causal factors that might lead to the conditions described. It looks at age, existing medical conditions and lifestyle as factors leading to vulnerability. The current evidence base suggests that these

Box 11: Who is at risk?

The heat can affect anyone, but some people run a greater risk of serious harm. These include:

- older people, especially older women and those over 75;
- babies and young children;
- people with serious mental health problems;
- people on certain medication;
- people with a serious chronic condition, particularly breathing or heart problems;
- people who already have a high temperature from an infection;
- people who misuse alcohol or take illicit drugs;
- people with mobility problems;
- people who are physically active, for example manual workers and sportsmen and women.

The Heatwave Plan (DoH, 2010c)

factors, particularly age, are correlated with medical harm and premature death during heatwaves (e.g. Fouillet, *et al.*, 2006). In England and Wales, older people are more likely to die prematurely as a result of heat stress, with residents of care homes the most at-risk group (Hajat, *et al.*, 2007).

These health criteria do indeed affect vulnerability at the individual level but there could be a far wider set of criteria that stakeholders need to be aware of when implementing the actions of the Heatwave Plan. Crucially, it is important to understand whether and how there is a spatial element to the distribution of vulnerability to heat, and to look more closely at how vulnerability overlaps with other forms of social disadvantage. Existing schemes and databases may then be used to help identify people in need of assistance during heatwaves.

Equalities assessment report

The equalities assessment report of the Heatwave Plan (DoH, 2010) offers an alternative expanded attempt to outline the factors that lead to vulnerability to high temperatures (see Table 2 on page 56). This list is noticeably broader than the risk factors identified within the Heatwave Plan itself. It takes an identity-based approach to understanding vulnerability (consistent with the remit and scope of the equalities assessment process) and thereby exposes gaps in the current understanding of how to identify vulnerable people. However, it fails to represent the geographical (place) or tenure issues concerning vulnerability to heat.

The state of our current knowledge about vulnerability for different social groups varies considerably. For example, the pattern of vulnerability in terms of gender is disputed; both men and women have been shown to be at heightened risk in studies undertaken in different locations (Brown and Walker, 2008). The same is true of socio-economic status; in some places and in some research this has been found to be an important determinant of vulnerability, less so in others (*ibid*). While to a certain degree there is an understanding of the factors that increase an individual's risk (from epidemiological and physiological studies), there are other factors that shape vulnerability that are harder to understand without reference to local and contextually specific factors and processes.

The wider social context of vulnerability to heat

So far, these definitions of vulnerability to high temperatures have concentrated on health and identity perspectives. While helpful and potentially accurate, they fail to make the links between the social factors and contexts that create various physiological or identity features of vulnerable people. It is necessary to

Table 2: Effect of heatwaves on minority groups

Age	Those over the age of 75 are especially at risk of the impacts of heatwaves – the older age groups being at increasing risk. Additionally, babies and young children are at increased risk. The Heatwave Plan highlights this risk and targets communications materials and guidance for health and social care workers to address this increased risk.
Disability	Those with serious physical and mental illness are identified as high risk groups from previous heatwave evaluations (mainly from France and the USA). The main mechanism is likely to be the increased exertion placed upon cardio-vascular and respiratory systems (the main causes of excess death); and also from increased amounts of medication use that negatively affects thermo-regulation. A proportion of increased risk is thought to be related to the inability to move from harm and protect oneself from overheating. Information in the Heatwave Plan and supportive guidance outlines what is known regarding risk factors and underlying processes to inform professional practice and communications materials.
Ethnicity	There is no current evidence to indicate whether or not people from different ethnic backgrounds are more or less affected by increased temperatures. However, it is known that there is a disproportionate number of people from Asian communities who have diabetes and cardiac conditions which are factors in heat related deaths. Further research should be able to indicate numbers affected and then further action can be identified if required.
Gender (including transgender)	Older women are especially at higher risk, compared to older men. This is thought to be due to differences in the decline of thermo-regulation mechanisms, and possibly due to variations in behaviour. Nothing is known on the impact on the transgender community.
Religion or belief	Different clothing and the need to cover the body more fully in different religions could impact on babies, children and older people.
Sexual orientation	There is no research to indicate that this group is affected differently from the general population. However, it is known that older lesbian, gay and bisexual people do not access services as readily as other groups and therefore consideration should be taken as to how these groups will be informed.

understand as fully as possible the processes and context that underpin vulnerability in the real world in order to improve measures to protect those at risk from heat stress.

The factors that make people vulnerable to high temperatures are complex. Furthermore, the evidence base that links social, geographical and perception factors to actual experience of heat stress is very limited so that our understanding of vulnerability is informed mostly by theory and deduction rather than by scientific analysis. Below we offer some thoughts on additional factors and processes that may create vulnerability to high temperatures.

Space and the built environment

There are likely to be spatial patterns to people’s vulnerability to heat. For example, urban residents are more likely to suffer from heat stress than people living in rural areas (Hajat, *et al.*, 2007). People who reside in places that absorb heat over time because of the local built environment (i.e. urban heat islands) are more likely to be exposed to high temperatures in their homes. People who live far from parks, gardens or woodlands are likely to have limited access to cool outdoor spaces.

There may also be spatial patterns to the distribution of poor health, low income or social housing, all of which may have some bearing on the factors that lead to vulnerability. But even within spatial areas of significance for heat (e.g. a housing estate inside an urban heat island), individuals' experience of heat stress will vary significantly, depending on social factors and individual behaviour, and on other built environment factors such as building materials, building design and layout, ventilation, insulation and cooling technology. This makes it difficult to identify vulnerable households or individuals at a regional level.

Transience

Non-sedentary groups (such as travelling communities), those more exposed to outdoor conditions (such as street homeless people) and non-resident populations (such as tourists) may be especially vulnerable to heat stress because of their reduced options for avoiding high temperatures or creating cool spaces as an adaptation to heat stress. This may be because of the inflexibility of mobile homes, a reliance on temporary accommodation such as hotels, tents or caravan facilities, or because of the behaviours of the group (e.g. tourism activities involve time outdoors with little rest and high exposure to direct sunlight and dehydration). Any temporary visitor is also likely to be 'invisible' to local health and social services and will fall beyond the reach of official responses to heatwave warnings or other planned responses unless specific effort is made to target transient groups.

Tourism is a key sector for the south-west economy and is likely to increase significantly in future, including spikes in visitor numbers during periods of hot weather. It is therefore important to understand how tourists, especially young families and older visitors, will be affected by high temperatures and how they can be protected and cared for during extreme heat events.

Social factors

Anecdotal evidence from community level adaptation research and consultation suggests that members of closely knit communities and networks (such as strong faith or ethnic communities) are more likely to receive help from other members of their community during a heatwave and to be identified as suffering from the effects of high temperatures (e.g. Brent Council, 2009). Conversely, individuals who live alone and do not belong to close communities (especially in diverse urban areas or remote rural parts of the south-west) may suffer from heatwaves without anyone else being aware and may therefore not receive advice or help.

Evidence is patchy at best. Some early studies suggest a link between isolation (living alone) and mortality (e.g. Klinenberg, 2002 in relation to the Chicago heatwave of 1995), while others identify stronger trends between mortality and residency in care homes, where people are not isolated but may face other risks and are subject to the response imposed by an institution (Hajat, *et al.*, 2007, Brown and Walker, 2008). The links between high temperatures and impacts other than mortality (e.g. discomfort, distress, dehydration and illness, or even violence and social unrest) have not been explored in the literature. It could be, for example, that dense inner city housing not only increases heat risks because of the layout (urban heat islands) but also increases the chances of social unrest during heatwaves.

Studies in the US have looked at the influence of socio-economic status on vulnerability to heatwaves, concluding that various non-white populations suffer disproportionately from heat, which cannot be explained by differences in physiology (e.g. Basu and Samet, 2002). Factors such as employment (Mirabelli, 2005), education and air conditioning (O'Neill, *et al.*, 2005) have been analysed in the literature and correlated with socio-economic status. Morello-Frosch, *et al.* (2009) highlight the racial differential in experience of climate change impacts, suggesting that various components of vulnerability overlap with 'people of color and the poor', making them most likely to suffer harm.

Current research into vulnerability to high temperatures is dominated by health research and usually constructed from mortality and other medical data. One key finding from Brown and Walker (2008) is that the socio-economic context is specific to each heatwave and that research into vulnerability needs

to account better for the qualitative nature of groups' and individuals' institutional and cultural adaptive capacity. For example, they cite research from France analysing the 2003 heatwave, which showed that medical professionals focused their resources and attention on the most physically ill patients but (or as a result) it was the physically fitter patients who faced the bigger risks (Brown and Walker, 2008:366). This sort of evidence demonstrates that the way in which vulnerability is constructed, defined and perceived could have a significant influence on the response offered by officials and the experience of heat stress at individual level.

Perception

People who are vulnerable to high temperatures need to be aware of their own vulnerability in order to take action to protect themselves, for example by spending time in cool places, avoiding strenuous activity and keeping well hydrated. The Department of Health's guidance (DoH, 2010a) identifies a number of 'top tips' for keeping cool. However, research suggests that the extent to which an individual acts on the risk of heatwave (such as responding to advice from awareness raising material) depends largely on whether individuals perceive themselves to be at risk.

In a study of the perceptions of older people in London and Norwich about heatwave risk, Abrahamson, *et al.* (2008) found that many older people and those with a chronic condition did not consider themselves to be in an 'at risk' category despite their actual age or the presence of a medically diagnosed chronic disease (also Wolf, *et al.*, 2009). These findings are supported by a considerable literature that has explored the relationships between perception, capacity and action in the face of risk and uncertainty (e.g. Grothman and Patt, 2005, Grothman and Reusswig, 2006, Kalkstein and Sheridan, 2007).

Misperceptions of vulnerability do not only affect older people or those who are ill. For example, tourists are unlikely to perceive themselves as vulnerable given their deliberate exploitation of sunny weather for leisure purposes, but they may be ill prepared to cope in the event of a heatwave.

Emerging evidence in this area suggests that awareness and perception are important to vulnerability. The key message is that the level of harm experienced at individual level can be significantly influenced by individuals' self-perception and the perception of decision-makers about who is vulnerable, and can result in either an overstated or understated awareness of vulnerability. The extent to which there is a difference between people's perception of their vulnerability (and therefore the likelihood that they will take proactive measures) and their real exposure or sensitivity to heat stress is difficult to estimate without having detailed local and personal knowledge. This also highlights the importance of raising awareness and of local, targeted support to address vulnerability during extreme heat events. In order to protect the most vulnerable from climate change impacts, strategies and plans need to understand the influence of perception and be designed to overcome misperceptions of vulnerability.

Summary

The factors that determine vulnerability are complex and the relationships between them are difficult to distinguish with any certainty using available information. Nevertheless, there are a number of factors that influence people's vulnerability to high temperatures at individual level:

- exposure to high temperatures at home, at work or in the community where they live, as the result of their home (building design and fabric), urban environment or type of job;
- sensitivity to the impacts of heat stress, influenced by their respiratory, physical or mental health, their age or their relative acclimatisation to heat;
- ability to change their lifestyle, home or whereabouts to escape or treat heat stress. For example, their ability to pay for air conditioning, their access to local cool outdoor spaces or the level of control they

have over their homes (e.g. council tenants, some private renters, residents of care homes and tourists have few options to adapt their homes);

- perception of their own vulnerability, their willingness to take action to avoid heat stress and their awareness of what heat stress is and how to prevent it;
- social networks and their 'visibility' or connectedness with members of the outside world: for example, relationships with people who will regularly check on their well-being or their connections with social services;
- transience, lack of local knowledge, inflexibility and 'invisibility' to officials. These factors may reduce their chances of receiving support during heatwave events, thereby increasing vulnerability.

Thus, while temperature can be mapped and modelled within urban environments (and details of some health conditions may be known from databases or existing sources), the extent to which people are vulnerable to heat stress is difficult to assess without employing detailed local knowledge. The factors that make people vulnerable to heat stress are complex, but there appears to be a very strong social dimension.

Furthermore, and crucially for those interested in social justice, the above factors tend to overlap and are dynamic within certain communities at disadvantage. For example:

- Low income jobs are more likely to involve outside labour or long hours spent in confined spaces such as driving cabins (TUC, 2009), which increases exposure to heat.
- Low income groups may be more likely to suffer from poor health in general, which could increase sensitivity to heat.
- Low income households are also more likely to live in social housing and have lower capacity to adapt their homes, either for tenure or affordability reasons, which reduces their capacity to adapt to high temperatures.

These overlapping layers of vulnerability mean it is important to go beyond a simple physiological definition of vulnerability to heat. Instead, the social processes that lead to vulnerability need to be understood so that vulnerable people can be properly identified and their vulnerability reduced.

How are the vulnerable identified?

As part of the Heatwave Plan, responsible authorities at regional and local level should identify who is vulnerable to heatwaves. Preparations can then be made and the necessary information and advice communicated to reduce premature deaths and stresses on health care services. However, the complex nature of vulnerability makes identification very difficult.

As the Heatwave Plan evolves, it will be important to integrate new assessment tools and usable data to help local decision-makers identify likely hotspots of vulnerability to high temperatures. These tools, and the research evidence base that underpins them, are beginning to emerge but are generally not yet operational. However, simple mapping techniques could be used to hone identification of vulnerability and a broad understanding of vulnerability can be employed to improve the way in which vulnerable people are identified under the plan.

Evaluation of the Heatwave Plan

In 2007, the Health Protection Agency undertook an evaluation of the national Heatwave Plan to evaluate its performance during the 2006 heatwave in the UK. Overall, the findings were positive but the strategic health

authorities interviewed during the evaluation raised a key issue in relation to the definition of vulnerable groups:

The definitions in the plan are so broad that in some areas they represent a very large proportion of the population. To check on these each day is not feasible, even using the combined strength of health and local authority social care staff. A more focused approach is needed to identify individuals and for actually approaching them. This might make more use of the non-statutory sector.

HPA, 2007

The primary care trusts also reported the difficulty of contacting vulnerable people. Asked if lists of vulnerable people were drawn up at practice or other local level during the heatwave period, 67 per cent of trusts were satisfied that they had been, 17 per cent were partially satisfied and 17 per cent were not satisfied. Of the trusts that were satisfied, only two-thirds (47 per cent of the 67 per cent) were also satisfied that the vulnerable individuals were contacted during Levels 2 and/or 3.

The report argues that, given these problems, it would 'seem sensible to refine the definitions more to focus on those most at risk. For example, women over 85 years living alone' (HPA, 2007:12). This is similar to a conclusion drawn by Abrahamson, *et al.* (2008) who argue that 'a targeted approach is likely to be appropriate for individuals who the GP is able to identify as at particularly high risk, but this should be more focused than currently recommended to ensure more selective deployment of clinical skills' (2008:125).

The evaluation report noted that there were some gaps in awareness of the Heatwave Plan at local level and that some had had trouble accessing the warnings (changing between levels on the Heatwave Plan). It also reported that there should be a greater focus on ensuring that care homes had made adequate provision for heatwave events, such as developing 'cool rooms'.

Equalities assessment

The equalities assessment (DoH, 2010) recommends that approaches to heatwave protection should take account of cultural differences between communities. This places further responsibility on staff at local level and stresses the need for partnership working. For example, charities, non-governmental organisations and community or faith groups may have greater networks of contacts with vulnerable people and a better understanding of the differences in cultural context.

Vulnerability and heatwave planning in the south-west: stakeholder views

This section is based on interviews with key stakeholders involved in heatwave planning in the south-west, including the regional government office, representatives from regional health care bodies (the strategic health authority and a primary care trust), local authorities and regional climate change partnership.

The sample size for the case studies was small and the results must be treated appropriately as exploratory findings. The interviews discussed vulnerability and relate the case studies to the wider context of climate change. They were not intended to carry out indepth research on the measures in question or to constitute sociological perspectives of vulnerability. We set out to answer the question: how are decision-makers equipped to protect people who are vulnerable to heat stress?

We found that the Heatwave Plan offers a clear structure for the implementation of measures to protect people from heat stress, based on a best practice approach to emergency response. The plan is also evolving to take a more proactive preventative approach to reducing vulnerability to heat. While the macro structure of the plan is clear, the focus on health and limited resources available for implementation at local government level means that potential synergies and multi-stakeholder collaboration may not be being realised fully. The identification of vulnerable people is complex and difficult without further guidance and improvements in the tools and methods available to local

decision-makers. Improved stakeholder networks and multi-agency working may help to improve the identification of vulnerable groups.

The case of the Heatwave Plan shows that emergency response can be well organised, but the issues of vulnerability to high temperatures require more political backing and a fresh impetus from practical research findings. This case study explores how stakeholders understand the overlaps between social justice, disadvantage and vulnerability to heat, and explores how concepts of vulnerability are interpreted and applied at local level.

Analysis of the interviewees' responses is arranged in three sections:

- social justice, vulnerability and heatwaves;
- implementation of the Heatwave Plan;
- roles, governance and recommendations for the future.

Understanding vulnerability and heatwaves

Interview discussions explored the depth of the interviewees' knowledge about climate change in general, and their understanding of vulnerability and social justice. All interviewees commented that the organisations they worked for had a good understanding of climate change. In part this was a function of the interviewees' roles (for example, within sustainability teams) but also because climate change was considered an important part of corporate strategy (see Box 12 below for examples).

However, when asked about individual vulnerability to climate change, respondents' understanding varied considerably and seemed to reflect their personal knowledge and experience rather than corporate or policy positions. For some, particularly those with responsibilities under the Heatwave Plan, vulnerability was seen purely in terms of the list of the risk factors from the plan. For others, vulnerability was a much broader concept. One interviewee identified a difference between the factors that put people at risk and vulnerability, which keeps changing based on people's location. Another commented that vulnerability is 'as much a geographical issue as it is an economic one'. Further, while 'the risks of excessive heat will increase, this is not the same as people's vulnerability to heat. That is dependent on health, economic situations, where we choose to develop, etc.'. In these ways, respondents saw beyond direct exposure to heat to the contextual factors that determine vulnerability.

One interviewee said that, in the case of the south-west, which attracts a large number of summer tourists, it would be necessary to consider 'transient populations' as especially vulnerable to heatwaves

Box 12: Organisations' commitments to climate change

As a good corporate citizen, the NHS can play a leading role in protecting and promoting the health of communities. By reducing carbon emissions and encouraging healthier lifestyles it can combat climate change, save money, and achieve health benefits.

NHS Somerset PCT²⁵

Climate change is recognised as the single most important environmental issue affecting the world today. GOSW plays an important role in tackling climate change in the region, as well as being an active member of the Climate SouthWest [partnership] ... which is working to ensure that the region is able to adapt to the impacts of climate change.

Government Office for the South West²⁶

and extreme summer weather since they might not have access to the type of economic resources and social capital they would have in their own homes.

The majority of interviewees made links between climate change and differential social impacts. When asked directly if they believed climate change would impact social justice issues such as inequality in the UK, the majority (five out of the six) considered the vulnerability of economically disadvantaged communities to be particularly high. They cited issues such as 'low incomes', 'affordability of housing', 'ability to afford adaptive responses' and 'increased energy bills and summer related fuel poverty' as potential barriers to successful climate change adaptation to heat. One interviewee commented that 'people are at more risk from natural hazards relating to climate change if they are socially vulnerable'. It was also recorded that the changing nature of vulnerability was not purely a function of a changing climate but also related to other drivers, such as an 'ageing population'.

When asked what makes people vulnerable to heat, interviewees who were most familiar with the Heatwave Plan quoted the risk factors cited in the plan, despite having the broader understanding demonstrated earlier. Those less familiar with the detail of the Heatwave Plan mentioned that it was necessary to move away from the traditional but limited understanding of vulnerability in order to understand its dynamic nature.

Respondents who work specifically on the Heatwave Plan tend to have a health-focused understanding of the factors that make people vulnerable and an understanding of response measures that relate directly to the remit of health agencies or relevant health and social care (e.g. care for the elderly). Respondents who do not work directly on the implementation of the Heatwave Plan were more likely to talk about wider social prevention measures that may be required and to focus on a broader view of vulnerability. This general trend of seeing heatwave planning as a health issue is reflected in the implementation structure of the plan.

There was no clear link between the answers given on issues of vulnerability, social justice and climate change and the level of seniority or position within the governance structure. It was clear that individuals' knowledge varied considerably between organisations. However, this individual knowledge and more sophisticated view of vulnerability displayed during interview did not necessarily translate into the official implementation of the plan.

Overall, the interviews showed that the Heatwave Plan is perceived as a 'health document' by public officials. This is unsurprising, given that the document is delivered through the Department of Health and focuses on health-related vulnerabilities arising from extreme heat and how those can best be addressed through government intervention. The 2009 Heatwave Plan says that 'this plan provides important guidance on how to reduce the impact they [heatwaves] will have upon health and in doing so, will save lives' (DoH, 2009).

The Heatwave Plan therefore has a well defined objective to help authorities cope with the health impacts of heat, but no remit to address any of the deeper (social, mainly non-medical) issues that underlie vulnerability to heat, some of which emerged during the interviews. This limited view may restrict the potential of the Heatwave Plan to protect and benefit the most vulnerable. For example, it does not attempt to include social aspects of vulnerability but focuses on risk factors linked to occupation, age and health. This is an important omission in light of the assertion that climate change is likely to affect the socially disadvantaged disproportionately.

Without looking at a wider range of vulnerabilities arising from extreme heat, the Heatwave Plan will also fail to ensure wider engagement and ownership across a range of government organisations and other service providers that could be important in preventing the most negative effects of heatwave events.

Implementation of the Heatwave Plan

The second set of questions related to putting the Heatwave Plan guidance into practice.

Clear structure

All interviewees identified the benefits of the Heatwave Plan for providing a 'coordinated approach' with a strong lead from central government. They also reflected on the need for areas and localities to devise their own context-specific plans in response to heatwave warnings. For example, one interviewee explained that the 'national Heatwave Plan provides a national framework plan for statutory organisations' and within this framework local authorities and health services could devise their own more specific and localised plans to implement responses. This reflects the principle of subsidiarity²⁷ followed in emergency planning.

It was also recognised that the current version of the Heatwave Plan (DoH, 2010c) contained a strong emphasis on preparation and response but also a more strategic overview of the need to plan now for longer term risks and actions. This meant that responsibility for implementing the Heatwave Plan may require action from very different functions (e.g. emergency planning plus strategic planning, social services, spatial planning, education).

The Heatwave Plan was generally well understood by interviewees. This reflects the clear structure of the plan and the demarcation of responsibilities across different levels of governance, timeframes and levels of severity.

Complexity at local level

In general, interviewees expressed some uncertainty about what happens at local level. This is perhaps unsurprising, given that this is where the complexities of identifying vulnerable people and issuing guidance occur. This uncertainty also partly reflects the roles of the individuals interviewed but it also suggests that there may be little bottom-up communication from the local level up the chain of governance. Information about the implementation of the Heatwave Plan, particularly in terms of 'operationalising' the risk factors to identify vulnerable individuals, does not seem to be communicated widely within the organisations interviewed.

It was not possible to include in the interviews any representatives of front line organisations involved in local level implementation of the heatwave response, such as care home staff or voluntary or private sector carers. These groups may have a much more certain (and accurate) idea of who is vulnerable to heat.

Interviewees gave very different answers when asked how their experiences and concerns could be fed back into the system to make the Heatwave Plan more relevant and attuned to their area's needs. There was no indication of how levels of preparedness at local level were being assessed, monitored or audited. However, several interviewees mentioned that this feedback should be enabled. While participation is considered important to enable local context to be built into assessments of vulnerability, none of the six interviewees was able to give specific examples or evidence of their individual or local contributions to the national, regional or local heatwave plans. It may not have been within the role of the interviewees to carry out this evaluation work and there may be auditing activity underway elsewhere within the governance structure but our interviewees were not aware of this.

Heatwave Plan focus on emergency planning

The Heatwave Plan is considered an important measure to address the risk of climate change. However, at present there seems to be little involvement from climate change or sustainability officers in implementing the plan. Given the widening ambition of the Heatwave Plan to cover event response, seasonal short term planning and, particularly, forward planning in the longer term (DoH, 2010c), it will be necessary to engage more individuals and departments, both from local and central government, in the plan's governance and implementation. This includes those with responsibilities other than for health. While there is clearly a need for government services, including health care, to respond effectively in the event of a heatwave, it is likely that a more proactive and multi-sector approach to heatwave preparation and planning, as well as to response, would be more effective in reducing vulnerability to heat longer term. The interview responses suggested that:

- The Heatwave Plan is not looked at in a climate change context but rather as an emergency planning and preparedness issue.
- Within emergency planning services, officials at local levels were only aware of the Heatwave Plan to the extent that it applied to their particular role. Their understanding of the wider governance issues, and how climate change can impact vulnerability and social justice, were very limited.
- The interviewees with most developed understanding of vulnerability to heat are not those who have a direct role in the implementation of the Heatwave Plan. Within the small sample, they tended to be involved in climate change or sustainability at local government level, not emergency planning.

One local government interviewee, who had direct experience of emergency planning and implementation of the Heatwave Plan, compared the preparation and implementation of heatwave planning to emergency situations resulting from severe winter weather. His council had successfully identified and dealt with issues facing immobile or highly dependent people as a result of being snowed in. In regard to surge capacity for heatwaves, he said that ‘you have exactly the same surge issues in any emergency planning situation’. There are clearly advantages to having a general emergency response system in place to deal very quickly with extreme events. It also makes it possible to roll out a well practised and familiar response strategy to deal with the situation as it occurs.

However, this approach may make responses so generic that they fail to protect individuals and communities from the impact of the specific hazard. Those vulnerable to high temperatures may be different from those vulnerable to flooding or snowfall, for example (both of which are historically more common occurrences in the UK). Vulnerability to high temperatures is determined by complex, local factors (i.e. household and individual characteristics as well as the built environment) that may differ from those for other hazards. This increases the need for strategies to deal with vulnerability to high temperatures that are firmly rooted in the local context.

It is important to move away from a short term emergency response as a means of dealing with heatwaves, towards longer term development planning. This will enable governments and communities to include climate change in the mainstream of their broader policies and programmes, with the full range of stakeholders and expertise involved. One interviewee suggested that heatwave plans are short term action plans and that planning needed to take place between extreme periods as well. Interviewees recognised this need for more preparedness and for action in between heatwave events, suggesting that short term emergency planning must be accompanied by longer term resilience building, together with investment in methodologies and data sets that can be used to identify vulnerable people. During the course of the various interviews, there was no indication that any preparatory action for heatwaves was taken outside the summer preparedness phase between June and September. It may be that this longer term activity falls outside the remit of the existing Heatwave Plan, but it is needed by society to reduce vulnerability to heat over time. A different approach to strategic planning may be needed in future.

Funding

Several interviewees mentioned funding as a concern regarding implementation. A lack of funding, especially given current budget pressures, may constrain the ability of regional bodies to coordinate and respond to demands from local levels. It was argued that the lack of additional funding to implement the Heatwave Plan had shaped the nature of implementation through ‘emergency and resilience planning work’.

The Heatwave Plan adds to the administrative and operational workload of a large number of potential agencies. There is a danger that implementation may not be effective if there are limited resources available. For example, The Heatwave Plan mentions ‘reviewing surge capacity²⁸ and the need for, and availability of, staff-support in the event of a heatwave’ (DoH, 2010c:21). It also refers to ‘making a request

to Environmental Health to do an assessment using the Housing Health and Safety Rating System (HHSRS)' (DoH, 2010c:21–22) if houses are deemed to be particularly vulnerable to a range of 21 hazards, including excess heat. If the house is found to be particularly unsuitable, the assessment can be used to apply for government housing renewal assistance. However the Heatwave Plan has no particular funding associated with its implementation so it is unclear what specific actions can be taken if surge capacity is found to be inadequate or if vulnerable individuals' housing renewal assistance, through conventional government grants, is denied. This study did not find any evidence of this type of assessment occurring in relation to the Heatwave Plan.

Because the national Heatwave Plan is a framework that coordinates different actions at different levels of governance, interviewees implied that much of the work of assessing those considered to be 'at risk' had to occur at local level. This emphasises the role of nursing, care and residential homes and local councils in 'ensuring care homes include summer preparedness on their risk registers'. This breadth of implementation activity is considered difficult under current financing arrangements, where heatwave planning appears 'added on' to existing emergency planning teams – at least among the organisations interviewed in this study. Given that the focus of the plan is health, it seems problematic that primary care trusts and health and social care providers should not have additional resources to tackle individual/community heat-specific vulnerabilities. The result is that heatwave planning falls low down priority lists. For instance, NHS Gloucestershire was unable to update its regional Heatwave Plan for 2009 because of the planning required to deal with the swine flu outbreak.

Interviewees recognised the need to improve the identification of vulnerability but highlighted the lack of resources available to them. If decision-makers were to make use of improved top-down tools to identify vulnerable people (such as urban heat island models) as well as more stakeholder networks and bottom-up approaches, additional funding would be required. However, without a broader ownership of heatwave planning and an escalation of the Heatwave Plan up the political agenda at regional and local level, improvements to the implementation of the plan will be difficult and limited.

Roles, governance and recommendations for the future

The final set of questions focused on roles and governance, and how the implementation process could be improved.

Interface between national, regional and local responses

Interviewees identified a clear role for central government in acting on climate change adaptation and addressing the social justice implications from the centre. It was also clear that the focus for identifying vulnerable groups needed to be at local level but based on information provided from higher levels of governance. For example, the role of a local authority was to ensure the messages had been communicated to care homes and to provide guidance where necessary. It was also important for central government to recommend new tools, data sources and techniques if these were necessary to improve heatwave planning at local level.

One interviewee commented that the understanding of how plans are validated and tested by organisations at local level was 'undeveloped' and interviewees were not clear about the exact mechanisms that should be in place. Because heatwaves are not 'high up on the regional risk register', there is considerable reliance on the plans simply being in place and on expecting them, ultimately, to be effective. The tiered structure of the Heatwave Plan lends itself to a 'pass it on' culture, whereas there is a significant amount of work to be done at local level if heatwave preparedness, planning and emergency response are to be carried out effectively. A greater shift is needed towards multi-agency working at local level.

Role of partnership working

A general theme to emerge from the responses about roles and governance was the emphasis on partnership working. This included local area agreements (LAAs) and strategic commissioning, and actions to mitigate risks identified in community risk registers at local authority level. This engagement across and between levels of governance was identified as being crucial, although there were divergent opinions on how well such communication and partnership working occurs in practice. One interviewee emphasised the networks of links and relationships at regional level, while another was uncertain whether engagement and communication had actually occurred or improved preparedness at local level. Better and closer communication and collaborative working is needed to improve the results achieved by the Heatwave Plan.

Local responsibility

As we have seen, the factors that make people vulnerable to high temperatures are varied and complex, and as a result they relate to different departments within local and regional government (e.g. emergency planning, social care, housing, health). The interviews revealed that responsibility for the Heatwave Plan sits primarily with the emergency planning division of a local authority and that interviewees with other roles (perhaps with strong individual knowledge of the factors that lead to vulnerability) were unwilling to answer questions about it. This suggests that a wider variety of departments across organisations need to be involved in heatwave planning and governance if it is to become more effective at identifying and protecting the most vulnerable people in society. In a local authority, this may include social services, housing, child protection, education, climate change and sustainability, spatial planning, emergency services and community groups. The Heatwave Plan may also need to engage other service providers more fully, such as care home staff, and voluntary and community organisations working with vulnerable groups.

Data and tools

Those interviewed included officials from local and regional government, health services and councils. Even across this diverse spread, there was a very limited awareness of data and tools that could be used to identify households and communities that are vulnerable to heat. While a few interviewees were confident that heatwave planning was included in community risk registers, they were unable to provide details of how this was done.

Local government representatives need to know what data already exists within the local authority or its partner organisations that can be used to identify vulnerable people, and what tools and support are available to improve decision-making. As mentioned, local stakeholders look to central government to answer these questions.

The scope and nature of the Heatwave Plan

The Heatwave Plan is a reactive strategy and its perceived importance has slipped in recent years. Both these factors could affect its potential to help reduce inequality and vulnerability to heat.

One interviewee said that the approach of regional agencies was akin to following a 'cure rather than prevention' strategy. The current structure and implementation of the Heatwave Plan requires authorities to observe the situation in summer months and to react only when the warnings reach a potentially threatening level. This interviewee also felt that the 'emphasis [on heatwaves] is a bit less at the moment' because the last heatwave had been seven years earlier and recent summers had not been excessively hot. This indicates that government agencies are inclined to take heatwaves seriously only when they have happened recently or when there is a very high expectation that they will happen in the near future, and the decline in public confidence in long term weather forecasting further exacerbates the low priority. Heatwave planning to protect vulnerable people does not seem to have been taken into the mainstream of regional or local strategic plans. Instead, it is dealt with 'as and when' heatwave threats arise, which reduces the chance of taking effective measures to improve the resilience of vulnerable people in advance.

These issues are interlinked. If the response to heatwaves was less reactive and considered as part of a longer term multi-agency strategy (rather than as a plan to address what might be an isolated event), relevant agencies would be able to take a more holistic approach and it would be less likely to 'drop off the radar'. A more proactive and high priority approach to heatwave planning would be better for vulnerable people because it could address the social processes that create vulnerability, thereby building resilience, rather than dealing with the 'end-point' determinants of heat stress: prevention rather than cure.

Linking expertise and governance

Several interviewees spoke about government agency partnership structures set up through the Civil Contingencies Act (2004). The Heatwave Plan has been structured on four levels of alert and the responsibilities of the various agencies are identified clearly when each of these alert levels is raised. This structure reflects that of the Civil Contingencies Act so that the Heatwave Plan follows a consistent approach that is known to be effective in emergency situations and is familiar to most public officials.

However, the civil contingencies command and control structure takes a top-down approach and it was clear from the interviews that there was little understanding of how the Heatwave Plan, with its emphasis on local implementation, actually operated in practice or how effective it was. For instance, one interviewee did not know how successful the governance structure of the Heatwave Plan was in cascading guidance from national level to local level because he was only familiar with his specific part of the implementation. This may reflect poor communication up the chain of command from local level.

As vulnerability to heatwaves is a function of a complex range of social processes, it is essential that the teams involved in developing and implementing local heatwave plans have the knowledge and experience at their disposal to understand fully the nature of local vulnerability to heatwaves. This may require greater stakeholder collaboration across organisations, particularly at local level where the complexity of local vulnerability to high temperatures can be jointly understood and informed by various perspectives and agents. This may therefore require more bottom-up or collaborative governance systems than are classically offered by civil contingencies planning.

Under existing systems, much of the difficult identification task is left to single local government departments with little practical help or guidance from regional or central stakeholders. There may be gaps in the ability and capacity at this micro-level to identify how vulnerability to high temperatures is determined and defined.

Summary

We asked the question: how are decision-makers equipped to protect people who are vulnerable to heat stress?

We found that the Heatwave Plan offers a clear structure for implementing response measures during a heatwave. However, staff in key agencies are not always able to identify or protect people who may be vulnerable to heat stress because of limited resources, the specific health focus of the plan, its 'emergency response' character, the complexities of identifying vulnerable people from a top-down perspective and a general lack of experience in operationalising the plan.

Nevertheless, the Heatwave Plan is a well considered, rapidly evolving policy instrument for adapting to climate change and protecting vulnerable people. Having it in place presents a significant opportunity to reduce vulnerability and protect vulnerable people from heat. The fact that it has been revised annually over the six years of its life also provides the opportunity to learn from its implementation and improve it in time for more extensive heat impacts in coming years.

Vulnerability

Individuals' understanding of vulnerability to heatwaves seems varied, according to the small sample with whom we discussed this during interviews. There is a tendency to echo the Department of Health's

perspective, which is limited to the health factors that cause vulnerability rather than including wider social processes and identity, place and tenure, which may also be factors.

This is unsurprising given the complexities of vulnerability and the lack of clear evidence to link factors of vulnerability with actual exposure, sensitivity and adaptive capacity. The psychological determinants of vulnerability (e.g. self-perception of risk) were not recognised by interviewees.

The Heatwave Plan is seen primarily as a health-related document, mostly requiring a response led by the health sector. It would be better to consider the wider dynamic social context for vulnerability to high temperatures, and to take a more proactive, preventative approach to building resilience within communities.

Implementation

The Heatwave Plan has a clear structure in terms of the national to local hierarchy and tiers of responsibility. This study did not include interviews with anyone at the most local level (i.e. care home or hospital), though emerging research in this area suggests that awareness of the plan among frontline care delivery staff may be quite low (Abrahamson and Raine, 2009).

No additional resources are made available for the implementation of the Heatwave Plan, which may inhibit development of more proactive responses. It may also mean that the plan becomes the domain of one single department at local government level because resources for collaborative working are not available. There was no evidence of extensive multi-stakeholder collaboration at local level to implement the Heatwave Plan. The lack of success with engaging frontline staff in this study may provide anecdotal evidence of the absence of a broad collation of stakeholders who recognise heat stress as an important issue. Instead, the interview discussions revealed a siloed narrow ownership of the plan. Effective stakeholder collaboration may be necessary to identify vulnerable people properly, especially to move beyond the physiological and health focus of the current guidance.

The data, tools and methodologies available to local decision-makers to help them identify vulnerable people are limited. As a result, there is perhaps some confusion over the factors that lead to vulnerability and this may impair the ability of the Heatwave Plan to reduce the risks for the most vulnerable.

Improvements in the data, tools and methodologies open to local decision-makers may improve the situation. Simple existing mapping techniques could be employed to aid understanding of likely exposure to high temperatures (and exposure under future climate conditions). Such techniques could be combined with local contextual bottom-up approaches, drawing on expertise from appropriate local agencies to help identify vulnerable people. The communication of approved approaches and methodologies from government down to local decision-makers may help to improve the effectiveness of the Heatwave Plan.

Governance

Interviewees seemed to agree that the plan's tiered structure was appropriate and clear but there appeared not to be any auditing of how local level agencies coordinate or implement their responsibilities under the plan.

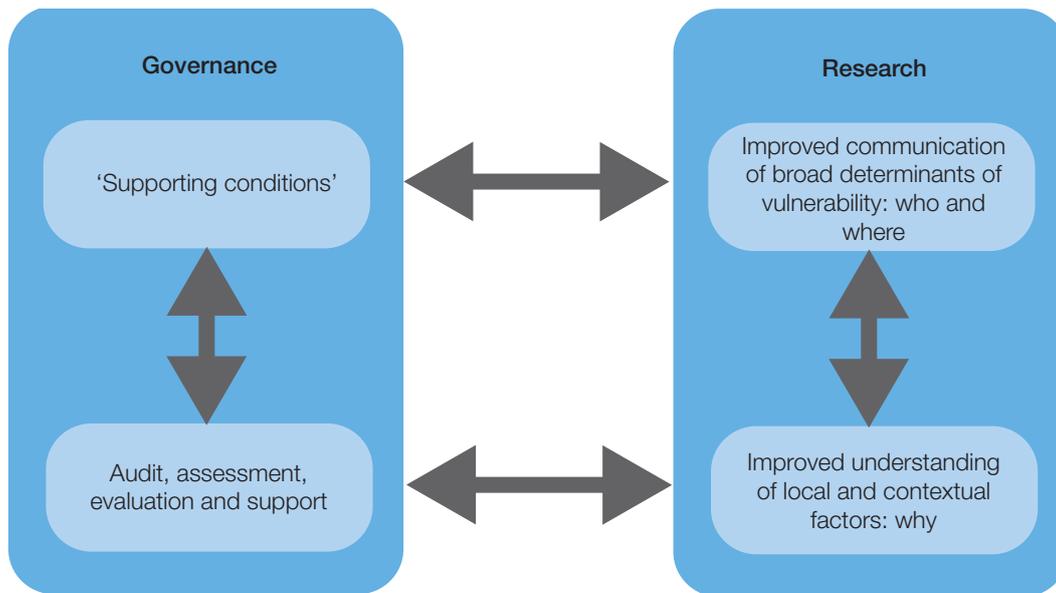
Heatwave preparedness does not feature in the mainstream of central or local government plans, especially outside the health sector. This may prevent the non-health and wider social context of vulnerability from being recognised and acted upon to reduce vulnerability and build resilience.

What is missing?

The Heatwave Plan has developed considerably since its first publication in 2004. It is recognised that there are still areas where the plan could be improved or developed further, for example through further research on the effectiveness of interventions and methods to identify the vulnerable. Some pertinent research gaps were identified during a seminar in 2008 attended by a variety of organisations involved in the implementation of the plan (HPA, 2008).

From the literature reviewed, and drawing on the conceptualisation of vulnerability to climate change in Chapter 1, we identify two broad areas where improvement could be made: governance and research (see Figure 8 on page 69).

Figure 8: Areas for improvement in the Heatwave Plan



In terms of research, there seems to be some consensus in the literature that there are currently gaps in our understanding of how vulnerability is shaped and maintained at local level and why particular groups are vulnerable (Brown and Walker, 2008, McGregor, *et al.*, 2007). Lessons from smaller indepth studies should be fed into broader studies that attempt to provide information on vulnerability at a coarser scale, for example regional or city-wide mapping (e.g. Mavrogianni, *et al.*, 2009, also Lindley, *et al.*, forthcoming). Improved methods for considering broad determinants of vulnerability at a regional or city level, focusing on exposure and sensitivity, can help by providing a consistent baseline and evidence base, supporting communication to different tiers of governance and providing a means of demonstrating how climate change will increase vulnerability.

Identifying resources to fund additional work is a key issue but it is clear that there is already a lot of research underway that is relevant to the broad decision-making community for heatwave planning at local level. What is also needed is greater interaction between researchers and those responsible for implementing the Heatwave Plan.

In terms of governance, a key issue from this study is the need for improved coordination between local implementation and strategic planning at the national level. According to practitioners (e.g. HPA 2007, 2008) there is a need for increased guidance and support from national and regional bodies, particularly to help identify vulnerable people. At the same time, there is also a need to audit how effectively the plan is being implemented at local level.

Recommendations

Develop a broader 'heat strategy' for the UK that builds longer term resilience

The Heatwave Plan is effectively a reactive measure to heatwaves and the only existing policy framework related to heat. The UK requires a broader 'heat strategy' to build longer term resilience in preparation for heatwaves. This should involve a range of stakeholders and include local government and other service providers. It should cover a range of relevant expertise, such as spatial planning, engineering, social services, environmental and public health, education and employers, and should address the social processes that underlie vulnerability to heat, rather than just the physiological 'end-point' determinants of heat stress.

Improve the forward looking preparedness of the Heatwave Plan

There may be a gap between emergency planning teams and climate change/sustainability teams in local government. Strong engagement from all relevant departments and teams is needed to ensure that the forward looking aspects of the Heatwave Plan receive more attention.

Share information in order to identify vulnerable people

Local decision-makers need guidance from national or regional government on data sources, tools and methodologies to help identify vulnerable people (top-down). There also needs to be more effective liaison between local level agencies on issues related to heat vulnerability to identify vulnerable people (bottom-up).

Evaluate how the Heatwave Plan is monitored at local level

Further thought is needed about how the local implementation of the plan is monitored and evaluated to ensure that vulnerable groups and individuals are identified and that there is the necessary cooperation and communication between relevant agents.

Consider the need for additional resources

Implementing these recommendations would require the investment of more resources in heatwave planning. This might be achieved if awareness is raised of how and why heatwaves pose a significant risk to society in the UK, both now and increasingly in the future.

Box 13: Forthcoming changes to governance of the Heatwave Plan

Since this research was carried out, the Secretary of State has announced wide ranging reforms to the NHS that will potentially reshape the governance and implementation of the Heatwave Plan. In particular, the abolition of strategic health authorities (to be replaced by new GP consortiums) will be significant.

It is too early to say exactly how the proposed reforms will affect the implementation of the Heatwave Plan. There was no review of the plan carried out between the Secretary of State's announcement and the publication of this report. However, there are potential advantages and disadvantages for the successful implementation of the Heatwave Plan from the point of view of protecting vulnerable groups.

More local control

GP consortiums will be locally based and run by decision-makers with a more detailed local knowledge than strategic health authorities. This could increase the chances of using local information to identify places and people that are at risk.

Under the proposed reforms, local authorities will play a greater role in social care and public health. If they are therefore more involved in heatwave planning, it could improve the use of local knowledge and aid cross-departmental coordination to identify and work with vulnerable groups.

Lost learning

In the short term there will be a loss of the strategic health authorities' institutional memory, built up over recent years of implementing the Heatwave Plan. There is also likely to be confusion in the short term, as GP consortiums are set up and struggle to come to terms with their new administrative and purchasing responsibilities. Heatwave planning, which is already seen to be a low priority at local government level, may fall off the agenda completely until an event occurs that harms vulnerable people.

4 Conclusions

Vulnerability to heatwaves and drought

This project contributes to the understanding of adaptation to climate change by focusing on current policy responses to heatwaves and drought. While the measures it considers are not explicitly designed to tackle climate change, they may help society adapt to two of the potentially most damaging impacts of climate change in the UK. The key interest of the study is in how these existing measures impact upon or protect those who may be most vulnerable to drought and heatwaves.

The case studies relate to adaptation responses to these two distinct projected impacts of climate change and they contrast in several ways. Responses to drought, in the form of water pricing, provide a gradual long term approach to adapting to a drier climate, while the Heatwave Plan provides an emergency response to an extreme weather situation. The way in which social vulnerability is conceptualised also differs between the two case studies:

- Vulnerability to drought is largely understood in terms of a household's ability to afford sufficient water.
- Vulnerability to heatwaves focuses on physiological characteristics (often currently understood through a health lens) but is more complex and multi-faceted.

Those particularly vulnerable to the impact of heatwaves are not necessarily those who are most vulnerable in drought conditions. However, there is potentially an overlap in that the only option for some people to reduce their heat stress would be to use water to cool down. This might be because their home is poorly insulated, they live within an urban heat island with no access to cool space, or they are housebound or restricted from accessing public space for cultural or domestic reasons. Little is known about how extreme high temperatures are actually experienced at household and community level. As heatwaves become more common, however, the use of water may become a more dynamic issue: for example if water use for recreational or domestic cooling purposes is restricted because of ability to pay.

Understanding vulnerability to both these hazards draws attention to the way in which some people may be hardest hit, for example those on low incomes, in particular locations and with particular medical conditions or mobility restrictions. Not only might we expect some of the same people to suffer most in heatwaves and struggle to afford sufficient water, there are times when both of these situations may impact upon them concurrently.

What does adaptation to climate change mean in practice?

The adaptation measures explored in this study allow us to consider two facets of adaptation to climate change:

- long term gradual changes to increase resilience to projected changes in circumstances (i.e. differential water charging to encourage more sustainable use of water in the face of drought conditions);
- emergency measures to respond to extreme weather events (i.e. heatwave plans).

While water pricing and heatwave plans have here been conceptualised as strategies for climate change adaptation, it is clear that this was not the primary driver for either policy measure. Interviewees conceded that both measures may have a role in adapting to projected climate changes but emphasised that this was not a key consideration in their planning or implementation. Water pricing mechanisms are driven primarily by current economic and affordability considerations. It is clear that the sector has a long term perspective and is building consideration of climate change into its planning in various ways. Despite this, the problem is dealt with as a supply and demand issue, and water affordability measures are seen mostly as cost recovery exercises; vulnerability to climate change is not a major concern. The Heatwave Plan itself is primarily categorised as an emergency response strategy.

In both the case studies there is a clear focus on current problems and risks (of drought, affordability of water and the prospect of heatwaves) rather than on how the impacts of heatwaves and drought may accelerate in the future. In both realms,²⁹ priority is given to responding to current concerns and less attention is paid to building preparation, resilience and prevention in relation to climate change. This is most evident in the Heatwave Plan, which focuses on responding to a health emergency rather than on developing a longer term, further reaching health strategy that encourages built environments and lifestyles that reduce vulnerability to heat stress.

Water pricing and heatwave plans can potentially be viewed as examples of adaptation to climate change whether or not stakeholders explicitly view them as such. Adaptation to climate change ‘can be motivated by many factors ... and manifested in myriad ways’ (Adger, *et al.*, 2005:77) and the lack of an explicit motivation does not mean that a policy measure may not contribute to this aim. Indeed, measures that are not explicitly packaged as climate change adaptations may be more effective at building resilience to climate change (i.e. adaptation ‘mainstreaming’).

The difficulty of linking everyday practical delivery of services to the more abstract concept of climate change means a focus on affordability, health and measures that have tangible current benefits. This may provide the best way forward. In addition, the current revival of climate scepticism and the fact of budget cuts means that focusing on existing problems on which there is consensus (protecting health and providing affordable services) is likely to give the most acceptable strategy for advancing climate change adaptation.

How is social vulnerability to climate change currently understood?

Vulnerability is a key concept in considering the impact of a changing climate. Although the term is intuitively understood by most people, understanding social vulnerability to climate change is complex because there are myriad individual, social, economic and geographic factors informing whether individuals and households are likely to be particularly hard hit. Vulnerability may vary across different impacts of climate change (e.g. flooding, high temperatures, droughts) and it is recognised to be a dynamic rather than a static condition, so the task of identifying potentially vulnerable people is challenging. While academics debate definitions and meanings of vulnerability to climate change, practitioners have to operationalise vulnerability in a practical way. This study focuses on these practicalities.

The two case studies explored how vulnerability to drought and to heatwaves is currently understood by key stakeholders involved respectively in water pricing in the south-west and in implementing the Heatwave Plan. This shines some light on how vulnerability to climate change is currently conceptualised, although it is important to emphasise that interviewees focused on vulnerability to heatwaves or drought and not to climate change in general.

Within the interviews, vulnerability to drought was largely understood in terms of water affordability. Those who are vulnerable are those who cannot afford to pay for sufficient water. Affordability issues were well understood and all stakeholders had clear (but distinct) remits to consider it. Agreement on this largely one-dimensional construction of vulnerability is unsurprising. The concept of water poverty as a subset of general poverty leads logically to an understanding of vulnerability in terms of affordability.

Additionally, interviewees were involved with water pricing mechanisms and therefore had a fairly common view of the problem. The broader context for vulnerability to differential water charging, namely the influence of legitimate requirements for high volumes of water (e.g. because of medical or household circumstances), was understood by most interviewees. It is partially covered by existing support schemes in the south-west, though the longer term implication of climate change on these factors received little attention.

By contrast, interviewee perceptions of vulnerability to heatwaves were multi-faceted and included personal attributes, location and the dynamic character of vulnerability. Although individuals had sophisticated and nuanced understandings of the complex nature of vulnerability to heatwaves, their definitions became more one-dimensional, focused on physiological issues, once they considered what vulnerability meant within the Heatwave Plan. Thus in contrast to the water pricing case study, vulnerability was largely seen through a health rather than a poverty lens. Again this is unsurprising, given the plan's specific health focus, its nature as an emergency response, and the provision of an 'official' list of mostly physiological determinants of heat risk.

One noticeable difference between the two case studies is the depth of understanding of the central issue of vulnerability. In the water sector, stakeholders have become used to working together and affordability is seen as a concern for all, even though the Consumer Council for Water is specifically tasked with representing consumer interests. In the health sector, there is no equivalent consumer body, heat stress and the social dimension of vulnerability are not well established issues and there is little shared understanding among decision-makers.

How well prepared are stakeholders?

The nature of the water sector as a privatised and heavily regulated utility sector perhaps lends itself to a clear definition of roles and to reliance on stakeholder collaboration. Further, in a sector that depends heavily on infrastructure, there are inherent delays in effecting any change. Decision-makers are therefore engaged in long term planning and better prepared to deal with future issues such as climate change and drought. The social care and health sector is more complex, less cohesive and open to constant reform and numerous public pressures. It is also more of a 'reactive' sector, aiming to cope with the demands placed on it by the population, rather than to tackle the underlying cause of illness, which has generally been seen as the role of other government departments or the public themselves. However, this situation is changing gradually and in time there is no reason why a similarly strong multi-stakeholder governance structure cannot be established for heatwave planning.

While academic discussions of social vulnerability to climate change are complex and multi-faceted, operationalisation of vulnerability tends to be one-dimensional. For example, because responsibility for enacting the Heatwave Plan lies with the Department of Health, vulnerability to high temperatures is understood from a health rather than a broader social perspective. Such an understanding of vulnerability to heatwaves will focus attention on many of those likely to be hardest hit, but may miss others who do not fit within the categories identified as vulnerable. Some interviewees recognised that reliance on the categories in the Heatwave Plan to identify vulnerable individuals took no account of the dynamic nature of vulnerability.

In the context of vulnerability to high temperatures, one reason for stakeholders' reliance on a more limited interpretation of vulnerability may be the absence of data and tools to identify the complex nature of who is vulnerable. In the contexts of both climate change and existing heat-related impacts, the obvious approaches to decision-making rely on top-down models such as climate change scenarios or urban heat island models. These tools provide the decision-maker with a spatial set of results that indicate where temperatures are likely to be hottest but do not show how that temperature will be experienced at local or individual level. Individuals' responses to those high temperatures will be influenced by a range of factors that cannot be modelled top-down.

Top-down decision support tools on heatwave risks need to be complemented by effective bottom-up action that identifies and supports those most at risk. Such a response requires a network of individuals within communities who can bridge the gap between the local community and 'official' agencies involved in the heatwave response. Community champions have been shown to be particularly effective in building flood resilience (CAG Consultants, 2009) and could be similarly successful in building resilience to heatwaves. Research on community resilience to climate change often draws attention to the role of social capital (Adger, 2000). Addressing vulnerability to climate change cannot simply be a top-down strategy; it requires action at community level too. The way to achieve 'just adaptation' may be through 'resilient community initiatives': bottom-up processes of community-led resilience, planning, awareness and emergency response. The question for policy is how to make this happen: how can policy create the conditions that foster community resilience to climate change?

Water pricing mechanisms and heatwave plans can play an important role in protecting those likely to be hardest hit by droughts and heatwaves and comprise part of a strategy for adapting to climate change. This 'mainstreaming' approach to adaptation ideally needs to be situated within more fundamental, holistic and long term thinking about how society is organised to become more resilient to the impacts of climate change. To create the conditions in which resilience is increased, adaptation to climate change in the UK will require comprehensive and systematic changes at national and local levels across the realms of health, social care and wider community and spatial planning. Adaptation policy should avoid becoming focused on physical risks; the true nature of vulnerability to climate change means that only the sort of holistic approach that is the objective of 'sustainable development' is likely to be successful (Adger, *et al.*, 2005).

When properly conceived, sustainable development provides the framework for achieving just adaptation, and achieving prevention as well as recovery from hazards. A sustainable society is envisaged as one in which environmental goods and bads are distributed fairly and evenly, including protection from climate change impacts. This justice objective has always been a central tenet of sustainable development (Atkinson, *et al.*, 2007). Society cannot be sustainable if it is not resilient to climate change, and so the concept of sustainable development must evolve to accommodate this objective. There is a need for those concerned with understanding vulnerability and adaptation to climate change to learn from the existing literature that links sustainable development and social justice objectives. Much of this has focused on environmental issues such as air quality, local environmental degradation and access to green spaces (Eames and Adebawale, 2002, Lucas, *et al.*, 2004) but the lessons about the need and potential to tackle issues of social exclusion and sustainable development concurrently apply equally to climate change impacts.

The key message from this exploratory study, then, is that 'adaptation' initiatives must build resilience among those who are most vulnerable to climate change in order to contribute to the goal of achieving social justice.

Notes

- 1 According to the Water UK website <http://www.water.org.uk/home/resources-and-links/waterfacts/waterprices> [Accessed 9 December 2010].
- 2 Single-occupier households are often inefficient in water use and rely on only one source of income to pay bills, meaning that they are more likely to have difficulties with affordability.
- 3 Water companies report that they struggle to recover debts from customers who are able but unwilling to pay their water charges, as well as from customers who have genuine affordability problems.
- 4 The Independent Review of Competition and Innovation in Water Markets states that water use rates per person can be 40 per cent higher for single-occupancy households than for double-occupancy (Cave, 2009). This is thought to be a result of inefficiencies in running appliances for single people rather than for larger groups.
- 5 'Adaptation' is not always termed as such, although any measure that deliberately or inadvertently reduces future exposure to climate risks, or builds capacity to respond to climate challenges, could be termed adaptation.
- 6 That is, 'those characteristics of communities and the built environment, such as the level of urbanization, growth rates and economic vitality that contribute to the social vulnerability of places' (Cutter, *et al.*, 2003:243).
- 7 Fines of around £1,000 can be issued to people breaking the terms of a hosepipe ban.
- 8 For more on the impacts of drought, including the social impacts, see the US National Drought Mitigation Centre website <http://drought.unl.edu/risk/impacts.htm> [Accessed 29 November 2010].
- 9 See Waterwise website http://www.waterwise.org.uk/reducing_water_wastage_in_the_uk/the_facts/the_facts_about_saving_water.html [Accessed 29 November 2010].
- 10 For more information, see <http://peseta.jrc.ec.europa.eu/docs/Tourism.html> [Accessed 29 November 2010].
- 11 The revenue generated by tourism does not directly subsidise the additional costs of supplying water to the high number of visitors in the south-west. Instead, the additional costs are transferred to consumers via their water charges. This means that an 'ordinary' consumer, for example someone on a low income, pays a premium to keep the water delivery capacity in the south-west high enough to meet the peak summer demand from tourism.
- 12 Figure 3 shows that current Tourism Comfort Index ratings for much of the Mediterranean are Excellent (red) during summer, but these will shift to become only Acceptable (as a result of uncomfortably high temperatures), whereas the south-west of England remains Very Good – and Excellent in parts – as a result of climate change.
- 13 For more information on the Walker Review, see the Defra website <http://www.defra.gov.uk/environment/quality/water/industry/walkerreview/> [Accessed 29 November 2010].

- 14 The end of a session of Parliament represents a deadline for bills that have not been through all parliamentary processes. The Speaker of the House of Commons and the party whips determine which are considered and debated by Parliament. There is a limited number of slots for private members' bills, of which the Water Tariffs Bill was one. Nick Harvey MP, who sponsored the bill, has not received another allocation for it to be read in the new session; there is therefore no foreseeable chance to rekindle the bill in the next Parliament (based on email communications with Nick Harvey's office, July 2010).
- 15 There is considerable debate about the minimum amount of water required per capita, particularly because of disagreements about what aspects of water use should be included in such an estimate (Chenoweth, 2007). South West Water used its own customer data on water consumption to set the thresholds of the rising block tariff. Further research may be needed to assess the appropriate definition and to decide whether it differs substantially between user groups.
- 16 For example, by installing water efficient toilets, water butts, grey water recycling or water harvesting systems. The freedom to fit water efficient systems may be most limited among social and private renters.
- 17 An example cited during the interview was of a customer with obsessive compulsive disorder who routinely washed five to ten times a day, causing high bills. An agreement was reached with the customer's doctor to prove that the condition legitimately influenced water use. Cases such as this helped lead to the inclusion of medical conditions within the WaterSure criteria.
- 18 At the time of the interviews in February 2010, only four large families had been recruited to the trial.
- 19 For more information, see WaterSure application form www.southwestwater.co.uk/media/pdf/2/c/WaterSure_Application_form_-_July_08_v3.pdf [Accessed 29 November 2010].
- 20 South East Water and Wessex Water are currently trialling seasonal tariffs, according to the interview with South West Water.
- 21 Rising block tariffs for water already exist in other European countries, such as Spain.
- 22 The temperature record for the UK (38.5°C) was set in Brogdale, Kent during the summer of 2003.
- 23 'Britain declares heatwave as temperatures rise towards 32°C', Guardian website <http://www.guardian.co.uk/uk/2009/jul/01/heatwave-met-office-health-advice> [Accessed 29 November 2010].
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- 25 <http://www.somerset.nhs.uk/welcome/about-us/sustainable-development/climate-change-and-carbon-management/> [Accessed 29 November 2010].
- 26 Government Office for the South West (GOSW) website <http://www.gos.gov.uk/gosw> [Accessed June 2010]. GOSW has since been disbanded and only a snapshot of its website is available via the National Archives website.

- 27 The principle of subsidiarity states that decisions should be taken at the most local level that is practical.
- 28 The Department of Health defines surge capacity as ‘the ability to expand provision beyond normal capacity to meet transient increases in demand, e.g. to provide care or services above usual capacity ... to meet increased demand.’ (DoH, 2007:137).
- 29 The water industry as a whole could be said to have a strong discourse of adaptation, in that its strategies and discussions reflect the need to adapt to future changes in climate, but the specific domain of water tariffs and support schemes do not have adaptation as a core idea.

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