



Policy brief

The 2022 heatwaves: England's response and future preparedness for heat risk

Summary

- The summer of 2022 saw unprecedented high temperatures, exceeding 40°C in some parts of the UK, leading the Government to issue heat health warnings equating to a national emergency for the first time.
- Impacts of the heat events were widespread. There were more excess heat-related deaths than in previous years, with especially severe health impacts for at-risk groups and vulnerable communities.
- As well as placing a significant burden on first responders and the healthcare system, the heatwaves disrupted transport infrastructure and the utility sectors, and caused economic losses at the local, regional and national levels.
- The heatwave season of 2022 serves as a warning that England and the rest of the UK are not ready to respond adequately to such extreme heat events. Yet events like this are likely to become more common and severe, thus preparedness needs to be improved, to reduce avoidable deaths, minimise the economic impacts of future heatwaves, and shield the most vulnerable from the worst of the effects.
- The risks and effects of extreme heat, from increasing prevalence of wildfires and drought to impacts on food security and our ability to live and work indoors or outdoors, are complex and multi-faceted, requiring a holistic understanding and comprehensive set of responses.
- The impacts of extreme heat are exacerbated by diverse factors including: political and economic constraints; compounding and cascading risks; inadequate building and infrastructure cooling; exacerbated urban heat island effects; a lack of understanding about heat-related impacts among the general public and healthcare workers; underlying health conditions of vulnerable populations; and misleading positive messaging about heatwaves in the media.
- This policy brief makes recommendations to decision-makers in local and national government, first responders, utilities and transport, the voluntary sector and beyond on how to enhance heatwave preparedness and response, based on England's recent experience.



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Policy briefs provide analysis on topical issues, presenting specific recommendations to inform ongoing policy debates. Drawing on the Grantham Research Institute's expertise, they summarise either our research findings or the state of knowledge about a particular issue.

This policy brief was written by **Candice Howarth, Andrea Armstrong, Niall McLoughlin, Ellie Murtagh and Adeline Stuart-Watt.**

The co-authors wish to dedicate this work to the memory of Adeline Stuart-Watt who tragically passed away before the publication of this brief. Adeline played an important role in shaping this research and she will be missed by her colleagues.

Box 1. Definitions: Met Office heat warnings

Extreme heat warning

Issued by the Met Office to highlight potential impacts to lives, infrastructure and property. Uses yellow, amber and red warnings.

Heat-health alert⁴

Issued with the UK Health Security Agency (UKHSA) and aimed at those in the health sector dealing with the health impacts of heat. Alert levels are on a scale of 0 to 4. Level 0 serves as a reminder to authorities of the need to plan. Level 1 (green) indicates summer preparedness and long-term planning. Level 2 (yellow) indicates alert and readiness. Level 3 (amber) indicates heatwave action. Level 4 (red) indicates a national emergency).

Heatwave

A threshold-based meteorological term designed to provide the media and public with consistent and reliable messaging. Temperatures must reach a maximum threshold (see Table 1, p3) for three consecutive days for an official heatwave to be declared.

Source: Met Office website. Accurate April 2023.

Introduction

Extreme heat is a relatively new challenge for the UK. There is currently insufficient research, policy or action to ensure that communities, businesses and systems are prepared for this risk and can adequately respond to it and recover from its impacts.¹ The 2022 heatwaves provide an opportunity to evaluate England's response and resilience to extreme heat events, to advance discussions and stimulate action on this issue. This policy brief sets an agenda for generating this focused discussion.

The current heatwave policy landscape in England

In England,² the main policy for responding to the health risks of heatwaves was, until April 2023,³ the 'Heatwave Plan for England', which included the heat-health alert system (see Box 1). The Heatwave Plan operated from 1 June to 15 September, and if thresholds for an alert were reached outside of this period, an extraordinary heat-health alert was issued (Met Office, 2023). The Plan, jointly produced by NHS England, the Department for Health and Social Care and the UK Health Security Agency (UKHSA), aimed to prepare for, alert people to, and prevent the major avoidable effects of severe heat on health. It focused on public health and wellbeing, including guidance for professionals working in care homes, health and social care (including hospitals and emergency responders) and schools to help support those most vulnerable to extreme heat. Separate UKHSA guidance was provided on the health impacts of drought with advice for the public (UKHSA, 2022). However, the Heatwave Plan for England's temperature thresholds are too high, with heat-related deaths also occurring before the thresholds are reached (Ward, 2020), and an evaluation of the Plan concluded that it needed improvement to protect people during hot weather where no alert was issued (Williams et al., 2019).

Box 1 provides descriptions of the different types of Met Office heat warnings that were in place during the summer of 2022.

The UKHSA also defines a 'heat period' as the day(s) on which a level 3 heat-health alert is issued or days when the Central England Temperature (CET) is above 20°C. A heatwave is declared when a location records a period of at least three consecutive days with daily maximum temperatures meeting or exceeding the heatwave temperature threshold. The threshold temperature varies by region, reflecting the differences in climate, and these thresholds are exceeded frequently (Howarth et al., 2023). Threshold maximum day and night temperatures (Table 1) are set by the Met Office and were revised in January 2022 using the 1991–2020 averaging period. This saw eight counties (Surrey, Berkshire, Buckinghamshire, Bedfordshire, Hertfordshire, Cambridgeshire, Lincolnshire and the East Riding of Yorkshire) have their maximum temperature threshold raised by 1°C (Met Office, 2022). The regional temperature thresholds for the heat-health alert system were higher than the temperature thresholds for heatwaves.

According to the Heatwave Plan for England, excess seasonal deaths may first become apparent at 24.5°C, but this varies by location, as seasonal deaths can occur at a lower temperature in on-average cooler locations. The population is therefore at risk even below the heatwave thresholds and heat-health alert (UK Government, 2014). These factors pose additional complexities when responding to heatwaves across locations and sectors.

1. The total economic costs of heat-related mortalities from climate change and socio-economic change in England are projected to be around £6.4 billion per year in the 2020s and £13.7 billion per year in the 2050s (Watkiss et al., 2021).

2. Our analysis focuses on England. In Scotland, Ready Scotland, a website maintained by the Scottish Government's Resilience Division, contains advice about hot weather. In Wales, Public Health Wales provides guidance for extreme hot weather. Northern Ireland follows the Met Office heat-health alert warnings and its website uses wording from the NHS and the Heatwave Plan for England.

3. In April 2023, the UKHSA introduced the new Adverse Weather and Health Plan (AWHP) for 2023–2034, which integrates and builds on the previous Heatwave Plan for England and Cold Weather Plan for England. This includes a move away from heat alerts based on probabilities of reaching threshold temperatures, towards impact-based alerts that combine impacts and likelihood.

4. The five main alert levels (Levels 0–4) of the Heatwave Plan are replaced in the new AWHP by colour-coded alerts (yellow, amber and red) presented in a matrix format. This is based on a combination of the potential impact of the weather conditions (on the population, health and social care and other sectors), and the likelihood of those impacts being realised.

5. The 2022 heatwave dates included in this policy brief are the epidemiological dates, which include two additional days, one day before and one day after, the heat-health alert period. During the third (30 July–5 August) and fifth (23–25 August) episodes, no heat health alerts were issued, although the 20°C CET (Central England temperature) threshold was reached.

The 2022 heatwaves in numbers

The summer of 2022 broke temperature records in the UK. The temperature exceeded 40°C on 19 July, and a Level 4 heat-health warning was issued by the UKHSA for the first time on 18 and 19 July. The magnitude, extent and severity of the extreme heat events experienced over five 'heat periods' (16–19 June, 10–25 July, 30 July–5 August, 8–17 August, 23–25 August)⁵ was unprecedented when compared with previous hot summers in the UK (McCarthy, 2022). During these five periods, 2,803 excess deaths were recorded among those aged 65 years and over and 3,271 excess deaths among all (excluding COVID-19 deaths): the highest excess mortality figure during heat periods recorded since the Heatwave Plan for England was introduced in 2004. Over 17–20 July, when temperatures were at their highest, saw an estimated 1,012 excess deaths for those aged over 65 in England (UKHSA, 2022).

The UK's Climate Change Risk Assessment report estimates that heat-related deaths in the UK could increase to 7,040 per year by 2050 under 4°C of global warming, if no adaptation occurs and including population growth (Kovats and Brisley, 2021).

Responses to the 2022 heatwaves in England

Given the extreme heat events in the summer of 2022, and projections of their increasing frequency and severity, it is important to determine points of weakness and possible improvements in existing heatwave guidance.

Stakeholders in our focus groups and interviews (see Box 2) agreed that the heatwaves were managed, in general, relatively well, notwithstanding the number of deaths and other impacts. However, it was felt that resources were at 'breaking point', and had the heatwaves been longer in duration or with even higher temperatures, responses would not have been as effective. The stakeholders agreed that England is not prepared to manage future extreme heat events, particularly if these were to occur more frequently at the same magnitude and duration, or if they were less frequent but of greater magnitude than the 2022 heatwaves.

Preparedness and response capabilities differed across sectors. Of the sectors most affected by heatwaves, rail transport and water were well prepared, according to the experts in our survey. Network Rail, for example, is in the process of updating its broader policies to take climate change into consideration. Despite this, rail and water sector workers, and first responders, stated that if the heatwave during the 10–25 July period had lasted longer, they would have experienced significant challenges. Feedback from first responders (particularly fire and ambulance services) indicated that resources and capacity were stretched to their limits, and that another or an extended heat period would have affected their ability to respond to heat-related emergencies.

The research highlights that responses to heatwaves in England could be more effective by addressing five key barriers:

- 1. Limited resources.** A lack of dedicated funding for heatwave preparedness and responses at national and local government level and across sectors has been compounded by successive cuts to public budgets. Few staff and personnel have adequate experience and training on heatwaves. Under-staffing during the heatwaves posed

Table 1. Threshold maximum day and night temperatures across regions of England

Maximum temperatures (°C)		
Region	Day	Night
London	32	18
South West	31	16
South East	30	15
Eastern	30	15
West Midlands	30	15
East Midlands	30	15
North West	30	15
Yorkshire and Humber	29	15
North East	28	15

Note: Regions are defined by the Met Office National Severe Weather Warning Service (NSWWS).

Source: UK Government, 2014; Met Office website.

Box 2. Research methods

Between September 2022 and January 2023 we collected time-sensitive data on responses to the 2022 heatwaves. Our preparatory research included a literature review, an assessment of heatwave policies, guidance and media coverage, and the creation of a simple system map highlighting the exacerbators of risk along with responses, to reduce the impacts of future heatwaves. Four focus groups were then conducted representing England as a whole, London, Manchester and the Yorkshire and Humber Region, with stakeholders from government and agencies, first responders, utilities and transport and civil society organisations. Thirty-eight semi-structured interviews were carried out with stakeholders from these categories across the four locations.

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challenges. There was also evidence of crisis fatigue following the COVID-19 pandemic.

2. **Attitudes and behaviours.** Members of the public engage in risky behaviours during heatwaves such as not taking appropriate steps to prevent dehydration and creating fire risk by lighting barbecues. A general poor understanding about heatwaves often results from a lack of sunburn alerts and signage in open spaces warning people to stay in the shade. There is also a scarcity of information on how to stop homes from overheating and how to protect water supplies.
3. **Preparedness and strategy.** Forward-planning measures and robust processes to deal with heatwaves are not commonplace as heatwaves are seen as exceptional events. Preparedness can be enhanced by actions including water conservation campaigns and scheduled hosepipe bans. There is currently no national strategy for preventing heatwaves from causing overheating in homes and workplaces, and many other negative impacts.
4. **Governance.** Heatwave response is rarely the product of collaborative, joined-up approaches co-produced by those affected by extreme heat and those involved in delivering responses to extreme heat. There is evidence of working in silos and with conflicting priorities.
5. **Knowledge gaps.** There is a general lack of understanding about heatwaves and cooling in local government and the buildings sector – particularly over retrofitting existing housing stock. Additional research is needed to better understand challenges arising from ineffective governance, limited resources and expertise, and inadequate communication strategies. A greater understanding of the nature and context of extreme heat risk and how to adapt is also needed, particularly with vulnerable people and communities in mind.

Assessment of current heatwave policy effectiveness in the UK

While there has been a Heatwave Plan for England (and a new Adverse Weather and Health Plan), and sectoral policies and guidance are in place, our research has exposed gaps in understanding and preparedness. This is partly because the UK does not have a history of adapting behaviours appropriately to cope with extreme heat.

Across the UK, average and extreme temperatures will continue to increase, with warmer winters, hotter summers and more intense, frequent heatwaves projected (Kovats and Brisley, 2021). Preparing better for extreme heat now, rather than at some point in the future, must be at the top of the agenda for government, organisations, cities and the public. This requires more data and knowledge, clearer policy leadership on extreme heat, more action on the ground, and a shift in cultural perceptions about extreme heat and keeping cool.

Beyond the Heatwave Plan for England, numerous policies that would be expected to address heatwaves lack consistency and integration. The accompanying annex identifies weaknesses in existing policies across the six sectors and themes named below, along with suggestions for how they can be improved. They include:

- **In the buildings sector**, policies do not include a maximum temperature threshold for working and other strategies only briefly mention overheating or are for guidance only (e.g. the National Building Design Code and Overheating Mitigation, Heat and Buildings Strategy). This calls for improvements in policies to consider decarbonisation, overheating and air quality holistically.
- **In the health sector**, first responders feel under-prepared. Local and regional extreme heat health plans should be developed to incorporate all impacts of heat on health.
- **In terms of vulnerable and at-risk groups**, there is insufficient understanding of who is vulnerable to extreme heat and why. Policies should better consider a wider range of vulnerable people (e.g. rough sleepers, people with disabilities, people who work outdoors) and provide easily accessible indoor and outdoor cool spaces for heat events.
- **In terms of preparedness**, the temperature thresholds in the health heatwave alert system are higher than, and hence misaligned with, the point at which excess deaths start to occur – which is at around 25°C. There is also limited understanding of how overheating affects workplaces and education services. Local governments should set a ‘safeguarding response’ minimum temperature threshold above which responses kick in, and invest in solutions for early detection of heat events.
- **In terms of climate change adaptation**, there is generally a siloed approach to climate mitigation and adaptation and huge variability in local authorities’ ability to produce adaptation plans. The National Adaptation Programme for England mentions heat risk though actions that focus on overheating buildings. This calls for greater interconnectedness between climate mitigation and adaptation agendas, and improved support for local authorities to produce adaptation plans.
- **In terms of communication**, there is no UK narrative regarding vulnerability to heat, risks of exposure, or the benefits of adaptation. There is a widespread lack of public awareness around the impact of extreme heat, calling for improved public messaging and communication.

“Heatwave plans can be standalone, but it is vital also to integrate them into existing climate adaptation, energy, environment and resilience plans.”

Future-proofing the UK against extreme heat

To improve the UK’s resilience to extreme heat, two questions need to be considered: (i) how should policies relating to heatwaves or extreme heat in the UK be further developed?; and (ii) what outcomes should we aim for?

Developing robust and comprehensive extreme heat policies

The role of extreme heat policies is to frame and address the problem of heatwaves and their associated issues. National policies must consider local specificities and how actions can be translated and interpreted at that level. Heatwave policies need to include multi-agency and cross-sectoral planning. Heatwave plans can be standalone, but it is vital also to integrate them into existing climate adaptation, energy, environment and resilience plans. Ideally, they should include long-term horizon planning (20 years or more) and should focus more on prevention in addition to short-term responses, for example urban planning measures such as green/blue infrastructure. Figure 1 below summarises our recommendations for shaping heat-related policies.

Figure 1. Recommended actions for heat-related policies in the UK





<p>Nature-based measures</p>  <ul style="list-style-type: none"> • Mainstreaming nature-based solutions, such as increased urban green space expansion and vegetation • New parks, street trees and urban forests • Green spaces in buildings (e.g. green roofs and walls) • Blue infrastructure, such as increased bodies of water in urban areas • Protection, irrigation and maintenance of urban green and blue spaces • Green transitways for public transport 	<p>Preparedness and response</p>  <ul style="list-style-type: none"> • Targeted behaviour change programme • Heatwave plan for organisations • Targeted public communication and messaging • Heat vulnerability assessment • Evacuation and access to shelter; ability to stay cool at home • Early warning systems and promoting early action • Instructions on heat protection measures • Social support (e.g. local heat wardens)
<p>Property measures</p>  <ul style="list-style-type: none"> • Switch to LED lighting • Passive building cooling and heat-sensitive architecture • Active cooling (air conditioning, electric fans) with recognition of long-term impacts (e.g. changes in peak energy demands in summer and the urban heat island effect) and affordability for low-income groups • Consider heat risks in building codes and regulation • Retrofit buildings (e.g. insulation alongside ventilation and cooling methods, paint roofs and walls white) • Building vulnerability assessments 	<p>Urban measures</p>  <ul style="list-style-type: none"> • Physical shading in public spaces • Cool pavements and streets • Indoor and outdoor cool spaces • Heat vulnerability assessment • Installing solar panels that provide shade • Cooling systems for critical infrastructure • Heat-resistant infrastructure (e.g. sustainable drainage systems)

Table 2. Recommended outcomes for policies on extreme heat

Outcome	Explanation
<p>Reduce avoidable impacts</p>	Excess deaths due to heat are significantly reduced, to the point that they are rare.
	Sufficient preparedness to respond to heatwaves and heat-related impacts do not impede provision of vital services to the population and vulnerable groups.
	Reduced impact of heat events on infrastructure and supply chains, and on productivity.
<p>Cultural and behavioural shifts</p>	Decision-makers and the wider population think differently about extreme heat and are well-equipped for keeping cool.
	The wide range of influences on risky behaviours in heat events are considered, facilitating a cultural shift (McLoughlin et al., 2023).
<p>Enhance resources for short- and long-term responses</p>	Sufficient funding and financial resources are allocated to the transition to sustainable and equitable cooling of cities.
	UK adopts innovative adaptations to extreme heat and cooling, learning from other countries or cities with a culture of heat (e.g. district cooling systems in Paris).
<p>Establish synergies</p>	UK Government has an effective national strategy and cross-departmental approach to extreme heat risk which includes the most vulnerable sectors and groups and leverages net zero policies and actions to reduce heat risk (e.g. through building energy efficiency standards).
	Heat, cooling and drought are interlinked in decision-making, policies and guidance in every government department and the sectors most affected by heatwaves.*
	Preparedness for other compounding, cascading risks such as those related to climate (e.g. food security), building on lessons from the COVID-19 response.
	UK adopts a whole-system approach to addressing extreme heat and cooling, including a reduction of heat in cities and more efficient, sustainable and equitable cooling needs in buildings.**

* Health, first responders, transport, buildings, environment, agriculture and food production, forestry, marine, water, energy, education services, local authorities, prisons, digital infrastructure/technology. ** E.g., avoiding conventional cooling which is responsible for over 7% of global greenhouse gas emissions (UNEP, 2023).

Desired outcomes from policies on extreme heat

Table 2 sets out four specific outcomes that relevant actors and stakeholders should aim for as they work to shape policies on extreme heat, as identified by our analysis of the 2022 heatwave responses.

Policy recommendations

Update and expand heatwave policy

- **Update UK and local government heatwave policies and guidance** to ensure all sectors and levels of government are informed, coordinated and prepared for more frequent, severe and extended heatwaves.
- **Create local and regional extreme heat action plans and a national strategy**, building on existing work to identify and map heat vulnerabilities and impacts across scales and sectors, and inform cohesive, coordinated and collaborative planning and action. The plans must identify funding and finance options, build on existing solutions, and advance nature-based solutions and green technology.

Enhance governance

- **Create complementary short- and long-term strategic approaches to heat risk.** Short-termism (i.e. immediate, emergency responses) is predominant in UK heat responses whereas long-termism (preparing for the future) is a more common approach among businesses. Improving governance and limiting impacts around heat risk can enhance both short- and long-term responses to heat risk. For example, clarity around roles and responsibilities, avoiding disjointed processes, considering local contexts, tailoring responses to the needs of specific vulnerable groups, and ensuring synergies between mitigation and adaptation measures and approaches to heat.
- **Form inclusive, cross-sectoral partnerships** to address extreme heat and cascading and compounding climate risks. Extreme heat can interact with other climate-related hazards such as flooding, drought and wildfires, increasing risks to communities, businesses and the built and natural environments. Deep and inclusive cross-sectoral partnerships are needed to manage these complex, compounding impacts.

Encourage a cultural shift

- **Improve public communication, education and engagement** on extreme heat risk and how people can prepare and respond. This involves increasing effective heat risk communication, targeting specific audiences (especially those most at risk), listening to concerns and feedback, and making heat risk more visible. It is also important to raise awareness of heat as a public health issue as well as a climate change adaptation one.
- **Establish a culture of heat in the UK.** Over time, the UK will become more exposed to heatwaves of varying frequency and duration, so it is important to increase public understanding of the risks, the extent to which populations are vulnerable, and the required behavioural responses. This requires an assessment of current heat risk awareness and a targeted communication and education strategy.

“The UK will become more exposed to heatwaves of varying frequency and duration, so it is important to increase public understanding of the risks.”

Address knowledge gaps

- **More local and regional data and mapping of heat risks and vulnerabilities** are needed to prepare for increasing heat risk in the UK. More effective translation and incorporation of such data are also required to inform rapid operational responses and strategic planning.
- **Learn from people and places more used to dealing with extreme heat.** Knowledge exchange with countries already responding to extreme heat events can help the UK adapt more effectively to extreme heat. In particular, the political and economic institutional governance of these places can offer valuable lessons. This can help to fill gaps in knowledge, bolster skills needed for policy and action at home, and enhance agency and efficacy in responding to extreme heat events.
- **Identify and understand influences on vulnerable groups** to reduce heat disadvantage and vulnerability. Extreme heat compounds risks for vulnerable people, young and old, and amplifies other stressors such as air pollution in urban areas, but many are still unaware of these increasing risks.

Conclusion

To improve the UK's resilience to more intense and frequent extreme heat events, action is needed in many areas, including enhanced political will, sufficient funding, appropriate short- and long-term strategies, improved public messaging and a cultural shift. Further research is also needed to assess public understanding, support and acceptance of heat policies, how to improve communications, and how to influence decision-makers to recognise the risks and impacts of heatwaves and implement appropriate responses.

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The authors would like to acknowledge funding and support from the LSE Urgency Fund and the ESRC Place-based Climate Action Network. They also thank Katya Brooks, Kamyra Choudhary, Annette Figueiredo, Fai Fung, Gemma Holmes, Anna Mavrogianni and Bob Ward for their comments on an earlier version of this brief, and Georgina Kyriacou and Natalie Pearson for editing and producing the brief.

The authors declare no conflict of interest in the writing of this brief. The views in this brief are those of the authors and do not necessarily represent those of the host institutions or funders. Any errors remain those of the authors.

This brief was first published in May 2023 by the Grantham Research Institute on Climate Change and the Environment. © The authors, 2023. Permissions requests should be directed to the Grantham Research Institute.

Suggested citation: Howarth C, Armstrong A, McLoughlin N, Murtagh E, Stuart-Watt A (2023) *The 2022 heatwaves: England's response and future preparedness for heat risk.* London: Grantham Research Institute on Climate Change and the Environment, London School of Economics and Political Science.