

Submission to the Environmental Audit Committee Call for Evidence on heat resilience and sustainable cooling

Candice Howarth, Lei Bian, Shouro Dasgupta,
Denyse Dookie, Sara Mehryar, Srinidhi Ravishankar,
Elizabeth Robinson and Swenja Surminski

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About this submission

This report consists of a submission by the Grantham Research Institute on Climate Change and the Environment to the call for evidence from the Environmental Audit Committee on [heat resilience and sustainable cooling](#).

The submission was written by Candice Howarth, Lei Bian, Shouro Dasgupta, Denyse Dookie, Sara Mehryar, Srinidhi Ravishankar, Elizabeth Robinson and Swenja Surminski, and was edited by Natalie Pearson. It draws on the research and policy analysis on climate adaptation and resilience conducted by the Grantham Research Institute, including as part of the Heat Resilience Risk Hub established by the Institute. The authors welcome the opportunity to respond to this call for evidence.

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The views expressed in this report represent those of the authors and do not necessarily represent those of the host institutions or funders. Any errors or omissions remain those of the authors. The authors declare no conflict of interest in the preparation of this submission.

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Key messages

- The extreme heat events in summer 2022 in the UK led to 3,271 excess deaths, 6.2% more than the five-year average. Older people, those with pre-existing health conditions, younger children and outdoor workers in the agricultural and construction sectors are particularly vulnerable to climate-related heat mortality.
- Excess seasonal deaths can start to occur when temperature thresholds exceed 24.5°C. Three-quarters of heat-related deaths are not attributed to heat extremes but instead to moderate increases in temperature, such as between one and five degrees above regional temperature thresholds. Adaptation to high temperatures in the UK should therefore be a year-round priority.
- Actions to adapt to heat risk without overloading the energy grid include investments in early warning systems, energy-efficient cooling systems, green spaces and urban shading, designing buildings to encourage cool air flow, and behavioural shifts to reduce heat exposure during the hottest times of the day.
- The UK can also learn from other regions, countries and cultures that are more experienced in living with high temperatures. Such lessons might include shifting behaviour to reduce exposure during peak heat times and rethinking the design of new and existing building stock to encourage cool air flow and create cool spaces.
- There is currently insufficient understanding of who is vulnerable to extreme heat and why. Policies should better consider a wider range of vulnerable people including rough sleepers, people with disabilities and people who work outdoors, and provide easily accessible indoor and outdoor cool spaces for use during heat events. Measures to keep people cool should be tailored to different heat-vulnerable settings such as hospitals and care homes, workplaces, schools and mass gatherings.
- There has been limited work in the UK on addressing broader risks from extreme heat, such as impacts on agriculture and food security, productivity, infrastructure and buildings, and transport. There is also a need to explore the risks of compounding climate risks as extreme heat interacts with other climate-related hazards such as flooding, drought and wildfires.
- The Government's third National Adaptation Programme (NAP3) is too narrowly focused on overheating in buildings. Furthermore, it does not feature adequate language and policy direction on heat resilience measures. A more holistic approach is needed that integrates heat interventions into numerous other policies, such as those relating to buildings, health, adaptation, preparedness and public communications.
- Resilience planning must be done collaboratively with community members through participatory design processes that align interventions with local priorities and foster social connectedness – a key protective factor during heatwaves.
- Stakeholder interviews, led by the Grantham Research Institute, indicate that there is no clear ownership of responses and resilience to extreme heat within central government and local authorities in the UK. Research has also shown that the lack of collaboration and coordination among different departments is one of the main gaps in the UK's response to the extreme heat.
- National heatwave policies need to include multi-agency and cross-sectoral planning, consider how actions can be translated at the local level, include long-term planning, and focus more on prevention.
- The UK Government should prioritise developing a comprehensive national Heat Resilience Strategy that brings together public health, emergency management, infrastructure and social service agencies at all levels to build a more coordinated and proactive approach to extreme heat risks.

Introduction

Europe, North Africa, North America and parts of Asia in summer 2023, send a stark warning of the future impacts of extreme heat under a changing climate.

Overall, the UK is unprepared to deal with the consequences of extreme heat and many sectors of society – from first responders to schools, workplaces and care homes – are poorly equipped to prepare for and adapt to this crisis.

Extreme heat is a 'risk multiplier', with the potential to trigger and amplify cascading shocks in the form of wildfires, crop damage and drought, yet there has been insufficient research into these effects in the UK, and an unsatisfactory policy response. This is reflected in a lack of understanding and practical measures to help people remain safe in their homes, and buildings that are poorly adapted to cope with high temperatures, particularly in cities.

Because the UK will experience warmer summers and increased frequency and intensity of heatwaves due to climate change, these problems will only continue to grow.

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 the public understanding of heatwaves, 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.

Responses to questions

1. What evidence exists on the relationship between heat and human health (mortality and morbidity), and which communities are worst affected?

The increasing frequency, intensity and duration of heatwaves due to climate change are already having a negative impact on human health. Exposure to extreme heat is associated with an increase in mortality from cardiovascular, cerebrovascular (relating to blood flow to the brain) and respiratory diseases (Hajat et al., 2007). Older people, those with pre-existing health conditions, younger children and outdoor workers in the agricultural and construction sectors are particularly vulnerable to climate-related heat mortality. Research has shown that in cities such as London, where the urban heat island effect pushes temperatures up even further, the risk of mortality increased by 3.9% with each 1°C above a heat threshold (Arbuthnott et al., 2020).

Population vulnerability to heat in the UK has been steadily rising and is estimated to have increased by 45% in the UK between 2000–2004 and 2017–2021, due primarily to global warming and an ageing population (Romanello et al., 2022). People over the age of 65 are at higher risk when mean temperatures exceed 17–18°C (Hajat et al., 2007), and excess seasonal deaths start to occur when temperature thresholds exceed 24.5°C (NHS, 2011). Three-quarters of heat-related deaths are not attributed to heat extremes but instead to *moderate* increases in temperature, such as between one and five degrees above regional temperature thresholds (Jenkins et al., 2022). Adaptation to high temperatures in the UK therefore should not be considered as a purely seasonal problem, but a year-round priority.

Summer 2022 in the UK saw five periods of extreme heat between June and August 2022, leading to 3,271 excess deaths (6.2% more than the five-year average) (ONS and UKHSA, 2022). There were more excess deaths in females compared with males (2,159 vs. 1,115) across these heat periods, a reversal of the trend observed between 2016 and 2021. Under future climate change, projections show that there will be an increase from an average of around 1,400 annual heat-related deaths in the UK over the period

1990–2019 to around 2,500, 3,700, 8,200, and 18,000 average annual heat-related deaths with average global temperature rise of 1.5°C, 2°C, 3°C and 4°C respectively, without adaptation efforts in place (Jenkins et al., 2022).

Heat stress is also linked to significant economic losses through its impact on labour capacity. In 2021, heat exposure led to the loss of 470 billion potential labour hours globally across the agricultural, construction, manufacturing and services sectors. Recent findings show that a combination of heat stress and dehydration contributes to an increased prevalence of chronic kidney disease, particularly in agricultural and construction workers (Nagai, 2021). In the UK, the number of working hours in high-exposure sectors (agriculture, construction, forestry, mining and quarrying) is projected to decline as a result of extreme heat by 1.43% (equivalent to 21.8 hours per worker per year, using 2018–2022 data on hours worked in the UK) by 2030 compared to the 1986–2005 baseline (Dasgupta et al., 2021).

2. How can sustainable cooling solutions and adaptation strategies be implemented in such a way as to minimise overheating, reduce energy consumption and prevent overloading of the electricity grid during peak demand?

The UK needs to consider carefully how it can keep its citizens cool, without increasing greenhouse gas emissions. Investing in more blue and green infrastructure (such as woodlands and ponds) could help avoid unnecessary increases in energy use associated with heat-regulating behaviours (McLoughlin et al., 2023). Aligning climate change adaptation and mitigation policies can be a particularly effective way to protecting people, especially vulnerable groups, from the impacts of extreme heat (Howarth et al., under review). Adopting a well-thought through strategy can generate multiple benefits and avoid costly trade-offs. Actions to adapt to heat risk without overloading the energy grid include increased investments in early warning systems, energy-efficient cooling systems and urban green spaces. Nature-based solutions such as green spaces and urban shading are an effective way of reducing exposure to heat, keeping people cool while leading to co-benefits such as improvements in air quality (Jennings et al. 2020).

The UK can also learn from other regions, countries and cultures that are more experienced in living with high temperatures. Such lessons might include shifting behaviour to reduce exposure during peak heat times and rethinking the design of new and existing building stock to encourage cool air flow and create cool spaces (Taylor et al., 2023).

3. What actions can be taken to protect those most vulnerable to the impacts of extreme heat?

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. A range of measures can be implemented now to help keep people and places across the UK cool (McLoughlin et al., 2023), and it is critical that they are tailored to different heat-vulnerable settings such as hospitals and care homes, workplaces, schools and mass gatherings (Jay et al., 2021). Such measures include ‘cool pavements’ that are more reflective of sunlight, increased shading, heat-sensitive urban planning and introducing more green and blue infrastructure such as planting more trees and bushes by roadsides and creating ponds. There are also straightforward protective and preparative actions that can reduce the negative heat impacts on people such as applying sunscreen, using a fan, adapting clothing or evacuating people to cool spaces. But this will not be enough to cope with the levels of extreme heat that are expected in the coming years.

How people perceive and react to heat events will be important. While research has shown an increase in concern about hot weather linked to climate change in the UK in last decade, people in the UK typically have positive associations with hot weather. This has been influenced by persistent media representations of heatwaves and hot days as positive events while discounting the dangerous impacts they can have on vulnerable populations. Therefore, it is important that the public have greater awareness of the risks they are exposed to and the behaviours they need to adopt (EAC, 2018). The UK

needs to establish a more sensible 'culture of heat', which can be encouraged through effective communication, education and engagement on extreme heat and how individuals themselves can prepare and respond to stay safe.

We know that local authorities, emergency services and utility companies across the UK are operating with stretched resources and only just managed to respond to the heatwaves in 2022 (Howarth et al., 2023). They are grappling with how to prepare for more severe and frequent extreme heat, and will require additional support to do so.

4. To what extent do the Government's Climate Change Risk Assessment and National Adaptation Programme (as well as other related strategies such as the Net Zero Strategy and Heat and Buildings Strategy) identify and address the risks from extreme heat? (Note: The third NAP, covering the five-year period from 2023-2028, is expected to be published in the summer of 2023)

Building resilience to extreme heat in the UK is one of the key priorities identified in third Climate Change Risk Assessment. In this report, the Climate Change Committee (CCC) shows that the UK is not prepared to deal with a variety of impacts of climate change, including extreme heat (CCC, 2021). Its assessment of the UK's progress in adapting to climate change concludes that "very limited evidence of the implementation of adaptation at the scale needed to fully prepare for climate risks facing the UK across cities, communities, infrastructure, economy and ecosystems" (CCC, 2023).

The Government's third National Adaptation Programme (NAP3) addresses overheating but is too narrowly focused on overheating in buildings. It states that there is a need for further research on this issue. The Institution of Civil Engineers stated that there is not enough urgency within the NAP3 and insufficient plans on how to adapt infrastructure and buildings to the risks extreme heat (ICE, 2023).

The Environmental Audit Committee's 2018 report on adapting to extreme heat raised the need to work more with local authorities to prioritise and build resilience to risks of overheating in their local climate plans (EAC, 2018), but this has not been a priority. To date, the focus of national policy and action has been on reducing heat-related deaths and preparing the health and social sectors for more extreme heat events. There has been limited work on addressing broader risks to government, businesses, the third sector and communities from extreme heat – such as impacts on agriculture and food security, productivity, infrastructure and buildings, and transport.

Furthermore, UK policy is only at the early stages of exploring how extreme heat will interact with other climate-related hazards, such as flooding, drought and wildfires, and how these compounding climate risks may further threaten communities, businesses and the built and natural environments.

5. Does the current planning framework do enough to encourage heat resilience measures such as cooling shelters, water bodies, green infrastructure and shading to be integrated into urban planning? Where such measures are incorporated, how accessible and successful are they?

No. NAP3 does not feature adequate language and policy direction on heat resilience measures. While heat resilience is mentioned in the context of the future direction of policy and research, it does not go far enough to outline the adaptation measures needed to better understand and encourage improved heat resilience. NAP3 does reference the 2021 Heat and Building Strategy which looks mostly at decarbonising heat and buildings and recommends to the adoption of new, smarter technologies and practices. But a more holistic approach to heat resilience is missing.

The topic of sustainable cooling does not feature within the NAP3, apart from a reference to a case study on resilient new prisons and prison expansions, and the 2021 Heat and Building Strategy.

The Adverse Weather and Health Plan includes a heat specific strategy, however the numerous other policies that would be expected to address heatwaves lack consistency and integration (Howarth et al., 2023). For example:

- 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. This calls for improvements in policies to consider decarbonisation, overheating and air quality holistically.
- In the health sector, 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. 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.

Improving resilience in urban areas requires a holistic and multi-dimensional approach. While the current planning framework encourages heat resilience measures, more could be done to fully integrate such interventions into urban planning and design. Cooling shelters, water bodies, green infrastructure and shading are important but often treated as isolated add-ons rather than core elements of creating habitable and sustainable cities.

Where implemented, the accessibility and success of heat resilience measures depends greatly on social equity considerations and community engagement. For example, cooling centres must be within a walkable distance of the most vulnerable residents or otherwise accommodate their needs. The benefits of new parks and trees should not only be enjoyed by wealthier neighbourhoods. Passive cooling through building design needs to be applied to affordable housing. Resilience plans formulated without local participation may fail to provide adequate protections or address specific cultural factors.

To encourage improved heat resilience, urban planning policies should provide incentives for retrofitting existing buildings and neighbourhoods and guide investments to areas of greatest need through mandatory vulnerability assessments. Dedicated funding streams for the long-term maintenance of green infrastructure are also needed. The co-benefits of green infrastructure for multiple hazards (flooding, extreme heat, air pollution, etc.) must be considered and communicated well to justify the measures taken. Most importantly, resilience planning must be done collaboratively with community members through participatory design processes that align interventions with local priorities and foster social connectedness – a key protective factor during heatwaves.

7. How effectively is the Government working across departments and with local authorities to ensure a coordinated approach is taken to heat resilience?

The cross-government working group on overheating, coordinated by Defra, shares and discusses progress across individual departments relating to overheating. However, research with stakeholders from government and agencies, first responders, utilities and transport and civil society organisations found there was no clear ownership of responses and resilience to extreme heat within central government and in local authorities (Howarth et al., 2023).

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 planning (20 years or more) and should focus more on prevention, for example urban planning measures such as green and blue infrastructure.

Local authorities are increasingly concerned about their exposure and vulnerability to overheating (Dookie et al., 2021). Discussions with different stakeholder groups as part of work by the Zurich Flood Resilience Alliance demonstrated that lack of collaboration and coordination among different departments is one of the main gaps in the UK's response to the extreme heat (Rözer et al., 2022). Given that extreme heat is often compounded or cascaded by other disasters such as wildfires, air pollution, drought, flash floods and storms, it is important to plan for a joint and coordinated response across different sectors and departments to various hazards. Actions to reduce heat risk may also have co-benefits or unintended consequences for other climate-related risks. Therefore, an integrated risk management approach is needed that brings together the key government departments and agencies responsible for emergency response, public health, infrastructure, land use planning, environment, social services and community engagement.

6. Does the UK need a dedicated Heat Resilience Strategy? What lessons can be learned from other nations when it comes to national strategies for heat resilience?

Yes. The UK Government should prioritise developing a comprehensive national Heat Resilience Strategy that brings together public health, emergency management, infrastructure and social service agencies at all levels to build a more coordinated and proactive approach to extreme heat risks. Sustained multi-year funding and support for local capacity building are also needed to help communities implement heat resilience plans tailored to their specific vulnerabilities. Partnerships with grassroots community groups and the voluntary sector should be strengthened to leverage local knowledge and assets in protecting the most heat-vulnerable residents.

Extreme heat is a relatively new challenge for the UK, and the response is currently piecemeal, lacking a multi-sectoral approach, and insufficiently incorporating solutions that reflect local opportunities or challenges. Overall, there is insufficient research, policy or action to ensure that communities, businesses and infrastructure are prepared for and can adequately respond to this issue.

A dedicated Heat Resilience strategy should:

- See an update and expansion of UK heat policy to ensure all sectors and levels of government are informed, coordinated and prepared for more frequent, severe and extended heatwaves. This should be complemented by local and regional extreme heat action plans to identify and map heat vulnerabilities and impacts across scales and sectors, and inform cohesive, coordinated and collaborative planning and action.
- Enhance governance to create complementary short- and long-term strategic approaches to heat risk that form inclusive, cross-sectoral partnerships. Improving governance and limiting impacts around heat risk can enhance both short- and long-term responses to heat risk.
- Encourage a cultural shift and establish a culture of heat in the UK. This requires an assessment of current heat risk awareness and a targeted communication and education strategy on extreme heat risk and how people can prepare and respond.
- Address knowledge gaps, specifically through gathering more local and regional data and mapping heat risks and vulnerabilities in the UK. Learning from people and places more used to dealing with extreme heat can help the UK to adapt more effectively.

A dedicated Heat Resilience Strategy should also be incorporated into comprehensive a heat-health action plan. This would require clearer definitions of a heatwave and its corresponding impacts in

different places, improved dynamic warning systems, and integration with the UK's national adaptation programme (Kotharkar and Ghosh, 2022).

The Grantham Research Institute on Climate Change and the Environment is hosting a specialist workshop on the topic of a UK heat resilience strategy on 19 September 2023 with contributions from the UKHSA, CCC, National Farmers Union, British Red Cross, UCL, LSE and many others. We would be very happy to share findings from this workshop.

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