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Friends of the Earth

Which neighbourhoods are most vulnerable to heatwaves?

New research identifies the areas in England most at risk from dangerous temperatures and how a new adaptation plan could mitigate the impacts.

Contents

People in some areas of the UK are more impacted by extreme weather events and less able to mitigate those impacts than others. And climate change, caused predominantly by the burning of oil and gas, is increasing the severity and duration of heatwaves. In the record-breaking year of 2022, extreme heat caused more than 4,500 excess deaths in England. And according to estimates, there were 263 deaths from the June-July heatwaves in London alone. New data analysis by Friends of the Earth identifies those locations most affected by unprecedented temperatures and where urgent action must be taken.

The UK is unprepared for extreme heat

Summers are becoming hotter and drier. 2022 saw record temperatures, with 40°C exceeded in multiple locations for the first time. This was also the first time the UK Met Office issued a red warning for extreme heat. A recent study by the Met Office has found that the chance of exceeding 40°C has been rapidly increasing – it's now over 20 times more likely than in the 1960s. It estimates a 50/50 chance of seeing a 40°C day again in the next 12 years and suggests that temperatures several degrees higher are now possible, as well as heatwaves that last a month or more.

It's not only human health that's at risk during prolonged periods of extreme heat. Nature, farming, food costs and infrastructure all suffer as well. And droughts will become more common, which reduce the cooling effects of urban green and blue space.

In its 2025 adaptation report, the government's official climate change advisors, the Climate Change Committee, warned: "The UK's preparations for climate change are inadequate.?Delivery of effective adaptation remains limited and, despite some progress, planning for adaptation continues to be piecemeal and disjointed. [...] The Government must act without further delay to improve the national approach to climate resilience." The UK government has increased spending on flood defences but spending on heat still falls short, and councils are under-resourced for preparing for and responding to heatwaves.

Where and who are at greatest risk?

This map is interactive, but we're aware that it's not perfect on mobile. We recommend opening the map on another device or visiting Mapstack.

Using 2022 data, Friends of the Earth has identified the **4,715 neighbourhoods**[1] in England that experienced the hottest temperatures in the 2022 heatwave. That's a **third of the country's area**. These neighbourhoods are therefore most likely to be exposed to future heatwaves. The average maximum daytime air temperature in neighbourhoods in this third of the country was 38°C over a 72-hour period, which is 10°C higher than the heatwave threshold used by the Met Office. In our research we refer to these dangerously hot places as "high-heat neighbourhoods".

The government's Climate Change Risk Assessment states: "Vulnerable people being exposed to high temperatures in hospitals, care homes and when receiving homebased care is of particular concern as temperatures across the UK will continue to rise and heatwaves become more common." We've therefore identified the number of care homes, hospitals and nurseries in these high-heat neighbourhoods.

Care homes

Researchers studying care homes during the 2022 heatwaves found "endemic overheating across the care homes," which was true for both converted and purpose-built buildings. As we learnt from the pandemic, care homes are under-funded, particularly vulnerable and have acute staff shortages (which may worsen when international recruitment is curbed). There are **9,589 care homes** in these high-heat neighbourhoods. In the appendix, we identify the local authorities and parliamentary constituencies with the greatest number of care homes.

Hospitals

In 2022-23, the NHS in England recorded 6,822 instances of overheating in hospitals. There are **1,012 hospitals** in these high-heat neighbourhoods.

Nurseries

Very young children are also at risk. We identified **10,064 nurseries** within these high-heat neighbourhoods. There are also around 750,000 people pregnant at any one time in England, who are also particularly at risk.

Additional vulnerabilities

Within these high-heat neighbourhoods, we identified **1,920 neighbourhoods** where people are most at risk due to additional vulnerabilities:

- **Enhanced exposure** – housing that's more likely to overheat because it's insulated to lower levels than EPC C; a high proportion of flats and caravans.

- **Low ability to prepare for heatwaves** – rented homes; low-income households.

- **Enhanced physical risk** – over-75s because of a very high mortality rate, which is more than 4 times that of 65-75 year-olds or younger; under-5s because their bodies are less able to regulate heat; neighbourhoods with low life expectancy as a proxy for poor health (a wide range of physical and mental health effects are known to increase risks from extreme heat).

- **Low ability to respond** – a lack of nearby green or blue space to provide a cooling effect; a lack of money to either travel to somewhere cooler or benefit from facilities that might have air conditioning, such as cafes and restaurants; further to travel to a hospital if seriously unwell; areas where a large proportion of people don't speak English as a first language and so may miss out on warnings or advice.

In the appendix, we've identified the local authorities and parliamentary constituencies with the greatest number of vulnerable neighbourhoods.

The 1,920 neighbourhoods most at risk have a higher proportion of people of colour (37%, which is twice the national average). There are also 2.9 million disabled people in these neighbourhoods. The Equality Act requires policy makers to reduce the inequalities faced by those who are defined as having "protected characteristics" – which, as well as ethnicity and disability, also include age and pregnancy. So, this finding is particularly relevant for local, regional and national policy makers (particularly in the context that the previous government failed to carry out a lawful Equality Impact Assessment of its National Adaptation Programme until Friends of the Earth initiated legal action).

Air pollution

High levels of air pollution exacerbate the challenge of very high temperatures. Research funded by the European Union found a "60% [increase] of CPD [chronic pulmonary disease] mortality and morbidity during heat exposure". Of the 1,920 neighbourhoods identified, all have air pollution above levels recommended by the World Health Organization (WHO) for either $PM_{2.5}$ or NO_2, and 83% breach WHO recommended levels for both pollutants.

Summary of results

In summary, we've identified **9,589 care homes, 1,012 hospitals and 10,064 nurseries** that are a priority for measures to mitigate extreme heat and enable them to better cope. **1,920 neighbourhoods** are also a priority for adaptation. Much of the UK is likely to be exposed to extreme heat, but it makes sense to focus limited resources on those most in need first.

See the full dataset of high-heat neighbourhoods.

Policy implications

For decades, scientists have been telling policy makers that burning fossil fuels and deforestation will increase global temperatures with significant negative impacts for human health, economies and wildlife. While the UK has done more than many to reduce emissions, we and other countries still haven't done enough. So, adaptation to current and future extreme weather events now needs to be given much higher priority.

The urgent need to adapt to extreme weather events includes an understanding that, even in wealthy countries, our ability to adapt is limited. Currently, our planet is on track for at least 2.7°C of warming. But recent modelling by the UK Green Building Council suggested that even at a lower level of warming (2°C), by the end of the century care homes in London and the South East will face temperatures above 28°C for 4 weeks a year. Shockingly, it warns that some cities and towns, including Peterborough in England and Fairbourne in Wales, will be uninhabitable because of flooding. Sea level changes will also exacerbate coastal erosion.

The UK government must take climate adaptation much more seriously. Its current National Adaptation Programme, required under the Climate Change Act, has been deemed "inadequate" by the Climate Change Committee.

Investing in heat resilience is not only necessary to save lives, it's also economically prudent. Heat-related mortality in England alone costs £6.8 billion a year, and that's likely to rise to £14.7 billion per year by the 2050s, according to NHS England. Extreme heat events will also reduce economic productivity, have educational impacts and lead to increased costs through infrastructure damage, wildfires and so on.

What should the government do?

We recommend the following policy actions:

- Working with regional mayors and local government organisations, and after consulting directly impacted communities, the UK government should urgently **produce a new National Adaptation Programme (NAP)** for England, given its existing plan is so poor. This should include a detailed heat strategy that identifies the most at-risk populations and locations. The NAP will also need to address issues such as flooding, droughts and storms and consider what's needed to enable infrastructure, agriculture and nature to adapt.

- Ensure that building retrofits funded through the forthcoming Warm Homes Plan to improve energy efficiency also **deliver sufficient ventilation** to prevent mould growth in the winter and provide cooling in the summer.

- For new domestic buildings, ensure the upcoming Future Homes Standard includes **passive cooling measures** such as ventilation and external shading (like shutters) where needed.

- New-build care homes, schools and hospitals, which require restricted window opening for safety reasons, should **incorporate high-level windows** that can be fully opened to allow cooling. The government announced £10 billion a year of spending on schools, hospitals and prisons in its Infrastructure Strategy, and it's prudent to ensure that this spending is also future-proofing these buildings.

- **New green and blue infrastructure**, such as trees and ponds, should be targeted towards the areas in greatest need of their cooling benefits.

- **Ensure a network of cool spaces** – such as community halls, churches and sports facilities – are equipped and funded in at-risk areas to open up to the public free of charge, offering a cool place for respite during heatwaves.

- Require and fund local authorities to **produce a heat action plan**, as part of a wider climate adaptation plan, which identifies heat risk locations and is clear on ward-level responses to heatwaves, including checking on elderly people living alone. Ensure councils have the resources to produce the plan and implement it.

- **Carry out public information campaigns** each year on what measures households can take to keep their homes cooler, from basic no-cost actions to investments in measures such as shutters. Accompany this with **mandatory training for staff** working in care homes, nurseries, hospitals and prisons, as well as monitoring to ensure the training is put into practice.

- **Invest £1 billion a year in heat adaptation**, as recommended by the Climate Change Committee, particularly targeting care homes, hospitals, nurseries and local authorities, funded through "polluter pays" taxes.

- Speed up action to **reduce air pollution to safer levels**, including through the switch to electric vehicles and investments in public transport, walking and cycling. Reduced air pollution will lessen the health impacts of extreme heat.

Who should pay?

As is the case globally, those who've done the least to cause the problem – including marginalised and vulnerable communities such as those living in poverty – are most at risk. Spending on adaptation must increase and be targeted where it's most needed. Our research using publicly available data identifies these locations.

The UK is getting hotter because of the continued burning of fossil fuels by the UK and other nations. So climate change is a problem that's been predominately caused by fossil fuel companies, which continue to make enormous profits. Nowhere is the case for "polluter pays" taxation stronger than in helping the most vulnerable in the UK and globally to safely adapt to our warming world.

Appendices

Appendix 1 – tables

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Appendix 2 – detailed methodology

Analysis of heat exposure

During summer 2022, the UK experienced 3 heatwaves across June, July and August. To assess the impact of these events nationwide, we analysed 1 x 1 km land surface temperature (LST) data from [NASA's Moderate Resolution Imaging Spectroradiometer (MODIS).](#) The data were processed to remove cloud interference and address quality issues.

For each heatwave day, we calculated the daytime maximum and nighttime minimum LST for every 1 x 1 km grid cell across Great Britain. Because high nighttime temperatures are especially harmful to health, we used both the daytime maximum and nighttime minimum to derive a 24-hour average temperature.

For LST analysis, we primarily relied on MODIS Aqua satellite data, which passes over the UK at approximately 14:35 BST. Where Aqua data were cloud-obscured, they were supplemented with cloud-free Terra satellite observations, recorded earlier in the day around 11:15 BST.

To complement the LST data, we also used modelled 1 x 1 km air temperature data from the [Met Office HadUK-Grid](#) for June - August 2022. As with LST, we identified the highest 3-day average daytime and nighttime air temperatures for each grid cell – most of which occurred during the July heatwave – and used these to calculate a corresponding 24-hour average.

The LST and air temperature data were then aggregated to Middle-layer Super Output Areas (MSOAs) by averaging the 3-day daytime maxima and 24-hour mean temperatures within each area.

To identify MSOAs at highest risk, we calculated deciles from the 3-day 24-hour average temperatures. Areas falling in the highest deciles for either LST or air temperature – or both – were classified as having elevated heat risk. This approach identified around two-thirds of MSOAs, covering about a third of England's land area.

We used both LST and air temperature datasets due to their complementary strengths and limitations. LST provides direct surface readings, effectively identifying areas of heat retention and urban heat islands, but it may overestimate the air temperatures that people experience. Conversely, modelled air temperature is more representative of human-experienced conditions but is based on a relatively sparse network of around 200 weather stations, with limited coverage in urban centres – potentially underestimating localised heat extremes.

Identifying at-risk neighbourhoods

In addition to heat exposure data, we scored and decile ranked each MSOA to identify the neighbourhoods most at risk and in need of adaptation spending. This was based on indicators across 4 key domains:

- Enhanced exposure

- Enhanced physical risk

- Ability to prepare

- Ability to respond.

Each domain was informed by multiple indicators and data sources as listed below:

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Each indicator was normalised to a value between 0 and 1, where 1 represents the highest level of vulnerability or exposure. These were then summed to produce a score for each domain, which was also scaled from 0 to 1. Finally, the 4 domain scores were combined to produce an overall social vulnerability score and domain.

All indicators and domains were weighted equally in calculating the final score and determining social vulnerability in the face of extreme heat.

MSOAs were then grouped into 3 tiers of social vulnerability: high, medium and low. The top third of areas (those with the highest vulnerability scores) were classified as most vulnerable to the impacts of extreme heat.

Neighbourhoods identified as being both most exposed to high heat risk and most vulnerable to the impacts of heatwaves were categorised as being the most at-risk neighbourhoods.

Data sources

Heat exposure

Land surface temperatures: [MODIS Land Surface Temperature/Emissivity Daily L3 Global 1 km Sin Grid](#) – MYD11A1 (Aqua) and MOD11A1 (Terra), June - August 2022.

Air temperatures: [HadUK-Grid Gridded Climate Observations](#) on a 1 km grid over the UK, v1.3.1.ceda (1836-2024), Met Office, (Download: June - August 2022).

Housing quality

Poorly insulated homes: number and proportion of homes in EPC bands DEFG. [Energy Performance of Buildings Data: England and Wales data,](#) DLUHC, 2025.

Flats and caravans: [RM205 – Dwelling type, Census 2021,](#) Nomis, ONS, 2024.

Enhanced physical risk

Population ages (over 75s and under 5s): MSOA population estimates, ONS, 2024.

Poor health: Life expectancy at birth and age 65 years by sex for MSOAs, England: 2016 to 2020, ONS, 2021.

Ability to prepare

Renting households: number and proportion of households privately or socially renting homes, or living rent-free, TS054 – Tenure, Census 2021, Nomis, ONS, 2024.

High proportion on low incomes: English indices of deprivation 2019, MHCLG, 2019. (Income domain aggregated to MSOA using population weightings.)

Ability to respond

Green space: Green Infrastructure Map, Natural England, 2025.

Garden space: Access to gardens and public green space in Great Britain, ONS, 2020.

Tree cover: number of neighbourhoods with tree canopy cover less than 10%. Mapping English tree cover, Terra Sulis on behalf of Friends of the Earth, 2022.

English proficiency: persons who don't speak English well or at all, TS029 – Proficiency in English, Census 2021, Nomis, ONS, 2024.

Distance to nearest hospital: health services domain (access to GPs, hospitals (NHS trust sites), pharmacies, dentists, leisure services) of the Access to Healthy Assets & Hazards (AHAH) version 4, 2024.

Notes

[1.](#)
There are 6,856 neighbourhoods in England – as designated by the Office of National Statistics – with an average population of 8,300 people. They're called Middle-layer Super Output Areas (MSOAs).