UNIVERSITY OF LEICESTER

Institute for **Policy**

Heat-Stress Preparedness

Increasing the resilience and adaptation of UK cities to heat-stress

Key Policy Recommendation

Use data from local heat-risk maps to support urban areas in:

- **Increasing their resilience** to warmer climates.
- **Adapting better** to climate change.
- **Targeting their responses** to protect populations at higher risk of heat stress.

The impact of local heat-risk maps for long-term adaptation

Local heat maps have diverse applications, including advice for non-health sectors such as **building standards and regulation with a focus on heat resilient cities**. Some of these include:

- Identifying city blocks where the heat risk is higher can help **reduce mortality during heatwaves**.
- Analysing heat data alongside socio-economic data within a city can protect **the most vulnerable populations to heat** (e.g. the elderly, children, individuals in poor health or with chronic conditions) by making them a priority.
- Helping to develop local health and resilience plans that outline how to protect local populations **contributes to the aims of the Adverse Weather and Health Plan** in the UK.
- Helping to plan new climate-resilient urban developments and increase the number of urban green spaces can … (is part of the sentence missing?).

Land Surface Temperature (LST) is a direct measure of how hot or cold the surface of the Earth would feel to the touch.
The Urban Heat Island (UHI) effect happens when an urban area is significantly warmer than its surrounding rural areas.
The Discomfort index (Di) groups ranges of temperatures to match human comfort or sensational temperature of the human body. The data is more easily interpreted, with categories such as 'Torrid' (30+ °C), 'Very hot' (26-30 °C), etc.

The case for local heat-risk maps

Urban areas will be particularly affected by extreme heat due to the **Urban Heat Island (UHI) effect** (see *Figure 2, page 3*). The UHI could get worse if we cause more heat in cities with cooling methods that are not passive or sustainable (E.g. air conditioning). Heatwaves remain an under-managed risk and have impacts on population health and health system delivery [1]. **Heat is a priority risk** for urgent action in England [2].

More frequent and severe heatwaves are expected in the UK as an effect of global warming, which will lead to an **increase in hospital admissions and heat-related mortality**. Up to 10,000 deaths per year due to extreme heat by the 2050s (under a high-warming scenario without adaptation) have been estimated. In comparison, excess mortality during heatwave episodes in 2022 was around a third of that (see *Figure 1, page 2*).

The projection of total **economic costs of heat-related mortality** from climate change and socioeconomic change in England over the past ten years amounts to approximately £6.4 billion per year [4]. Current UK **heat alerts and guidance documents are regional**, making it difficult to address urban circumstances at a finer scale.

(Figure 1: No. of all-cause excess mortality during UK summer heatwave episodes [3])

Evidence base

The UHI effect in the city of London on a hot day can be seen in *Figure 3 on page 4* using our Land Surface Temperature (LST) data. These temperature maps can be transformed to an actionable index such as the Discomfort index (Di). **The Di is a 'feels-like' temperature, key to providing a link between the satellite observed heating and the impacts this has on the human body**.

The sun can heat dry, exposed urban surfaces (roofs, pavements) to temperatures 27 to 50 °C hotter than the air [5] **on a hot summer day**. However, rural areas will have more shade and moist surfaces and remain close to air temperatures. Urban areas with trees and vegetation benefit from the shading and evapotranspiration that can lower surface and air temperatures by 1-5°C during peak summer [6].

A study in London estimated that the **urban forest helped to avoid around 16% of Urban Heat Island-related mortality from 2015-2022** [7].

Using external shutters on windows can avoid an estimated 38–73% of heat-related deaths during typical future summers, but will be less effective during hotter weather [8].

The impacts of heat are not evenly distributed. Underlying socioeconomic inequities in cities make the challenge of cooling even more complex.

Implementation

Local urban planning for heat resilient cities could be enhanced using satellite data by **creating long-term strategic approaches to heat risks and vulnerabilities in the UK**.

As part of this, a UK web map application based on satellite LST data could be made **available for councils to have an understanding of the city's baseline UHI and the primary city blocks impacted**.

The map would be used to create a **heat risk assessment and implement measures where they are most needed**. There are three main types of solutions that can be implemented: nature-based, urban and to properties.

Urban

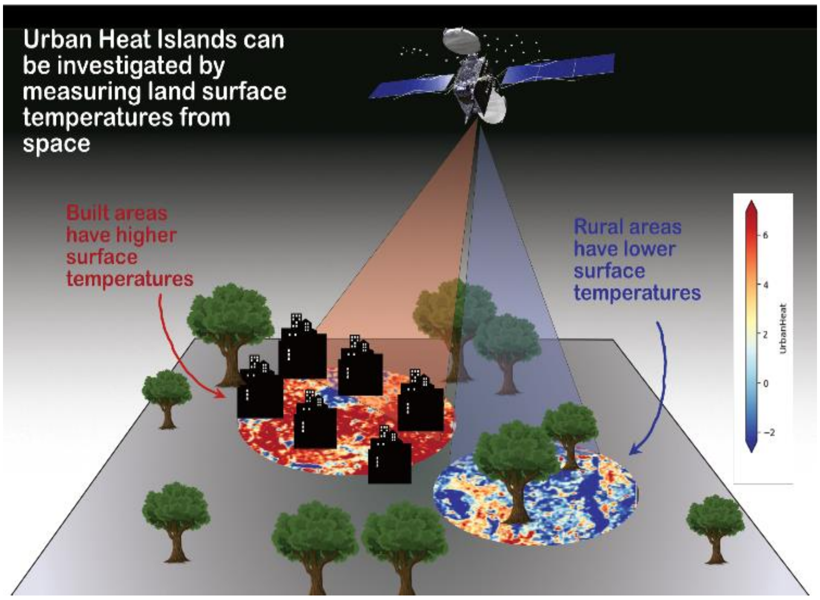
- Reflective urban surfaces reflective (e.g. buildings, pavements, roads).
- Shading structures in key public areas.
- Hydration stations and drinking fountains.
- Public cooling infrastructure for vulnerable communities without access.

Property

- Passive cooling for new developments.
- Reduced UHI for new developments that must demonstrate off-setting measures (e.g. green spaces, shading, cool roofs etc).
- Retrofitting measures.

Nature

- Increased street tree coverage in high priority areas.
- Green transitways for public transport or cool corridors.
- Green space in buildings (e.g. green roofs and walls).
- Blue infrastructure (e.g. pools, recreational water features).



(Figure 2: The UHI Effect)

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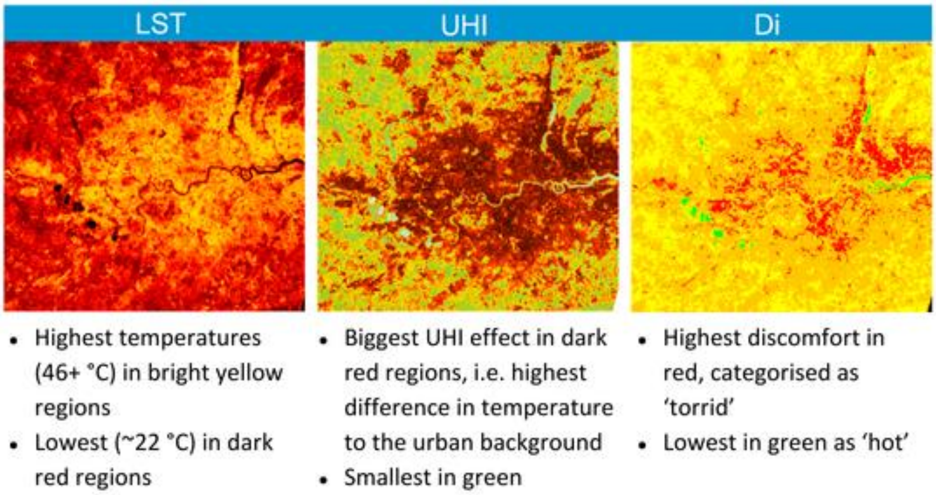
(Figure 3: Satellite data of London on a hot day (7th July 2022) (Landsat 8 processed by University of Leicester)



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