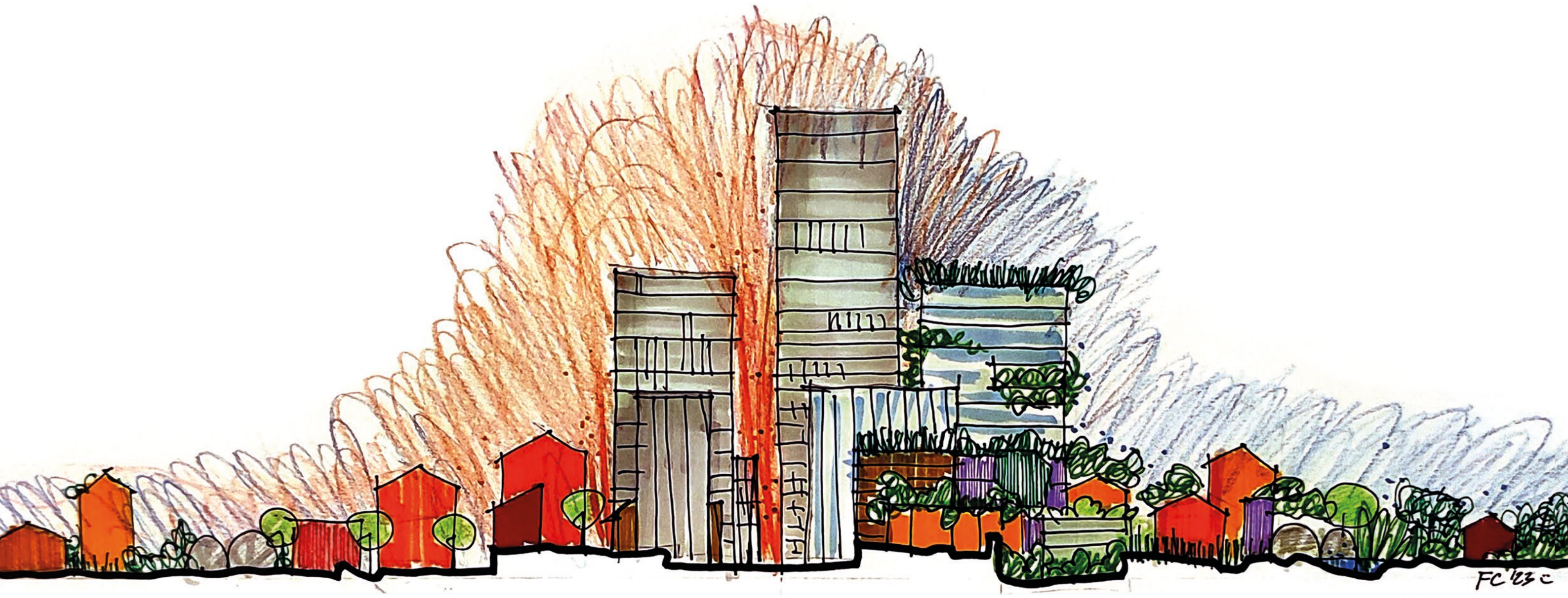
European Commission

SCIENCE FOR POLICY BRIEF

The Future of Cities Series



EU cities and heat extremes

HIGHLIGHTS

→ **Heatwaves** are one of the most concerning consequences of climate change, with record-breaking temperatures becoming more frequent and intense, and projected to continue.

→ Extreme heat is particularly alarming in cities, where it leads to the **Urban Heat Island** effect.

→ In response to the Urban Heat Island effect, both **mitigation** (reducing emissions) and **adaptation** (increasing overall resilience) actions are needed.

→ The deployment of urban **green** and **blue infrastructures** is regarded as one of the most effective measures to counteract heat extremes in cities.

→ Measurable **indicators** and **evaluation tools** to monitor progress vis-à-vis the implementation of mitigation and adaptation solutions are strongly advocated.

→ Although single-point actions at the local level can already offer a significant contribution to the containment of heat extremes, their **integration** and **scaling up** are required to make a difference.

Joint Research Centre

INTRODUCTION

This policy brief outlines different ways to tackle heat extremes in cities, suggesting strategic recommendations, best practices, and analytical approaches that local authorities can make use of.

Heatwaves and Urban Heat Islands

Heatwaves and their local manifestations are some of the most severe consequences of climate change and the increase in frequency and intensity of record-breaking temperatures is projected to continue [1]. Around half a trillion euros over the past 40 years have been accounted for, together with between 85 000 and 145 000 human fatalities across Europe because of extreme weather and climate-related events. Among these fatalities, more than 85 % as the result of heatwaves between 1981 and 2020[1]. In the last summer periods, many densely populated areas experienced record heat[2]. Notably, of the roughly 10 000 cities in the world, nearly half faced an increasing trend in heat exposure[3] between 1983 and 2016. For example, recent studies revealed that potential exposure to extreme heat among urban dwellers exceeded 1.7 billion people [2]. Consequently, monitoring such exposure is very relevant to address risk reduction [3].

Heatwaves refer to prolonged, extremely high temperatures that can cause the microclimatic phenomenon known as 'Urban Heat Island' (UHI).

The consequences of increasing temperatures are exacerbated in cities [4] where health threats and other severe risks are more likely to happen. Notably, the urban warming component is on the increase and local temperatures can go up, whereby cities become hotter than surrounding suburban regions and rural areas [5], causing urban overheating [6]. The reason why temperatures within urban areas can become generally higher than their surroundings may be attributed to more sealed surfaces (which absorb heat during the day and release it at night), and higher density of both people and heat-emitting infrastructures. These factors combine with often low ventilation and fewer green areas and waterways to provide cooling. By altering the nature of the city's surface, and generating large amounts of anthropogenic heat, cities modify the microclimate and air quality, increasing their ecological footprint. A UHI also traps atmospheric pollutants ('urban pollution island') [7] which in turn deteriorate the quality of life and have a direct impact on energy demand. In cities characterised by a high density of built surfaces, peak temperatures may be up to 10°C higher than in surrounding rural areas with an average between 4 and 6°C [4]. The intensity of an UHI is usually quantified through the 'Land Surface Temperature' (LST) and is referred to as 'Surface Urban Heat Island' (SUHI) [8], leading to a strong relation with landscape patterns. Notably, land cover types represent an important factor influencing local temperatures, due to the significant difference between impervious and vegetated surfaces.

Surface Urban Heat Island is subject to variations across and within urban areas.

Europe's cities and towns have high rates of artificial land cover. As a result, measuring and identifying thermal hotspots at different spatial granularities could support policy interventions. In addition, this mapping process may be used to propose context-specific adaptation measures. For example, the map in Figure 1 represents the UHI intensity per city for 100 European cities[4] and shows that city size matters as many more populated cities tend to have at least a medium-high UHI intensity. This kind of spatial visualisation helps make comparisons among cities to get a first insight into the UHI phenomenon and understand to what extent it affects cities according to their dimension and geographical distribution.

Notwithstanding the unique characteristics of each city, due to a combination of climate, geography, morphology, and structure, some common patterns can be also discerned. For example, a study conducted on 14 megacities around the world revealed that urban hotspots tend to be concentrated in industrial areas as well as in those areas characterised by unregulated urbanisation. At the same time, green zones and water bodies correspondingly create cooler conditions, while lower surface temperatures are generally associated with a drier climate, as well as with desert areas [9].

1 *https://www.eea.europa.eu/publications/economic-losses-and-fatalities-from*

2 *https://www.eea.europa.eu/en/topics/at-a-glance/climate*

3 *https://projects.apnews.com/features/2021/global-extreme-heat/index.html*

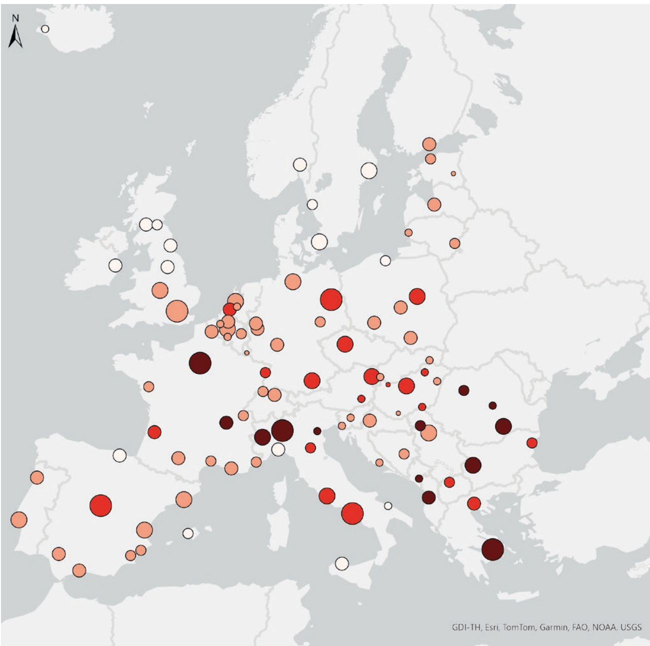
4 Urban Heat Island (UHI) intensity captures how much warmer a city is on average as compared to the nearby rural areas. It is based on elevation, land use, soil sealing, a vegetation index, and temperature differences due to human activity. More info is available at: *https://europa.eu/!Nw6qmG*.

Therefore, to create the most effective place-based policies and intervention classifications, a deeper comprehension of temperature variations and their urban distribution within cities is required [9].

When addressing the issue of extreme urban heat, the energy sector is also an important perspective to consider.

Notably, the increase in temperature associated with a UHI may reduce the need for heating in winter, also depending on the buildings' features. However, some studies show that this temperature change is often insufficient to compensate for the increased demand for air conditioning in summer [10]. Yet, there could be urban contexts in which this counterbalance is more feasible. This raises the need for careful place-based assessments to enhance the formulation of policy and planning solutions that consider the existence of geographical and magnitude variations.

Figure 1 – Urban Heat Island intensity per city



Urban Centre population
< 100 000
100 000 - 250 000
250 000 - 500 000
500 000 - 1 000 000
1 000 000 - 2 500 000
≥ 2 500 000

UHI intensity in °C (90th percentile)
< 1
1 - 1.5
1.5 - 2
> 2

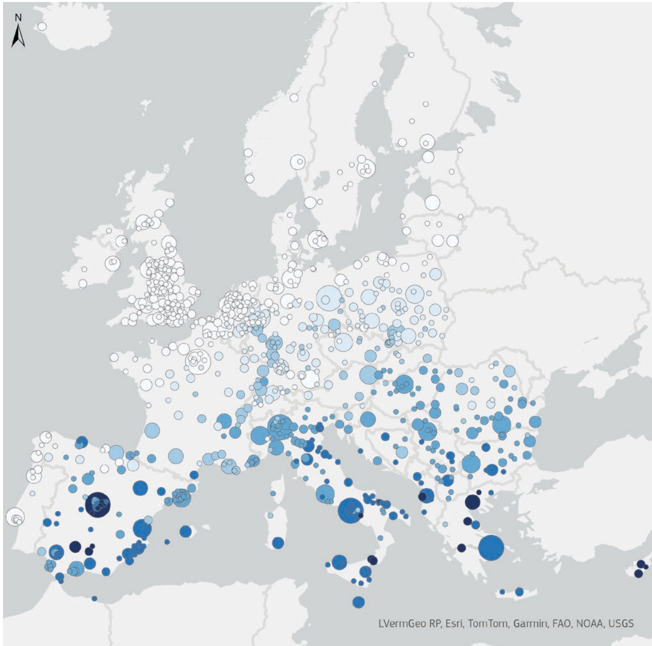
Source: Authors' elaboration on DG REGIO population data and on data by European Environment Agency (2020)

0 300 600 km

Source: Authors' elaboration from https://europa.eu/!Nw6qmG

For example, the map in Figure 2, showing the Cooling Degree Days (CDD)[5] index, reveals that the need for cooling buildings has a diversified distribution per city, being more concerning in Southern Europe, with lower values in North and East Europe and it is not very dependent on city size and population.

Figure 2 – Cooling Degree Days per city



Urban Centre population
< 100 000
100 000 - 250 000
250 000 - 500 000
500 000 - 1 000 000
1 000 000 - 2 500 000
≥ 2 500 000

CDD index
< 25
25 - 50
50 - 200
200 - 350
350 - 500
≥ 500

Source: Authors' elaboration on DG REGIO population data and DG JRC PVGIS data (2022)

0 300 600 km

Source: Author's elaboration from https://europa.eu/!gyJtFm

In addition to its detrimental effects on energy, urban overheating seriously impacts low-income populations, public health, human productivity, and environmental quality among others, determining heavy economic consequences.

Consequently, a shift to more sustainable ways of living is key to withstand the impacts of climate-related hazards [11].

5 Cooling degree days (CDD) index is a weather-based technical index designed to describe the need for the cooling (air-conditioning) requirements of buildings. More info at: *https://ec.europa.eu/eurostat/statistics-explained*

KEY FINDINGS – Which strategic recommendations?

Consulting the literature, it is already possible to collect some key findings and strategic recommendations that can contribute to a better and more informed decision-making process as well as to more effective policy management of heat extremes in cities. Strategies include:

- To exploit the existing data as well as monitoring and modelling systems of the urban thermal environment, available also thanks to remote sensing information from satellites [12]. This could imply the necessity to update the urban governance team, including new staff equipped with the right technical expertise.
- To target high-exposure areas as well as vulnerable neighbourhoods when planning specific interventions. For example, a uniform distribution of green requires more vegetation to reach the same decrease in exposure [12].
- To design urban adaptation plans sensitive to the spatial dimension. The impact of adaptation strategies, for example, where to implement urban greening [12], can significantly vary according to their location and depend on the urban morphology and population distribution. Space matters and every city is unique despite the existence of common patterns!
- To ensure a balanced combination between buildings, green spaces, and pavement, which are the three elements able to mostly affect local temperatures [9]. This includes the importance of carefully managing land use planning choices, which can influence the local microclimate [13].
- To map the wide availability of underused portions of urban territories, such as brownfield sites, reintroducing appropriate doses of urban greenery where the soil conditions permit. Hence, these parts of the city could serve for the deployment of hubs for green and blue infrastructures[6]. This is in line with the EU soil strategy for 2030[7] and the Thematic Partnership on Greening Cities within the Urban Agenda for the EU[8].
- To ensure the combination of several strategies adapted to the local circumstances in a holistic way. An example includes considering the combined cooling effect of water bodies, besides the well-established role of green infrastructure [14].
- To enhance citizens' participation, fostering communication [15].
- To implement behavioural change, raise awareness, and provide further protection to vulnerable groups.
- To establish heat action plans and heat officers.
- To look at different spatial scales – even the single building - and benefit from the integration of different levels of government as well as cross-sectoral urban departments.

CHALLENGES AND OPPORTUNITIES – What can we do?

The severity of heatwaves and UHI is widely recognised[9], together with the urgent need for action. But what can we do? This section delves into a set of punctual solutions as well as some boxes with best practices that can inspire possible replication initiatives.

Mitigation is essential to limit the impact of climate change by reducing emissions. At the same time, we should adapt by diminishing exposure and vulnerability and increasing the overall resilience and adaptive capacity of cities. Notably, according to the Covenant of Mayors database, 'extreme heat' is the hazard most targeted by adaptation actions at the city level[10].

Some effective responses have already been identified to reduce the magnitude and impact of the UHI effect. Examples include[11] [16] (see also Boxes 1 and 2):

- Integrating enhanced green infrastructure onto conventional streets.
- Increasing the number of trees and other vegetated surfaces. When feasible, planting groundcover, shrubs, grasses, and shade trees that can withstand drought.

6 *https://environment.ec.europa.eu/strategy/biodiversity-strategy-2030_en*

7 *https://environment.ec.europa.eu/topics/soil-and-land*

8 *https://ec.europa.eu/regional_policy/policy/themes/urban-development/agenda_en*

9 *https://urbanresilienceforum.eu/fileadmin/user_upload/EURESFO-2022-report.pdf*

10 *https://www.globalcovenantofmayors.org/impact2022*

11 *https://www.epa.gov/green-infrastructure/reduce-urban-heat-island-effect*

- Putting in place policies that promote the use of green walls and roofs, which are ideal for providing indirect and ambient cooling effects.
- Integrating water features/flowing water in public areas for cooling and provision of drinking water to the population together with adopting water use efficiency measures.
- Retrofitting and renovation of buildings with insulation, shutters/shades as well as the use of more reflective materials such as white paint on streets and buildings.
- Putting in place urban farming practices.
- Providing public health measures and timely health care (see also box 1). Examples may include warning systems able to guide the population during extreme heat events or maps displaying the location of shelters and potable water points.

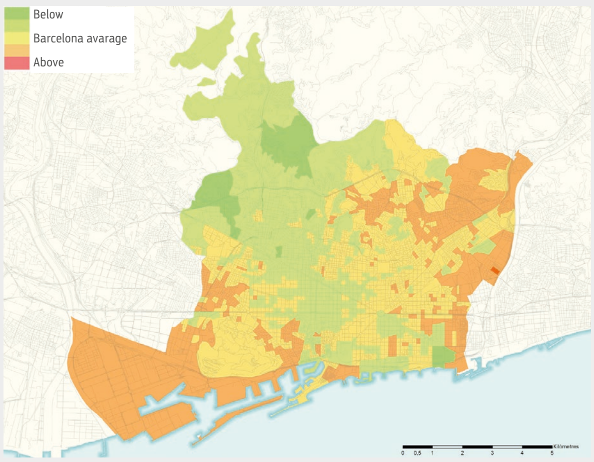
Furthermore, many are the analyses demonstrating the cooling effect of urban green (see also Box 3). Given the capacity of trees to cool the air, the deployment of green spaces in cities is regarded as one of the most effective measures to counteract the UHI effect. Urban vegetation, and trees in particular, reduces air temperature through shading and transpiration (i.e., the process where part of the heat is converted into water vapour). Not only the amount and distribution of green spaces are important in lowering the temperature, but the health and typology of the vegetation matter as well, because environmental stressors, such as drought, can also alter the capacity of green spaces

Box 1: Climate shelters in Barcelona

Barcelona (ES) is experiencing more frequent and intense heatwaves that are unevenly affecting some areas and specific citizens' groups. The *Climate Shelters project* (*www.uia-initiative.eu/en/uia-cities/barcelona-call3*), implemented by the City Council, aims to develop a network of cooling centres, transforming pilot schools through implementation of blue (water points), green (spaces for shade and vegetation), and grey solutions (building insulation), opening them to the wider public during heatwave episodes. Combining the territorial distribution of temperatures (Figure 3), and an assessment of the vulnerability level of different neighbourhoods, the City Council identified the district of Nou Barris, and several areas in the districts of Sants-Montjuïc, Les Corts and Eixample as areas that are most affected by heatwaves.

One public school per district was selected based on the level of vulnerability and exposure to heatwaves of both the school and its surroundings and the impact that the intervention would have on pupils and the neighbourhood. The cooling effect of the measures was calculated by measuring the temperature inside and outside the school, in the schoolyard, and within classrooms, as well as measuring the Thermal Discomfort (DI) of beneficiaries. If some indicators show that the thermal discomfort is similar in comparison to other schools (also due to COVID ventilation protocols), the perception of temperature has very much improved in pilot schools. Even if the variety of solutions implemented at each school makes it difficult to obtain general results on the cooling effect of the interventions, it seems that the use of mixed solutions – grey, blue, and green - produces a higher impact. The City Council is now upscaling the project to all public primary schools in the city and plans to transform all of them by 2030. So far, 11 schools were transformed in 2020 with the support of the Urban Innovating Actions (UIA), with 47 additional schools in Summer 2022 and 17 during Summer 2023, totalling 75 schools transformed so far.

Figure 3 – Barcelona spatial vulnerability to heatwaves



Source: Climate plan 2018 - 2030

to provide ecosystem services[12], like reducing local temperatures. A study carried out in 93 European cities estimated that increasing urban tree cover by up to 30% could reduce heat-related deaths by almost 40% [17]. The size, shape, composition and spatial configuration of green spaces are also worthy factors to consider [22]. Moreover, green areas can fulfil many other useful functions in cities, contributing to the overall quality of life of the urban population [18].

Many mitigation and adaptation measures may fall within the category of the so-called Nature-based Solutions (NbS).

NbS are defined *as actions that work with and enhance nature to restore and protect ecosystems and to help society adapt to the impacts of climate change and slow further warming, while providing multiple additional benefits (environmental, social, and economic)* [19, p.9] (see also Box 2). Well-designed NbS are advantageously able to tackle climate change mitigation and adaptation challenges, simultaneously delivering additional benefits for people and nature. NbS include protecting, restoring, and managing natural, semi-natural, and agricultural systems, incorporating green and blue infrastructures in urban areas [20; 21]. Implementing NbS could significantly mitigate heat-related hazards and decrease mortality.

Among the NbS umbrella, a specific group encompasses the so-called 'Natural Climate Solutions' (NCS) which refers to actions able *to reduce greenhouse gas (GHG) emissions from ecosystems and harness their potential to store carbon* [19, p.20]. In this context, the EU Biodiversity Strategy for 2030, to protect nature and reverse ecosystem degradation, introduced a proposal for a Nature Restoration Law[13], which sets binding targets to restore European ecosystems. One target specifically addressed to urban ecosystems proposes to reach no net loss of urban green space and tree canopy cover by 2030, and an increasing trend of urban green space and tree canopy cover, until satisfactory levels are reached. Next to NbS, the potential of innovative technologies should be exploited, including a vast array of low surface temperature coatings, advanced materials,

12 *https://www.nwf.org/Educational-Resources/Wildlife-Guide/Understanding-Conservation/Ecosystem-Services*

13 *https://environment.ec.europa.eu/topics/nature-and-biodiversity/nature-restoration-law_en*

Box 2: Greening Torino and replication of Nature-based Solutions

Through *proGIreg project* (*https://progireg.eu*) the city of Turin took concrete action to adapt to the increasing effects of climate change in one of the most vulnerable areas, the neighbourhood of 'Mirafiori Sud'. The idea was to transform an area which symbolised the industrialisation of Northern Italy into a thriving green district by developing an extended system of seven types of nature-based solutions:

- New regenerated soil
- Community-based urban farms and gardens
- Aquaponics
- Green walls and roofs
- Accessible green corridors
- Local environmental compensation processes
- Pollinator biodiversity

Acknowledging the limited impact that punctual greening intervention could have in fighting climate change, and particularly heatwaves, Torino has joined a replication process – led by ICLEI Europe – to recreate proGIreg solutions within and beyond the metropolitan area. During a 'local replication workshop', key replication criteria to accelerate and facilitate the duplication of such actions were discussed. Subsequently, an 'international replication workshop' took place, to foster potential within cities to help speed up NbS deployment. In this line, with its most recent 'Piano di resilienza climatica' (Climate Resilience Plan), the city committed to increase the development of green infrastructure and permeable surfaces, including 40 actions specifically aimed at protecting against heatwaves and implementing NbS. Through an inclusive approach, Turin demonstrates that it is possible to address environmental challenges linked to climate change with the help of NbS, as long as they are co-created with the end users. Also, seemingly small-scale interventions can contribute to a large-scale transformation in a city creating green networks. Building a community of practice around NbS is a crucial part of the city's success, and proGIreg aims to foster this by bridging relationships with different actors that can last beyond a context-specific project.

water-based technologies, and systems for solar control and heat dissipation [22], along with others.

MEASURING AND MONITORING ADAPTATION AND MITIGATION – Which indicators and tools?

Measurable indicators and evaluation tools are valid ingredients when it comes to monitoring progress, enhancing the knowledge base of a specific urban context [23], and the assessment of future scenarios. In this context, the SDGs framework could be a useful reference, providing a structured and universally recognized set of metrics to guide cities and countries in implementing, evaluating, and improving their adaptation and mitigation responses [24; 25].

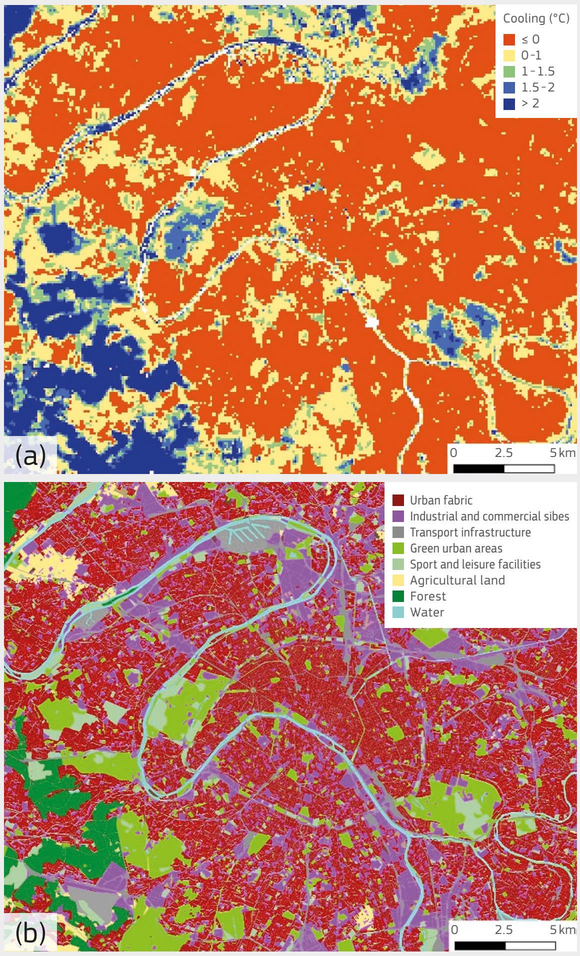
In particular, SDG 11 (Sustainable Cities and Communities), includes targets and indicators related to urban planning, green spaces, and disaster risk management, directly relevant to mitigating the UHI effect and improving urban resilience to climate-related disasters like heatwaves. A practical example of an indicator linked to SGD 11 is related to the *population with access to urban green areas within 400 m walking* (Figure 5) [18] that shows the importance of going beyond the more traditional indicator on the *share of green areas by city.* Results indeed reveal that a high level of green areas does not necessarily correspond to a high degree of accessibility and city size does not always matter when speaking about green areas' proximity, with many disparities within cities.

Above all, spatial indicators equipped with geographic information may be particularly useful to visualise the distribution of certain layers through the use of maps. This can help decision-making linked to regeneration plans. Overlapping different spatial indicators in one single map at different granularities can help detect geographical vulnerabilities, crossing layers that - if left isolated - do not always offer exhaustive advice. For example, associating the location of infrastructures that are more potentially vulnerable to the effects of climate change (like hospitals or schools) to UHI intensity areas could reveal information that is generally less easily available to policymakers. Next to that, more granular visualisations at the city level can uncover hidden dynamics that contribute to informing future EU policy guidance on cities, fostering an inter-scalar approach [26] (Figure 6).

Box 3: The role of green spaces in reducing urban temperature

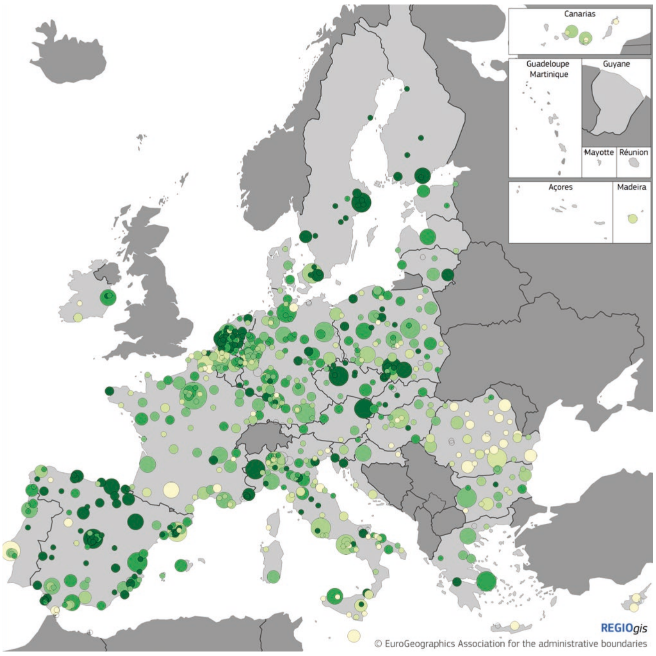
An effective management of green spaces is key to ensuring healthy urban ecosystems in light of increasing urbanisation and climate change. In a study carried out in more than 600 European cities [27], the role of urban green spaces in reducing air temperature was analysed. For instance, in the city of Paris, urban trees reduce the air temperature by 0.8°C on average, with peaks up to 7°C. Figure 4 shows a close-up of the cooling effect in the city of Paris. Areas where the cooling effect is more pronounced (light blue and blue areas, where cooling is above 1.5°C) are those where large parks are situated, such as the Jardin des Tuileries and Jardin des Plantes, in the city centre, as well as Bois de Vincennes and Bois de Boulogne on the east and west borders of the city (Figure 4).

Figure 4 – Close up of the cooling effect (a) and main land cover classes (b) in the city of Paris



Source: Marando et al. (2022) (a) [27], Urban Atlas (b)

Figure 5 – Population with access to green urban areas within 400 m walking



Urban Centre population
- < 100 000
- 100 000 - 250 000
- 250 000 - 500 000
- 500 000 - 1 000 000
- 1 000 000 - 5 000 000
- ≥ 5 000 000

% of population
- < 40
- 40 - 50
- 50 - 60
- 60 - 70
- 70 - 70
- ≥ 80
- No data

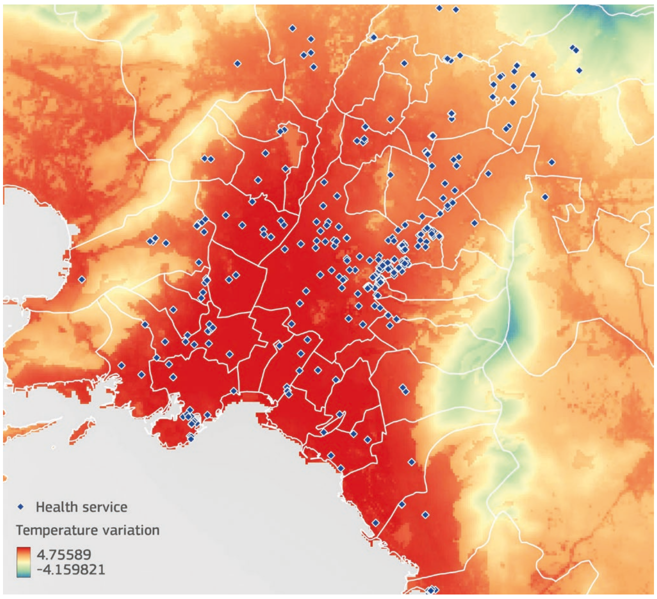
Access = being able to reach at least one green urban area (or forest) within 400 m walking

Source: DG REGIO based on Copernicus Urban Atlas 2018 and TomTom data

0 500 km

Source: Poelman, 2018 [18]

Figure 6 – UHI intensity and hospitals in Athens (EL)



Source: Authors' elaboration from https://cds.climate.copernicus.eu/cd-sapp#!/software/app-health-urban-heat-islands-current-climate?tab=app

Besides the use of spatial and non-spatial indicators, the consultation of dedicated dashboards can also contribute to the monitoring of climate-related achievements[14,15] (see also Box 4). For example, the European Environment Agency (EEA) monitors tree cover and urban green spaces, providing different data visualisation formats[16]. Moreover, cities can report on adaptation and mitigation measures results through both the ICLEI/CDP Track[17] and through MyCovenant[18]. These reporting frameworks offer a hands-on tool for cities to measure their advancements and gain visibility in the international arena for their climate success.

Box 4: The Disaster Risk Management Knowledge Centre

The European 'Commission's Disaster Risk Management Knowledge Centre (DRMKC)', hosted at the Joint Research Centre (JRC), brings together different European Commission services, European countries and the community dealing with disasters to manage disaster risk in a more coordinated way. Activities of the DRMKC support the translation of complex scientific data and analyses into usable information, providing science-based advice for Disaster Risk Management (DRM) policies. Among the resources of the DRMKC, the 'Risk Data Hub' (RDH) is a web platform with a central role in the 'EU Climate Adaptation Strategy'[19]. The latter promotes the use of the RDH for harmonised recording and collection of climate-related physical risk data and losses. Moreover, the RDH collates and ensures unrestricted access to DRM data. This repository of information can support municipalities and regional authorities in developing pathways towards climate resilience through a better understanding of the risk drivers in their regions, thereby advancing the implementation of the objectives of the 'EU Mission on Adaptation to Climate Change'. The latter aims to support regions, cities, and local authorities to reinforce their resilience to climate change, accelerating the climate resilient transition in 150 European regions and communities by 2030.

14 *https://climate-adapt.eea.europa.eu/en/about*

15 *https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-adaptation*

16 *https://www.eea.europa.eu/data-and-maps/dashboards/urban-tree-cover*

17 *https://www.cdp.net/en/cities*

18 *https://eu-mayors.ec.europa.eu/en/home*

19 *https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52021DC0082*

THE WAY FORWARD

Heat extremes and the consequent UHI phenomenon will persist and as predicted by climate models, are even expected to worsen in the future. A very serious increase in the night and daytime temperatures in European cities is expected, impacting on health, human productivity and overall environmental quality[20]. Policy actions to orient concrete interventions are needed, as fully demonstrated by extensive scientific evidence. The UHI effect represents an important issue facing not only large cities but also smaller cities and towns to different extents. Local increases in the average annual temperature are recorded, as well as the environmental, social, and economic costs associated with cooling and consequent ever-growing energy demand and consumption. Notably, extreme heat is the most common hazard impacting the energy sector, accounting for 36 % of all energy-affecting hazards[21]. As shown, the urgency to cool down does not always have a uniform European distribution. Hence the need for diversified and place-based solutions to up-scale and accelerate adaptation and mitigation actions has to be structurally integrated into the urban policy agenda[22].

Furthermore, heat-related consequences have a disproportionate impact on vulnerable populations and marginalised groups, including the elderly, young children, people affected by chronic conditions, and also low-income, unemployed, and homeless people. The demographic changes taking place can also play a role in modifying the vulnerability of our societies to urban overheating. This raises the need for equity-oriented policies and actions. Considering that vulnerable communities tend to concentrate in dense urban neighbourhoods, they are more likely to be exposed to the UHI phenomenon. This raises the need to formulate measures that can benefit everyone to the same extent while arresting the development of new inequalities and the exacerbation of the already existing ones[23] [15].

All in all, there is already a sufficient level of knowledge, tools, and measurement techniques to deal with climate change-related consequences and counteract the effects of extreme urban heat in all its manifestations, despite the need for more scientific confidence and accuracy. Yet, an integrated perspective, i.e. a more widespread upscaling of actions and the combination of several strategies adapted to the local circumstances are the most powerful. This includes the formulation of science-based policies sensitive to the spatial dimension. On the one hand, looking granularly at the urban scale with finer data, without losing touch with the European-wide perspective would be ideal. This is especially true concerning phenomena like the UHI one, whose intensity and severity are very much impacted by the geographical location and the urban morphology, and one solution does not always fit all. On the other hand, also common strategies and mutual learning practices between urban areas with similar characteristics could be beneficial to let them remain livable and sustainable while becoming more resilient and fit for climate-related events.

20 *https://www.eea.europa.eu/publications/europes-changing-climate-hazards-1/heat-and-cold/heat-and-cold-extreme-heat*

21 *https://www.globalcovenantofmayors.org/wp-content/uploads/2022/11/2022-GCoM-Impact-Report.pdf*

22 *https://progireg.eu*

23 *https://www.eea.europa.eu/publications/just-resilience-leaving-no-one-behind*

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