Flames of Change II:

Urban Action on
Extreme Heat Across
Europe and Central Asia

Disclaimer

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country or territory or of its authorities, or concerning the delimitations of its frontiers or boundaries. Views expressed in the document are those of the authors and do not necessarily reflect those of the United Nations, its member states, or Making Cities Resilient 2030 core partners. Mention of the names of firms and commercial products does not imply the endorsement of the United Nations.

This publication may be freely quoted but acknowledgement of the source is requested.

Citation: Making Cities Resilient 2030 (2025). Flames of Change II: Urban Action on Extreme Heat Across Europe and Central Asia.

To download the full document, please visit www.undrr.org/publication/flames-change-ii-urban-action-extreme-heat-across-europe-and-asia

For additional information, please contact:

MCR2030 Europe and Central Asia Scretariat
United Nations Office for Disaster
Risk Reduction (UNDRR)
37-40 Boulevard du Régent, Brussels 1000, Belgium
mcr2030-eca@un.org

Table of Contents

Forewords

Natalia Alonso Cano, Chief of the Regional Office for Europe and Central Asia, UNDRR

"As record temperatures continue to escalate across Europe and Central Asia, extreme heat is no longer a seasonal concern but rather a persistent and life-threatening hazard. It is a growing, year-round risk that affects health, infrastructure, and the very fabric of urban life. Flames of Change II: Urban Action on Extreme Heat Across Europe and Central Asia builds on the momentum of our first report, published in 2024, showcasing how cities are moving from awareness to action. Through new case studies and deeper insights, this edition reflects our collective commitment to practical, locally driven solutions. I hope this review will further inspire cooperation, innovation, and investment to protect our communities and advance resilience in the face of intensifying heat."

Vasileios Latinos, Head Resilience and Climate Adaptation, ICLEI European Secretariat

"As the climate crisis accelerates, extreme heat and wildfires are no longer seasonal anomalies—they are persistent threats reshaping our world. This report highlights the urgent need for cities and regions to confront heat stress as a critical hazard. Urban centers, home to over half the global population, face rising temperatures that strain health systems, infrastructure, and ecosystems. Rural and peri-urban regions are battling unprecedented wildfire risks that threaten lives, livelihoods, and biodiversity. By focusing on local governance, early warning systems, sustainable urban planning, and community resilience, this report outlines pathways to reduce risk and protect vulnerable populations. Cities and regions are not only on the front lines—they are leading the fight. It is imperative that we act decisively, together, to build a heat-resilient future."

Aleksandrina V. Mavrodieva, Lead Author (Consultant)

"Extreme heat has become one of the most tangible markers of climate change in Europe and Central Asia, impacting people and economies, and projected to lead to an increasing number of heat-related deaths and health complications, especially among more vulnerable groups, such as children and the elderly. The World Bank estimates that by midcentury, the economic loss from extreme heat in the region could reach 2.5 percent of GDP, if measures are not taken to address the issue. It is, therefore, extremely positive and encouraging to see that multiple cities across Europe and Central Asia have started initiatives to tackle extreme urban heat and stand ready to discuss both the challenges and the opportunities they face daily. It has been a privilege to work with the many representatives of city and municipal authorities and academic institutions who have contributed with their valuable responses to this report and thus ensured that the included case studies represent a picture of real experiences and scalable solutions and we truly hope some of these examples would support other localities in their efforts to reduce, adapt to and respond to the impacts of extreme heat."

The United Nations Office for Disaster Risk Reduction (UNDRR) works towards the substantial reduction of disaster risk and losses to ensure a sustainable future. UNDRR supports the implementation of the Sendai Framework for Disaster Risk Reduction 2015–30, which sets out a people-centred approach towards achieving a substantial reduction in disaster losses from man-made and natural hazards and a shift in emphasis from disaster management to disaster risk management. The Regional Office for Europe and Central Asia (ROECA) covers 55 countries and works with countries and stakeholders to reduce disaster risk in Europe and Central Asia.

Acknowledgements

Executive Summary

Today, more than ever, cities are forced to consider various solutions to manage extreme events and mitigate urban heat. The summer of 2024 was the warmest on record for Europe, with parts of the continent experiencing substantial heatwaves and heat stress for extended periods of time.[1] Heat is estimated to cause the largest number of deaths in Europe among all weather and climate-related extreme events. In 2023 alone, close to 48,000 deaths were attributed to heat. In 2022, this number was estimated to be over 60,000.[2] Climate risks – characterised by the increasing frequency, intensity and duration of heatwaves and extreme heat events – are increasingly impacting infrastructure, food security, water resources, financial stability and public health. At the same time, policies and adaptation strategies fall short of effectively and comprehensively addressing the complex risk landscape.[3]

More than half of the world's population resided in cities by 2011, and this share is expected to double by 2050. A 2023 study by the Central Asia Resilient and Low-Carbon Cities found that, over the last 30 years, the population of the largest urban centres in Central Asia had increased by an average of 48 percent.[4] In the European Union, the urban population comprised 75.7 percent in 2023 and is expected to continue growing.[5] As cities grow, it is becoming ever more challenging to serve the needs of residents given changing climate conditions.

The urban heat island effect, characterised by faster surface warming in cities compared to rural areas, further exacerbates the situation. High-impact scenarios indicate that 72 percent of cities in Europe may be subject to temperature increases of over 10°C during heatwaves.[6]

For most cities across Europe and Central Asia, it has become painfully clear that urban heat, including extreme urban heat, is the new normal and part of an uncertain future. Addressing these issues has become a necessity. Based on case studies derived from interviews with local-level practitioners, this report demonstrates that – even though cities face multiple challenges in addressing extreme urban heat and wider climate change risks – a multitude of smaller and larger interventions and solutions are possible, which can have tangible, positive impacts on human life and community resilience.

The perspectives of 11 partner cities and municipalities were collected through a questionnaire. The responses to the questionnaire comprise the core of this report, including discussions on common challenges and scalable solutions. The focus is on providing an account of on-the-ground, lived experiences that may be relevant for other local governments across the region. In addition, the responses are complemented by case studies and desk-based research. The report outlines the reasons why respondents prioritise urban heat, and outlines the various policies and measures developed and implemented to address urban heat reduction, mitigation, response and adaptation. These measures are grouped into three main themes: governance and financing, urban design and planning, and early warning systems.

Among the reasons why extreme urban heat and the urban heat island effect have become key risks, respondents highlighted impacts on infrastructure (e.g., roads and transportation, and water systems), increasing energy demands for cooling, deteriorating air quality, and significant effects on people's health and quality of life. Importantly, cities have recognised the importance of **preparedness, mitigation and adaptation** in tackling the impacts of urban heat, and have started **incorporating specific measures into policies and action plans**.

1   Copernicus (2024) C3S seasonal lookback: summer 2024. European Commission. See https://climate.copernicus.eu/c3s-seasonal-lookback-summer-2024#:~:text=Summary&text=Summer%202024%20was%20the%20warmest,substantial%20heatwaves%20during%20the%20season

2   European Environment Agency (2024) The impacts of heat on health: surveillance and preparedness in Europe. See www.eea.europa.eu/en/analysis/publications/the-impacts-of-heat-on-health#:~:text=For%20example%2C%20for%202022%2C%20it,et%20al.%2C%202024

3   European Environment Agency (2024) European Climate Risk Assessment. ISBN: 978-92-9480-627-7

4   World Bank (2023) Cities Across Central Asia Can Unlock Full Economic Potential by Implementing Low-Carbon and Climate-Resilient Development Strategies. See www.worldbank.org/en/news/press-release/2023/09/27/cities-across-central-asia-can-unlock-full-economic-potential-by-implementing-low-carbon-development-strategies

5   Trading Economics (2025) European Union – Urban Population (% of Total). See https://tradingeconomics.com/european-union/urban-population-percent-of-total-wb-data.html

6   Sweco (2024) Building heatwave resilience in European cities. See www.swecogroup.com/wp-content/uploads/sites/2/2024/06/Building-heatwave-resilience-in-European-cities_webb_240620.pdf

That said, the responses also show that the development and implementation of urban heat management policies vary significantly across localities. Cities and municipalities reported several key challenges in tackling urban heat, including the absence of policy frameworks, a lack of coordinating bodies and hence disparities between actions, insufficient human and financial resources, limited awareness, inadequate early warning capacity, and diverging stakeholder interests.

Addressing these challenges requires multiple measures and sustained financing. However, the most essential building blocks for ensuring long-term gains are **political commitment** and **strong, continuous leadership**.

Embedding urban heat management in wider climate adaptation and disaster risk reduction policies and strategies and ensuring coherence and alignment between documents and initiatives is key for providing a clear governance framework. Political support for climate resilience, particularly through the development of a **heat strategy or action plan, and a wider disaster risk reduction and climate strategy** is crucial for ensuring long-term focus on heat risk mitigation and linking it to overall climate adaptation efforts. Urban heat strategies and action plans need to **include realistic objectives, clearly defined roles and responsibilities, indicators and timelines, budget lines for each activity, and defined monitoring mechanisms**. Regular updates and adjustments should also be envisaged. Critically, these efforts need to be integrated into long-term urban development and resilience planning and be aligned with other existing and planned strategies and activities.

Several respondents recommended establishing a **focal point or coordinating body** for urban heat management as a good practice to mitigate siloed working among administrative bodies. Coordination with national governments was also identified as a decisive element for success.

Specialist training for urban planners, architects and city officials, along with securing additional financial and technical resources for implementation, should be a priority for cities and municipalities. **Investing in ongoing capacity building** is essential for equipping administrators and other stakeholders with the skills, knowledge and tools required to manage urban heat risks.[7]

One of the first steps that mayors and local administrations can take is to conduct a comprehensive assessment of needs, gaps, planned and ongoing initiatives, and corresponding budget allocations across departments. **Initial heat risk mapping** can be done in collaboration with academic and research institutions, local and international organisations (e.g., the Red Cross), and through community engagement in ways that are low cost, help identify high-risk spots within the urban fabric, establish important partnerships, raise awareness and foster a sense of engagement among citizens.

All respondents emphasised that dedicated, predictable budgets are crucial to safeguard long-term gains and implement larger-scale solutions. Cities benefit most if **various financing mechanisms are utilised simultaneously** for projects of various scales. Data collected during project implementation can support future funding requests, particularly once a track record of positive impacts – for example, on urban quality of life – has been established. Public-private partnerships can be leveraged to fund large-scale projects, such as district cooling systems and green infrastructure initiatives. Competing interests between public and private sectors can be alleviated through specific policies, which can combine legal requirements and offering incentives.

Aligning the diverse objectives of various stakeholders requires **effective communication and strategic planning**. Stakeholder engagement and coordination was also identified as a key step towards strengthening resilience. Mayors and governing bodies will need to engage stakeholders, and highlight the economic, social and health impacts of (extreme) urban heat, as well as the co-benefits of action.[8] Overcoming coordination obstacles involves **fostering a shared understanding of goals, establishing clear communication channels and developing processes that align the interests of all parties involved**.

7   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package. See www.undrr.org/media/103947/download?startDownload=20250114
8   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package. See www.undrr.org/media/103947/download?startDownload=20250114

Partnerships can be established with a number of relevant stakeholders, including academic institutions, private sector actors, cultural and religious centres, neighbouring municipalities, and larger networks – such as the Making Cities Resilient 2030 (MCR2030) campaign, ICLEI Local Governments for Sustainability and C40 Cities. Meaningful **community engagement** is essential for designing policies and measures that correspond to actual needs and smoothing out different viewpoints and conflicting interests. Community engagement can also serve as a valuable vehicle for implementing appropriate actions and creating a sense of ownership among residents. Special attention should be given to **vulnerable groups**, and both their needs and capacities to contribute.

Conducting **risk assessments and collecting quality disaggregated data** should be the basis for any planning and policy development, as measures need to be backed by a comprehensive understanding of the risk landscape. Importantly, the implementation of one measure should not negatively impact other risk areas, and long-term vision and planning are essential in this endeavour. Conducting a city baseline heat risk assessment and mapping can be an important first step to address data gaps and support early-stage city action planning. This can be done in collaboration with academic and research institutions, regional and international organisations, and the community itself.

For many cities, extreme urban heat has become an issue only in recent years, leaving not only residents but also institutions insufficiently aware of the risks involved. **Building capacity, educational programming**, regular meetings with relevant public officials, and a designated urban heat focal point to coordinate engagement and input can enhance understanding and shift perceptions. Representatives from different departments and sectors – such as infrastructure, waste, energy, urban planning, construction and finance – will need to be brought together.

Engagement mechanisms can be developed that enable local governments to openly discuss ideas and plan interventions with the support of interested private companies, academic institutions and community leaders. By expanding educational campaigns and encouraging sustained community input from the outset, cities can ensure that residents are well informed and empowered to take protective measures during extreme heat events.

Public health campaigns, especially those targeting vulnerable groups such as elderly and homeless people, have successfully raised awareness about the importance of hydration, staying cool and using public cooling centres during extreme heat events.

Several cities have addressed the lack of technical capacity for early warning through **effective collaboration with multiple sectors**, including urban planning, public health, environmental protection, social services and emergency response. Collaborating with local media, telecommunication service providers and the wider community can increase the effectiveness of early warning messaging and systems, providing vital communication that can save lives. Heat ambassadors can be appointed to engage with the community, while partnerships with local NGOs, refugee centres, hospitals and care homes can be established to reach the most vulnerable groups in society.

A few respondents mentioned challenges in balancing economic development policies and environmental aspects with the need to preserve and expand green spaces. For example, land-use conflicts can arise in areas where new green spaces or infrastructure displace existing developments. The **adoption of adaptive building codes, and integration of energy-efficient and environmental standards** into the construction of new buildings and the modernisation of old ones – including the use of cool roofs, building insulation and green facades, and circular economy solutions to reduce

energy waste – were mentioned as solutions with long-term benefits that do not require the expansion of green spaces in densely populated areas. The higher initial cost could be compensated through **tax deductions or other incentives** provided by the municipality. Engaging private sector actors in the planning process can **raise awareness of the co-benefits** of investing in green solutions, such as improving building energy efficiency, and reducing cooling and heating costs.

Finally, it is essential that all solutions are planned and implemented in a manner that is **sustainable over the long term and does not contribute to the creation of other risks**.

The experiences – both challenges and success stories – of the 11 cities and municipalities can

guide others in their own efforts to tackle urban heat. This report forms part of a series of knowledge products focused on managing (extreme) urban heat. It follows the publication of the first *Flames of Change: Innovating Heat and Wildfire Governance for Inclusive Communities* report,[9] which looks at innovative and inclusive heat and wildfire governance in Europe, and its special focus on disability inclusion in disaster risk reduction and prevention.[10] The report is also aligned with the United Nations Office for Disaster Risk Reduction (UNDRR) *Urban Heat Risk Management Resource Package*,[11] which provides a comprehensive overview of common challenges and success factors, based on in-depth interviews with stakeholders, and examples from multiple cities around the world.

9   Available at: www.undrr.org/publication/flames-change-innovating-heat-and-wildfire-governance-inclusive-communities
10   Available at: www.undrr.org/publication/flames-change-special-report-disability-inclusion-disaster-risk-reduction-and
11   Available at: www.undrr.org/media/103947/download?startDownload=20250331

Introduction

Centuries ago, communities started developing innovative techniques for heating and cooling their dwellings and the cities they lived in. Narrow streets in ancient Rome limited direct sunlight during hot summers, whitewashed buildings in Greece reflect sunlight and help reduce temperatures to this day, while buildings across Persia (modern-day Iran), Egypt and the Middle East were designed with special crevices and openings that capture the breeze and thus channel cooler air inside.[12]

Today, more than ever, cities are forced to consider different solutions, be it traditional or modern, to manage extreme events and mitigate urban heat. The summer of 2024 was the warmest on record for Europe, with parts of the continent experiencing substantial heatwaves and heat stress for extended periods of time.[13] Heat is estimated to cause the largest number of deaths in Europe among all weather and climate-related extreme events. In 2023 alone, close to 48,000 deaths were attributed to heat. In 2022, this number was estimated at over 60,000 deaths.[14]

A 2024 report by the European Environment Agency warned that Europe is the fastest warming continent globally, with climate risks increasingly impacting infrastructure, food security, water resources, financial stability and public health. At the same time, policies and adaptation strategies fall short of effectively and comprehensively addressing the complex risk landscape.[15] In Central Asia, climate projections point to an increase in mean temperatures of up to 6.5°C by the end of the century, compared to pre-industrial times. A number of regions are expected to experience negative impacts on water availability, with knock-on effects on food security, and also increased migration from rural areas towards cities.[16]

More than half of the world's population resided in cities in 2011 and this share is expected to double by 2050. A 2023 study by the Central Asia Resilient and Low-Carbon Cities found that, over the last 30 years, the population in the largest urban centres in Central Asia had increased by 48 percent on average.[17] In the European Union, the urban population comprised 75.7 percent in 2023 and is expected to continue growing.[18] As cities grow, it is becoming ever more challenging to serve the needs of residents given changing climate conditions.

The urban heat island effect is characterised by faster surface warming in cities compared to rural areas. This is due to the materials used for roads and buildings, such as asphalt and concrete, which absorb and retain heat during the day, and emit the heat in the sounding air. The lack of sufficient greenery and open water sources contribute to the accumulation of heat. The urban heat island effect leads to an increase in energy consumption for cooling, which ironically contributes to further heat accumulation. Air quality is also negatively impacted. High-impact scenarios indicated that 72 percent of cities in Europe may be subject to temperature increases of over 10°C during heatwaves.[19]

Tackling extreme urban heat and the urban heat island effect requires targeted, comprehensive and sustained

12 Stone, B. Jr. (2024) Ancient Rome had ways to counter the urban heat island effect – how history's lessons apply to cities today. PreventionWeb. See www.preventionweb.net/news/ancient-rome-had-ways-counter-urban-heat-island-effect-how-historys-lessons-apply-cities-today; Sanibel Air and Electric (2025) Ancient Cooling Techniques: Exploring Creative Methods of Staying Cool in Ancient Civilizations. See https://sanibelair.com/ancient-cooling-techniques-exploring-creative-methods-of-staying-cool-in-ancient-civilizations

13 Copernicus (2024) C3S seasonal lookback: summer 2024. European Commission. See https://climate.copernicus.eu/c3s-seasonal-lookback-summer-2024#:~:text=Summary&text=Summer%202024%20was%20the%20warmest,substantial%20heatwaves%20during%20the%20season

14 European Environment Agency (2024) The impacts of heat on health: surveillance and preparedness in Europe. See www.eea.europa.eu/en/analysis/publications/the-impacts-of-heat-on-health#:~:text=For%20example%2C%20for%202022%2C%20it,et%20al.%2C%202024

15 European Environment Agency (2024) European Climate Risk Assessment. ISBN: 978-92-9480-627-7

16 Reyer, P.O. et al (2015) Climate change impacts in Central Asia and their implications for development. Climate Analytics. See https://climateanalytics.org/publications/climate-change-impacts-in-central-asia-and-their-implications-for-development

17 World Bank (2023) Cities Across Central Asia Can Unlock Full Economic Potential by Implementing Low-Carbon and Climate-Resilient Development Strategies. See www.worldbank.org/en/news/press-release/2023/09/27/cities-across-central-asia-can-unlock-full-economic-potential-by-implementing-low-carbon-development-strategies

18 Trading Economics (2025) European Union – Urban Population (% of Total). See https://tradingeconomics.com/european-union/urban-population-percent-of-total-wb-data.html

19 Sweco (2024) Building heatwave resilience in European cities. See www.swecogroup.com/wp-content/uploads/sites/2/2024/06/Building-heatwave-resilience-in-European-cities_webb_240620.pdf

measures, and strong political and policy backing. The key challenges include limited human and financial resources, siloed approaches, space constraints for green and blue solutions, conflicting interests, and a lack of awareness and leadership.

That said, several opportunities and solutions exist, which have proven successful in practice. According to a modelling study by the Barcelona Institute for Global Health, one third of the deaths caused by the urban heat island effect could be avoided if trees covered 30 percent of urban spaces.[20] The city of Białystok in Poland has greened its bus stops to provide relief for residents during hot periods. Cascais in Portugal has created green corridors, which reduce the city's vulnerability to both flooding and heatwaves.[21] The city of Rotterdam in the Netherlands has a long-term policy, developing climate resilience plans that identify urban heat as a key risk factor.[22]

Different solutions may be more appropriate for different local realities. Across all cases, however, strong leadership, established strategies and action plans with dedicated resources, a focal point or coordinating body to oversee and monitor activities, and multi-stakeholder, participatory community approaches that leave no-one behind have proven to be effective and efficient. These measures help ensure long-term resilience gains, while also improving residents' quality of life.

For most cities across Europe and Central Asia, it has become painfully clear that extreme and urban heat are the new normal and part of an uncertain future. Addressing these issues has become a necessity. This report uses real case studies, derived through interviews with local-level practitioners, to demonstrate that – even though there are multiple challenges in addressing urban heat and wider climate change risks – a multitude of smaller and larger interventions and solutions are possible, which can have tangible, positive impacts on human life and community resilience.

This second edition of Flames of Change builds on the first report released in April 2024, which highlighted the urgency of urban heat risk, and pioneering practices from MCR2030 Resilience Hubs and local governments. The MCR2030 initiative – coordinated by UNDRR and supported by a regional coordinating committee comprising over 40 members – helps cities assess, plan and implement risk-informed strategies to build long-term resilience.

Anchored in the Sendai Framework for Disaster Risk Reduction 2015–30, and contributing to the SDGs, Paris Agreement and the New Urban Agenda, MCR2030 provides a structured resilience roadmap, connecting cities with partners, tools and financing solutions. It promotes the use of the Disaster Resilience Scorecard for Cities, and other frameworks that enable cities to understand, plan for and act on disaster and climate risks, including urban heat.

This report also responds to the UN Secretary General's Call to Action on Extreme Heat, which urges governments and institutions to scale up investments, planning and early warning systems to protect lives and livelihoods in the face of rising temperatures. Complementing the Global Resource Package on Extreme Heat developed by UNDRR and MCR2030 partners, Flames of Change II provides localised insights from Europe and Central Asia, offering practical examples of how cities are taking meaningful action despite limited resources and compounding challenges.

20   Barcelona Institute for Global Health (2023) Europe: Trees could prevent 30% of deaths caused by urban heat islands. PreventionWeb. See www.preventionweb.net/news/europe-trees-could-prevent-30-deaths-caused-urban-heat-islands

21   Dengler, S. et al (2020) 3 ways to beat the heat in European cities. World Bank Blogs. See https://blogs.worldbank.org/en/sustainablecities/3-ways-beat-heat-european-cities

22   Sweco (2024) Building heatwave resilience in European cities. See www.swecogroup.com/wp-content/uploads/sites/2/2024/06/Building-heatwave-resilience-in-European-cities_webb_240620.pdf

Methodology

This report is part of a series of knowledge products that focus on managing extreme and urban heat. It follows the publication of the first *Flames of Change: Innovating Heat and Wildfire Governance for Inclusive Communities* report,[23] which looks at innovative and inclusive heat and wildfire governance in Europe, and its special focus on disability inclusion in disaster risk reduction and prevention.[24] This report also aligns with the *UNDRR Urban Heat Risk Management Resource Package*,[25] which provides a comprehensive overview of common challenges and success factors, based on in-depth interviews with stakeholders, and examples from multiple cities around the world. A set of targeted recommendations for both local and national governments is also available.

This report aims to highlight local-level policies and practices for addressing urban heat, and to align specific challenges with possible solutions. For this purpose, a questionnaire was developed and shared with members of the MCR2030 initiative from Europe and Central Asia to which 11 cities and municipalities responded. The responses from the 11 cities and municipalities inform the greater part of this report, including Chapter 3 on common challenges and scalable solutions. The emphasis is on providing an account of on-the-ground, lived experiences that may be relevant for other local governments across the region. Moreover, the responses have been complemented with desk-based research, including examples from other cities and municipalities, and Chapter 3 draws on previous research on solutions and recommendations. Furthermore, the report has been reviewed by MCR2030 Regional Coordinating Committee members, and the UNDRR Regional Office for Europe and Central Asia, and their valuable comments have been integrated as much as possible.

Chapter 1 provides the respondents' reasoning for identifying urban heat risk as a priority for their city or municipality in order to present a current snapshot of local-level hardships and concerns, instigated by recent prolonged heatwaves and other extreme events. In Chapter 2, policies and measures for urban heat reduction, mitigation, response and adaptation are presented, as planned and developed by the 11 cities and municipalities that responded to the questionnaire. The measures presented are divided into three main themes: governance and financing, urban design and planning, and early warning systems.

Chapter 3 summarises the most common challenges faced by cities in the region and aspires to provide relevant and tangible solutions. Finally, the Conclusion summarises the key messages and delineates possible next steps.

---

23   Available at: www.undrr.org/publication/flames-change-innovating-heat-and-wildfire-governance-inclusive-communities
24   Available at: www.undrr.org/publication/flames-change-special-report-disability-inclusion-disaster-risk-reduction-and
25   Available at: www.undrr.org/media/103947/download?startDownload=20250331

Chapter 1:
Cities' Perspectives

Prioritising Extreme Urban Heat

Cities and municipalities are increasingly recognising the need to incorporate extreme heat measures into local policies, strategies and activities in order to tackle the impacts of climate conditions and the urban heat island effect. The responses from the 11 cities and municipalities outlined some of the challenges they face and their reasoning for prioritising extreme urban heat.

Amadora, Portugal

Amadora – a densely populated urban municipality in the Lisbon Metropolitan Area, with a population of almost 200,000 – faces significant challenges from rising temperatures and the increasing frequency of heatwaves. In 20 out of the last 30 years, higher than average temperatures were reported and projections indicate an average temperature increase of 0.4°C by the end of the century. The urban heat island effect, exacerbated by high population density and impermeable surfaces, further heightens the city's vulnerability. Key drivers of heat exposure, in addition to high population density, include constraints on expanding urban green areas, and socioeconomic factors that impact energy efficiency and cooling accessibility. Vulnerable groups, such as elderly people and low-income households, are particularly threatened during extreme heat events.

Amadora's approach to managing urban heat risk has evolved significantly, driven by rising temperatures, severe heatwave events and targeted resilience-building initiatives. Following a severe 2003 heatwave, Amadora began recognising the need for heat preparedness, but it was in 2010 that the city truly started to prioritise heat risk management. This shift was driven by Amadora's decision to join the MCR2030 initiative. The initiative's approach required Amadora to complete a resilience scorecard assessment, identify resilience gaps and develop a disaster risk reduction plan to respond to the gaps, which highlighted urban heat as a significant risk.

Bonn, Germany

The city of Bonn is located in a basin-like location in the Rhine Rift Valley – one of the warmest regions in Germany. The effects of climate change are increasingly noticeable in the form of more hot days, tropical nights and extreme weather events in general. The effects observed so far include urban heat island effects in the city centre, drought damage to vegetation, damage to transportation infrastructure and heat-related health impacts, particularly for vulnerable population groups. Due to heatwaves, such as the ones experienced in 2003 and 2018, there has been an increase not only in heat-related illnesses and mortality but also in air pollution-related issues. Low water levels in the Rhine River, one of Bonn's main transport routes, has significant consequences for freight transport.

Ceadâr-Lunga, Republic of Moldova

For the municipality of Ceadâr-Lunga, urban heat risk has become a priority due to rising temperatures and extreme weather conditions, the increasing frequency and severity of natural disasters; the higher incidence of heat stroke and worsening of chronic diseases; the expansion of paved and concrete surfaces; damage to road and social infrastructure with increasing maintenance and repair costs; and the deterioration of water, air and soil quality; and declining afforestation.

Kraljevo, Serbia

In the city of Kraljevo, urban heat has been observed to impact people's health and water resources. The greatest threats include shortages of drinking water in more rural areas and river levels falling below minimum thresholds, leading to significant challenges for biodiversity.

Furthermore, high temperatures accelerate the spread of fires in open spaces, with a greater risk of fires at the local landfill. In addition, the devastation of areas affected by climate change leads to erosion, which increases the risk of flash floods.

Leova, Republic of Moldova

In the city of Leova, climate change impacts – including rising global temperatures, which are especially pronounced in southeastern Europe – have led to more frequent and intense heatwaves. Increased urbanisation and urban development, and reductions in green spaces and vegetation, amplifies the urban heat island effect.

Leova has observed several impacts caused by increased urban heat, including weakened asphalt that accelerates road deterioration and increases maintenance costs, as well as effects on water reservoirs and municipal water supply systems due to heat-induced evaporation. A number of public health concerns have also been identified, with instances of heatstroke, dehydration and cardiovascular stress, particularly among vulnerable groups, becoming more frequent. Moreover, as heat exacerbates air pollution, the incidence of respiratory conditions such as asthma and bronchitis has increased. Prolonged exposure to high temperatures has discouraged outdoor activities, impacting mental health and community engagement. High temperatures have also stressed native plants and wildlife, reducing biodiversity in and around the city, while prolonged heat is expected to deplete soil moisture, and further stress local agriculture and urban greenery.

Regional and international emphasis on climate resilience and sustainable development, including initiatives such as the European Green Deal, may have encouraged local action.

Montijo, Portugal

Urban heat is mainly driven by two factors: climate change, and urbanisation and housing expansion. The city of Montijo has experienced huge urban and residential development. The rapid growth and consequent abandoning of rural areas has heightened CO_2 emissions in those areas, despite the city's best efforts to expand green corridors, and leisure areas and parks. As more people move into the city, they replace natural vegetation and soil with buildings, roads and other impervious surfaces that absorb and re-emit more heat. Climate change is increasing the frequency, intensity and duration of heatwaves and extreme heat events, which could raise the temperature of the city by several degrees.

Mykolaiv, Ukraine

The city of Mykolaiv in southern Ukraine is increasingly exposed to extreme weather conditions, including urban heatwaves. The key drivers of this increase are global warming, urbanisation, shrinking green spaces and high building density. Noticeable impacts of increased urban

heat include damage to road surfaces; overheating of buildings and higher load on energy networks due to the greater use of air conditioning; a rise in cardiovascular and respiratory illnesses, and heatstroke, especially among elderly people and children; and the drying up of green areas, deterioration of water quality and loss of biodiversity.

Ohrid, North Macedonia

In the municipality of Ohrid, urban heat has affected infrastructure, causing damage to asphalt.

Rome, Italy

Urban heat risk has become a pressing priority for the city of Rome due to the escalating impacts of climate change, which have made heatwaves more frequent, intense and prolonged. In particular, this has led to a significant increase in average annual temperatures and exacerbated the phenomenon of urban heat islands, where densely built and paved areas trap and release heat more efficiently than surrounding rural zones. Addressing this issue has become urgent due to the impacts of climate change, urban expansion and growing public health concerns, particularly for vulnerable populations such as elderly people, children and people with pre-existing health conditions.

The effects of extreme heat on Rome's infrastructure are evident. High temperatures cause road surfaces to deform, accelerating asphalt deterioration and increasing maintenance costs. Rail networks also suffer, as thermal expansion of tracks poses safety risks. The energy grid experiences immense stress during periods of peak demand for cooling, leading to frequent power outages and blackouts. Public health in Rome is another area significantly affected by urban heat. Hospitals report higher admissions during heatwaves, with an increase in cases of cardiovascular diseases, respiratory conditions and heatstroke. The impact is particularly severe for people living in inadequate housing or without access to air conditioning. Overheating in buildings, combined with inefficient energy management, further exacerbates these challenges.

Rome's urban ecosystems are severely stressed by urban heat. Trees and green spaces experience thermal stress,

diminishing their ability to provide essential services such as CO_2 absorption and shading. Urban biodiversity faces growing threats, with many species forced to migrate or endure increasingly harsh conditions.

Ub, Serbia

In the city of Ub, rising temperatures have led to a shortage of drinking water and a reduction in the habitat of Scots pine (*Pinus sylvestris*), which is used for the afforestation of bare sandy areas and rocky areas.

Wroclaw, Poland

The city of Wroclaw has experienced heatwaves and droughts during summer months, exacerbated by the urban heat island effect. These conditions underscore the need to address urban heat risks in order to protect public health, infrastructure and local ecosystems. Observed impacts include increased energy consumption due to heightened demand for cooling, heat stress among vulnerable populations, and strain on green spaces and water resources.

The overarching goal of the Wroclaw's Climate Change Adaptation Plan (MPA), adopted as the city's strategic document in 2019, is the sustainable development of a healthy, green and satisfied city under climate change conditions. Consequently, high temperatures along with intense rainfall and strong and very strong winds have been identified by the MPA as the most important climate change risks in Wroclaw.

Bonn. Image: City of Bonn

Chapter 2:
City Responses

Cities and municipalities have taken significant steps to mitigate, reduce, adapt to and respond to the negative impacts of extreme heat. Responses from the 11 cities surveyed reveal a wide range of specific policies and actions implemented at the local level. The measures presented in this chapter are divided into three main themes: governance and financing, urban design and planning, and early warning systems.

2.1. Institutional Capacity and Stakeholder Engagement

2.1.1. Governance and Cross-Cutting Policies

Amadora, Portugal

Heat risk management in Amadora is a collaborative, structured effort driven by both political and operational leadership. The governance framework is supported by strong political commitment from the Mayor, who provides high-level alignment and support across city departments, ensuring that heat risk management remains a priority. This political backing secures stakeholder buy-in and embeds resilience goals across various city functions, giving heat risk strategies essential visibility, and driving collaborative planning and decision-making.

The Civil Protection Department serves as the technical lead, acting as the focal point for coordination and implementation of disaster risk reduction strategies, which include climate change adaptation and urban heat risk measures. Several municipal departments contribute to heat risk strategies. The Urban Planning Department integrates heat risk reduction into city design, incorporating green infrastructure and cooling elements to reduce urban heat effects. The Social Action Department supports vulnerable groups, including elderly and homeless people, by conducting outreach and providing resources during heatwaves. The Environment Department enhances green spaces and natural cooling areas, supporting a holistic approach to heat risk reduction. The Health Department is

a key stakeholder for its potential to monitor public health impacts, coordinate health services and support vulnerable groups during heat events. The Health Department has the capacity to provide critical data and guidance that could shape the city's heat response strategies, including extreme heat protocols, though the city is working to fully integrate these functions.

Together, these departments form a cohesive, multi-agency approach to managing urban heat risk. In addition, the Civil Protection Department consolidates information from each department to coordinate efforts effectively, ensuring that Amadora's heat risk strategies are both comprehensive and adaptive to the city's evolving needs.

Bonn, Germany

The designated office for heat management is the Environmental Office of the Department of Climate Adaptation. Efforts across city departments are coordinated in close cooperation, for example, through workshops and joint statements.

Bonn is currently developing its Integrated Climate Adaptation Strategy as well as its new Biodiversity Strategy. Both strategies incorporate strong elements for local resilience and have been prepared in a participatory way, including workshops involving relevant municipal departments. This enhanced dialogue has significantly improved cross-departmental collaboration. In addition, since 2019, the Bonn Sustainability Strategy has brought together all municipal efforts across Bonn's key sustainability areas in a systemic manner.

Ceadâr-Lunga, Republic of Moldova

The city of Ceadâr-Lunga has established the Emergency Situations Commission. The commission includes the police, the emergency management department, advisers, the public health centre, the state construction inspectorate, the hydrometeorological service, the gas service, the environmental inspectorate, the agro-industrial complex department, the food safety agency, and the sanitary and epidemiological station. General management is carried out by the mayor of the municipality. Depending on the emergency, the mayor may establish specialist

commissions by order. These can include teams to ensure compliance with and implement measures during a state of emergency, inspect seedlings and assess the effects of drought, examine agricultural crops for drought affects, and evaluate damage caused by heavy rains. If necessary, the Emergency Situations Commission may declare a state of emergency for the municipality and, for example, issue orders to minimise the risk of fires in the spring and summer.

At the municipal level, there is no strategy for reducing the risk of heat. In 2018, the Sustainable Energy and Environment Action Plan was approved, within the framework of which the city committed to reducing CO_2 emissions by 30 percent by 2030. To fulfil its obligations, the Mayor's Office is implementing projects including the thermal insulation of public buildings (e.g., kindergartens, community centres and the municipal sports school), installation of photovoltaic panels, construction of a municipal solar station, modernisation of street lighting, and training of automated and technical specialists in working with solar panels.

Kraljevo, Serbia

As present, heatwave risk management is organised through a system of competent institutions, namely the Ministry of Health Centre and Institute of Public Health, Republic Hydrometeorological Institute, and Department for Emergency Situations. Furthermore, the Staff for Emergency Situations, a local disaster risk reduction and emergency management platform, plays an important role at the local level.

A dedicated local centre for climate adaptation and mitigation is being established. Additionally, in cooperation with local self-governments in the West Morava River Basin,[26] the city of Kraljevo's Department for Civil Protection is working on measures aimed at mitigating the negative impacts of heatwaves and minimising damage. The department carries out significant activities for other local governments in the West Morava River Basin. During and especially after disasters, the department supports other municipalities and cities in the Republic of Serbia by assessing damage and post-disaster needs.

Heatwaves are part of disaster risk reduction planning and represented in the Assessment of the Risk of Disasters, the Adaptation Plan to Changing Climatic Conditions and the Programme of Rural Development Resistant to Changed Climatic Conditions.[27] These documents were created as part of a broad dialogue process.

Leova, Republic of Moldova

In the city of Leova, urban heat risk management has not yet been developed into a fully formalised, standalone strategy. Nevertheless, it is integrated into broader climate resilience and urban planning efforts. The Mayor and the Vice Mayor responsible for municipal utilities and urban services coordinate efforts related to urban infrastructure and emergency response, including issues arising from extreme heat. Collaboration exists between municipal enterprises that provide technical and operational support during heat-related emergencies, such as maintaining water supply and waste management services.

At the beginning of 2024, Leova joined the flagship UNDRR initiative MCR2030. Overall, the city scored 62 out of 141 points in an assessment of the "10 MCR2030 essentials." In 2015, Leova developed the General Urban Plan for a 25-year period, which includes short, medium and long-term measures to ensure functional and sustainable development across the territory. The city also has the Socioeconomic Development Strategy 2021–26 and the Urban Revitalisation Programme for the City of Leova 2023–27.

The Mayor holds the authority to convene the Emergency Situations Commission. The Commission's activities largely focus on post-event interventions rather than on proactive actions to reduce disaster risk.

The benefits of disaster resilience are recognised, although there is no formal process to integrate resilience into local

---

26 https://riskzm.rs
27 http://civilnazastitakraljevo.rs/the-process-of-creating-a-disaster-risk-assessment
    http://civilnazastitakraljevo.rs/PDF/FinalDraft_Kraljevo_LAP.pdf
    http://civilnazastitakraljevo.rs/PDF/PSRK_grad_Kraljevo.pdf

administration functions. Nevertheless, a positive example in this regard is the installation of fire hydrants, which – despite significantly increasing the cost of the water supply network – have been prioritised to reduce the spread of fires and shorten emergency response times.

Montijo, Portugal

Urban heat risk management is organised and divided between three local government departments, all under the authority of the presidency. Montijo's Environmental Department is responsible for urban and landscape areas, and maintenance and urban hygiene. The Urbanism Department is responsible for integrating and developing local urbanism and planning policies. Finally, the Civil Protection Service analyses, evaluates and manages risks, including climate change effects and risks.

Through the Montijo Municipal Climate Action Plan (PMAC), the municipality intends to respond to the new normative and legal requirements established by the Basic Climate Law. The law calls for information to be made more readily available to residents and civil society, in accordance with the principle of transparency, thereby enabling public participation in climate action and the systematic monitoring of information.

The municipality aims to develop a local strategy, defining climate change mitigation and adaptation measures, with targets to reduce CO_2 emissions by at least 55 percent by 2030, 65–75 percent by 2040 and at least 90 percent by 2050, relative to 2005 levels, thereby accelerating decarbonisation and boosting the municipality's resilience to climate change.

The actions proposed in the PMAC are based on defined guidelines and community programming, and include clear goals, timelines and financing options.

Mykolaiv, Ukraine

Heat risk management is coordinated through the city council, with the Department of Energy, Energy Saving and Implementation of Innovative Technologies playing the central role. The department works closely with the Department of Health, and the Department of Housing and Communal Services. While the Department of Health provides information support to the population, the Department of Housing and Communal Services oversees infrastructure adaptations, and the Energy Department implements energy-efficient solutions.

In Mykolaiv, there is no dedicated office for heat risk management, though a coordination group has been established under the city council. The group ensures co-operation between departments and works with national authorities and international organisations (e.g., ICLEI Local Governments for Sustainability and the Covenant of Mayors East), as well as with the private sector, to attract funding and expertise.

Heat risk reduction strategies are linked to disaster risk reduction programmes and activities. For example, efforts to expand green areas improve the urban microclimate while simultaneously reducing heat risks and preventing soil erosion. Setting energy-efficient building standards and developing and implementing a sustainable energy and climate action plan are interconnected measures that help limit the impacts of urban heat.

Vienna Championing on Climate Policy

The city of Vienna, Austria, developed its first climate plan in 1999 and, in 2018, became one of the first European cities to adopt a strategy for combatting urban heat. Since then, the city has implemented several measures, including a network of bike lanes to encourage non-heat-producing modes of transportation, while also maintaining established infrastructure, including a large system of municipal pools originally built in the 1920s and over 1,000 public drinking fountains.[28]

28 Limb, L. (2024) Madrid, Frankfurt, Vienna: How are European cities adapting to heatwaves? EuroNews. See www.euronews.com/green/2024/06/13/madrid-frankfurt-vienna-how-are-european-cities-adapting-to-fiercer-heatwaves

Ohrid, North Macedonia

Within the municipality of Ohrid, inter-sectoral cooperation exists between the bodies responsible for the environment, urban planning and construction land management, utilities, and traffic and streets. However, there is no dedicated focal point for heat management. Strategic documents prepared at the local level are aligned with higher-level planning documents and strategies.

Rome, Italy

Urban heat risk management in the city of Rome is structured through a coordinated network that involves municipal authorities, regional agencies and national organisations. Rome's Department for Ecological Transition and Resilience (Roma Capitale) assumes the leadership role in managing urban heat risks. The department is responsible for formulating strategies, implementing actions and fostering collaborations among different stakeholders to address the challenges posed by extreme heat events.

The Regional Agency for Environmental Protection (Agenzia Regionale per la Protezione Ambientale, ARPA Lazio) plays a key role by providing critical data on urban climate patterns, monitoring trends and issuing early warnings during heatwaves. ARPA Lazio collaborates with the national meteorological service to create predictive models and develop effective mitigation strategies.

The city's Climate Adaptation Plan, spearheaded by Roma Capitale, establishes strategic objectives for mitigating the impact of urban heat. This plan emphasises long-term measures, such as enhancing green infrastructure and improving building energy efficiency.

The Mayor's Office and the Department for Environmental Policies mobilise resources, advocate for sustainable urban development, and ensure that heat mitigation efforts align with broader climate resilience goals. The Civil Protection Department coordinates emergency responses during heatwaves, focusing on assisting vulnerable populations such as elderly people, children and people with pre-existing health conditions. This involves distributing resources, operating cooling centres and implementing awareness campaigns to minimise health risks. The Health

Department collaborates closely with local hospitals and medical facilities to address the increased strain on healthcare services during extreme heat events. The Public Green Agency is tasked with expanding and maintaining urban green spaces, which act as natural heat mitigators by reducing surface temperatures and improving air quality. Meanwhile, the Transport Agency oversees the safety and resilience of public transport infrastructure, ensuring that heat-related issues, such as rail track deformation and power outages, are addressed promptly.

While there is no single dedicated office for heat management, the Department for Ecological Transition and Resilience – which serves as the central body overseeing climate adaptation strategies – leads efforts to integrate heat mitigation into broader urban resilience plans. It ensures collaboration between city departments – including public health, civil protection, urban green management and transportation – to address the multifaceted impacts of heat. The department works closely with external partners. At the national level, the department collaborates with the Ministry of Environment for funding and policy alignment. Regionally, ARPA Lazio provides critical climate data and forecasts. Partnerships with the private sector focus on green technologies and energy-efficient infrastructure, while international networks – such as C40 Cities and ICLEI Local Governments for Sustainability – offer technical expertise and support regarding global best practices.

Heat risk reduction is an essential component of Rome's broader climate change adaptation plan, which aims to strengthen the city's resilience to the increasing frequency and intensity of extreme weather events. As part of this plan, heat risk reduction measures – such as the expansion of green spaces, the use of reflective materials in urban design and the creation of cooling centres during heatwaves – work synergistically with broader disaster risk reduction strategies. These strategies include measures to mitigate the impacts of flooding, which is another climate-related risk that Rome faces. For example, the same green spaces used to reduce heat can also absorb excess rainwater, reducing the risk of flash flooding during heavy rainfall events.

Furthermore, Rome's heat risk reduction efforts support the city's long-term climate resilience by improving the urban environment in a way that addresses multiple

vulnerabilities. The integration of climate-responsive urban planning – which includes energy-efficient buildings, green roofs and improved water management systems – not only helps to mitigate heat risk but also contributes to reducing the overall environmental impact of the city. These measures are aligned with broader climate change adaptation objectives, which aim to ensure that Rome can thrive despite the challenges posed by climate change.

Additionally, the heat risk reduction strategies employed by Rome are closely aligned with its broader efforts to protect vulnerable populations, which is a key component of the city's disaster risk reduction plan. By focusing on the most vulnerable communities – such as elderly people, people living with pre-existing health conditions and people on low incomes – Rome's heat action plans help to ensure that these groups are adequately supported during periods of extreme heat.

Wroclaw, Poland

Strategically, urban heat risk management in Wroclaw is integrated into the city's Climate Change Adaptation Plan (MPA), which identifies three categories of adaptation actions, namely information and education, organisation, and technical. Detailed actions from these categories are included in 21 adaptation fiches, which cover essential actions for adapting diverse urban spaces to climate change, raising awareness among and educating residents, and preparing urban structures for climate challenges.

Regarding implementation, the coordination of measures in the event of a heat phenomenon is carried out by the Mayor of Wroclaw in accordance with the Crisis Management Act of 26 April 2007.

While there is no dedicated office or focal point for heat management, Wroclaw's climate adaptation initiatives are coordinated through the Climate and Energy Division, as well as the Spatial Planning Division. These divisions work collaboratively with external partners – including national agencies, private sector entities and international organisations – to implement projects aimed at mitigating

heat risks. For example, the city has participated in the GrowGreen project to implement nature-based solutions, addressing both heat stress and flooding.

In the event of an emergency, actions are coordinated by the Mayor of Wroclaw in cooperation with the Municipal Crisis Management Centre.

The MPA is reviewed and, if necessary, updated every six years. Progress on the implementation of its actions is monitored through annual data collection and in-depth analysis.

To support monitoring and evaluation, outcome indicators have been adopted to assess the extent to which the MPA's strategic objectives are being achieved through the adaptation actions outlined in the action fiches. In addition, information is collected from municipal entities on related investments.

As the need arose to develop additional monitoring indicators for adaptation actions, product indicators were proposed for the actions implemented under the MPA. These output indicators enable monitoring of the direct effects of MPA implementation, including rainwater management, greenery, urban planning and educational activities. In addition, the Institute of Meteorology and Water Management monitors risks associated with extreme weather events.

Wroclaw's heat risk reduction strategies are integral to its comprehensive MPA. By implementing nature-based solutions, the city simultaneously addresses heat stress and flood risks. For instance, redesigned courtyards in the Olbin district incorporate green infrastructure that manages stormwater and provides cooling, enhancing overall urban resilience.

In addition, Wroclaw adopted the Master Plan for Urban Space in the City Centre in 2021. The plan supports pro-climate measures and guides sustainable development and urban planning in the city centre, integrating green infrastructure and reducing urban heat island effects. Furthermore, the City Strategy 2050 and General Plan are being developed.

2.1.2. Partnerships

Amadora, Portugal

In Amadora, key stakeholders – including the Red Cross, local police and the Social Department – work together to enhance outreach, especially to vulnerable groups such as elderly and homeless people. The city's health and social services visit 3,000–4,000 residents twice a week to ensure they are receiving the necessary support and information. Stakeholder involvement in Amadora's heat risk management also involves contributions from the municipality, academia, the private sector, international organisations, NGOs and civil society.

The municipality plays a crucial role by obtaining and consolidating essential data that enables Amadora to track, analyse and respond effectively to heat risks. Regular working group meetings bring together city departments and stakeholders to coordinate on strategies, data-sharing requirements and community needs.

Partnerships with academic institutions, including the Universidad Nova de Lisboa, have been established to develop Amadora's climate profile, offering insights that inform climate adaptation and heat risk strategies. This collaboration strengthens Amadora's ability to base decisions and actions on reliable climate data and academic research.

Local communities and vulnerable groups are essential stakeholders in Amadora's heat risk management. Participatory planning processes promote community engagement, with residents helping to identify and implement solutions. Key community partners – such as the Portuguese Red Cross, local fire department and police – support Amadora's early warning system by disseminating heatwave warnings and safety information to residents, particularly vulnerable groups. These partners provide on-the-ground support, ensuring the communication of risks is effective and inclusive.

Partnerships with international organisations, such as UNDRR, and participation in the UNDRR's Making Cities Resilient campaign (later the MCR2030 initiative) provide valuable frameworks for assessing and managing heat risks. As part of the UNDRR campaign, Amadora completed a scorecard assessment that highlighted urban heat as a significant risk. Sharing knowledge with other participating cities in the United Kingdom, Italy and Sweden enabled Amadora to adopt diverse perspectives and improve its internal heat risk management practices.

Partnerships with private sector companies, such as USEND IT, have been instrumental. The company contributed technology and financial resources to develop the city's early warning system, which sends alerts to residents during heatwaves. This collaboration has strengthened Amadora's emergency communications and overall resilience infrastructure.

Bonn, Germany

Many of Bonn's residents are involved in efforts privately and participate in municipal initiatives. Scientific collaboration with the local university also takes place, for example, through student seminars. Several NGOs, such as Fridays for Future (which includes parents and scientists), are also involved.

A core networking partner is the Bonn Network International Civil Protection and Disaster Risk Reduction, which conducts regular lectures, and facilitates an interdisciplinary exchange and multilevel collaboration.[29]

In addition to this, the city has recently established a sustainability hub, consulting businesses on sustainability options. The hub offers potential for future collaboration.

Since 2022, Bonn has been a member of the MCR2030 initiative, and since June 2023 has served as a resilience hub with a three-year programme involving numerous partners and networks, including ICLEI Local Governments for Sustainability, and the Bonn Network International Civil Protection and Disaster Risk Reduction.

Leova, Republic of Moldova

Leova's City Hall collaborates closely with a range of specialists and institutions, such as the Environmental

---

29   www.bonner-netzwerk-int-kats.org/en-gb

Protection Inspectorate Leova, the Deputy Mayor for public utilities, the cadastral engineer, the chief architect and the public utilities engineer. Together, they oversee the design and maintenance of urban spaces, the expansion of green areas, tree planting, ecosystem restoration projects to mitigate the urban heat island effect, and the maintenance and enhancement of heat-resistant infrastructure, including roads and public buildings.

Several local NGOs focus on environmental sustainability and climate change support aimed at raising awareness about urban heat risks and implementing nature-based solutions, such as tree planting.

At the moment, collaboration between the city of Leova and private sector actors is limited. Although partnerships have been established for the development of public spaces and infrastructure, private developers are rarely involved in mitigating heat risks, whether through incorporating green spaces or energy-efficient designs into their projects.

Currently, there appears to be limited collaboration with energy companies specifically targeting heat risk reduction. However, partnerships focused on energy efficiency in public buildings or private housing could become a future priority, particularly in terms of improving insulation and the adoption of renewable energy solutions.

While Leova has not extensively utilised public-private partnerships for heat risk management, such collaborations offer an opportunity for the future, especially in urban green space development, infrastructure improvements and climate adaptation projects.

There is no specific system in place for incentivising private actors to engage in green initiatives. However, the city is considering this as a possible area to develop, especially with the growth of sustainability-focused projects.

Mykolaiv, Ukraine

The city of Mykolaiv receives support from organisations – such as the Covenant of Mayors East, ICLEI Local Governments for Sustainability and United Nations Development Programme – which provide technical assistance, training and grant funding for energy efficiency, greening and climate change adaptation measures. Mykolaiv shares its experiences with partners from other cities, addressing heat-related issues through municipal partnership programmes and forums.

Local civil society organisations and activists are involved in tree planting, educational campaigns on heat adaptation and volunteer initiatives.

During periods of extreme heat, international humanitarian organisations – such as the Red Cross –provide water, shaded shelters and other resources for vulnerable groups.

Rome, Italy

Rome collaborates with national institutions, such as the Ministry of Environment, to access funding for climate resilience projects. Internationally, the city participates in networks such as C40 Cities, which facilitate the exchange of best practices and technical expertise on innovative approaches to urban heat risk management.

International organisations have also been instrumental, with agencies such as the World Health Organization and the United Nations Environment Programme offering both technical expertise and global best practices on heat risk management. Rome has participated in international networks and initiatives that focus on urban resilience and climate adaptation, such as C40 Cities where cities share knowledge and strategies for addressing climate-related risks, including heatwaves.

Collaboration with other cities has also been valuable. As part of the EU Urban Agenda, Rome has engaged with peer cities to share experiences, participate in joint research on climate resilience and develop collaborative heat action plans. This exchange of knowledge with cities facing similar climate challenges strengthens Rome's ability to develop effective heat risk mitigation strategies.

Rome's collaboration with private sector actors – including construction companies, developers and energy providers – is essential to its heat risk management approach. In urban planning, construction and development companies are encouraged to adopt sustainable building practices, such as installing green roofs, using cool roofing materials and ensuring energy-efficient designs that reduce heat absorption. Local authorities often work with these companies to ensure

compliance with building codes that include climate adaptation measures.

In terms of public-private partnerships, Rome has collaborated with energy companies to improve the energy efficiency of the city's infrastructure, which includes reducing the heat produced by inefficient buildings and increasing access to cooling technologies for vulnerable populations. These partnerships are also crucial in the development of district cooling systems, which provide affordable air conditioning in densely populated areas during extreme heat events.

Rome has benefited from consultation and technical assistance from private sector firms specialising in climate adaptation, urban design and environmental engineering. These companies often work alongside the city's planning departments to provide technical guidance on effective strategies for mitigating heat risks, such as the installation of green spaces, water management systems and the design of climate-resilient public infrastructure.

Wroclaw, Poland

The city of Wroclaw has actively engaged with various stakeholders to address urban heat risks through collaborative initiatives.

At the invitation of ICLEI Local Governments for Sustainability, the city established the Polish Nature-Based Solutions Hub in Wroclaw in May 2023 as part of the NetworkNature project, funded by the European Commission's Horizon 2020 programme, and currently the project is being carried out as "NetworkNature+" from August 2023 by the Horizon Europe programme.

The hub was founded with the support of three Wroclaw universities and the Lower Silesian Branch of the Association of Landscape Architecture. Moreover, the hub has since also partnered with the Institute of Urban and Regional Development.

The establishment of the hub strengthens collaboration between Wroclaw, and other cities and organisations across the country, facilitating knowledge sharing on Nature-Based Solutions. The hub's activities focus on promoting the potential of Nature-Based Solutions to reduce heat stress and flooding, among other things, and on developing effective strategies to support climate change adaptation in other regions.

The Polish Nature-Based Solutions Hub in Wroclaw fosters multi-level, vertical cooperation between cities, regions and national governments in the field of nature-based solutions.

Furthermore, Wroclaw participates in the LIFECOOLCITY project Using Remote Sensing to Manage Blue-Green Infrastructure of Cities in Climate Change Adaptation and is the first test city in the project where the identification of needs and redevelopment of blue-green infrastructure will be carried out alongside an evaluation of their effectiveness. The project will develop a programme to analyse environmental data, and support decisions on the maintenance and creation of new green spaces, which will improve quality of life in the city, and mitigate the urban heat island effect and droughts. The solutions developed in cooperation with scientists and a remote sensing company could ultimately benefit up to 10,000 cities across the European Union. The overall aim is to improve the management of greenery and adapt urban spaces to climate change.

At the international level, Wroclaw participates in international projects supporting EU targets for sustainable development, as well as climate change mitigation and adaptation. Notably, the city has joined the EU Mission: 100 Climate-Neutral and Smart Cities by 2030, and the EU Mission on Adaptation to Climate Change.

In addition, Wroclaw collaborates with private sector entities – including construction firms, developers and energy companies – to enhance urban resilience to heat by participating in projects aimed at, among other things, mitigating urban heat island effect.

2.1.3. Urban Heat Data

Amadora, Portugal

Access to data is a hurdle for Amadora, with essential information from the private sector – such as banking and insurance data, as well as health data from hospitals – difficult to obtain. Recognising the importance of this data for planning, Amadora is working to improve collaboration with public hospitals to access data on heat-related illnesses, emergency admissions and hospitalisation patterns during heatwaves. This information helps the city identify vulnerable groups, monitor the effectiveness of interventions and direct resources to where they are most needed. By working closely with health institutions, Amadora aims to develop targeted, preventative strategies to reduce heat-related health risks across the community.

Leova, Republic of Moldova

A partial monitoring mechanism is in place to track and manage urban risks, including extreme heat. This mechanism functions through collaboration between local authorities, such as City Hall, and specialised institutions, such as the Environmental Protection Inspection and the Emergency Situations Department. Data is collected from various sources, including weather monitoring stations and public health facilities, and reports from local institutions.

The information is analysed to assess potential risks and trigger preventive measures or immediate responses. Coordination is facilitated through regular meetings of the Emergency Situations Commission, which ensures that relevant stakeholders, including municipal services, healthcare providers and public safety departments, are informed and aligned. However, challenges remain in fully integrating this data-sharing process and institutionalising comprehensive risk scenarios.

Montijo, Portugal

A special service – Casa do Ambiente (Environment House) – has been established and integrated in the Lisbon and Tagus Valley Metropolitan Area, which is dedicated to studying and managing urban heat management. All cities in the area can use the resources developed by the service to learn more about the effects of climate change.

The city's climate change adaptation strategy includes an assessment of the impacts, and an analysis and update of the modelling of the current situation using data from Climatological Normal. Based on the results of this assessment, actions are proposed to mitigate the effects of the main climate risks identified in the climate projections for the municipality, such as a decrease in total annual precipitation, an increase in temperatures (particularly maximum temperatures in autumn), and an increase in the frequency of heatwaves and very intense precipitation events.

Mykolaiv, Ukraine

Weather stations, data from energy networks and health statistics are used to assess weather and heat-related impacts. Mapping of heat zones in the city is conducted to identify the most vulnerable areas. However, insufficient data to predict impacts and inconsistency of databases across departments remain challenges.

Disaster Resilience Scorecard Assessment Conducted in Astana, Kazakhstan

The city of Astana, as a member of the MCR2030 initiative, conducted the Disaster Resilience Scorecard Assessment exercise in 2020–21, which helped identify several important gaps. For example, several gaps relate to the severely diminished greenery and lack of shading in public spaces. The assessment coincided with the development of city planning documents, which incorporated recommendations from the exercise.[30]

---

30   UNDRR, Making Cities Resilient 2030 (2024) Flames of Change: Innovating Heat and Wildfire Governance for Inclusive Communities. See www.undrr.org/media/94985/download?startDownload=20250403

Rome, Italy

Rome employs a comprehensive monitoring system to address urban heat risks, integrating data collection, forecasting and public communication. The system operates under the coordination of ARPA Lazio, which

serves as the primary agency for monitoring climate-related phenomena, including extreme heat events. ARPA Lazio collects real-time data on temperature, humidity and air quality through a network of meteorological stations located across the city and surrounding areas. This data is used to generate predictive models for heatwaves, providing early warnings to city authorities and the public.

The Civil Protection Department works alongside ARPA Lazio to implement emergency protocols during heat events. It disseminates heatwave alerts through various channels, including online platforms, SMS and local media. These alerts include advice for vulnerable groups, such as staying hydrated, avoiding outdoor activities during peak heat and accessing cooling centres. Public health monitoring is managed by the Health Department in collaboration with hospitals and clinics. This includes tracking heat-related illnesses, identifying high-risk areas and ensuring that healthcare facilities are prepared to handle higher patient loads during periods of extreme heat. In addition, the Urban Green Management Agency monitors the health of trees and green spaces, assessing their capacity to mitigate heat and adapting maintenance strategies accordingly. The Transport Agency inspects critical infrastructure, such as railways and roads, to prevent disruptions caused by excessive heat.

"The implementation of advanced forecasting tools and early warning systems has significantly contributed to Rome's success in managing heat risks. The city uses meteorological data to predict heatwaves and issue timely warnings, allowing both authorities and citizens to prepare in advance. The use of data for tracking urban heat islands and identifying the most vulnerable areas also aids in more targeted interventions."

2.1.4. Financing

Amadora, Portugal

In Amadora, the Civil Protection Department manages the budget for heat risk, with approximately €5 million allocated to civil protection, and around €1 million dedicated to climate adaptation and disaster risk reduction. However, this funding is insufficient for comprehensive risk management, highlighting the need for additional financing sources.

Financing Solutions – Athens

The Resilience Strategy for Athens 2030 is anchored by a €55 million loan from the European Investment Bank. The loan includes a natural capital finance facility to support the design and implementation of four nature-based solutions: three green corridors and the Lycabettus Hill Sustainable Water management programme.[31]

Ceadâr-Lunga, Republic of Moldova

Ceadâr-Lunga is a small city in the south of Moldova, with a population of 18,504 people. Consequently, the city's budget is limited. To manage heat risks and implement other development projects, the Mayor's Office actively participates in funding competitions with development partners, with most financing provided in the form of grants. At the same time, the Mayor's Office contributes co-financing, ranging between 50 and 100 percent of the grant amount for each project.

The City Hall works to attract funding for projects in transport infrastructure (e.g., low-carbon public transport and bicycle lanes), afforestation and water resource management (e.g., using rainwater to irrigate green areas).

---

31   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package.
See www.undrr.org/media/103947/download?startDownload=20250114

Leova, Republic of Moldova

The city of Leova's Investment Attraction, Information and Protocol Department seeks funding for sustainable urban development projects, including measures to mitigate heat risks. The department collaborates with local action groups (e.g., GAL EcoPyretus) to fund and implement heat resilience projects.

A reserve fund within the city budget is used to cover expenses related to emergencies, though it is currently focused more on post-event recovery rather than proactive resilience-building measures.

While Leova has not yet implemented specialised financing models, such as green bonds or public-private partnerships specifically for heat risk management, it has accessed national funding programmes, such as the National Fund for Regional and Local Development, to support broader resilience-related projects such as infrastructure upgrades (e.g., the renovation of the city park in 2022–23).

On 28 May 2024, the contract for the development of the Valul lui Traian tourist complex was signed. In addition to creating tourist accommodation, the project aims to rehabilitate the aquatic basin and recreational area located near the natural monument. The total project cost is MDL 16 million, with 10 percent funded by Leova City Hall, and 90 percent by the National Fund for Regional and Local Development.

Leova has also received funding from Japan and Sweden for projects focused on resilience, which indirectly contribute to tackling the impacts of increased urban heat.

Mykolaiv, Ukraine

Mykolaiv is exploring several financing mechanisms, including budget allocations for greening and energy efficiency programmes, attracting grants (e.g., from the Covenant of Mayors East and GIZ); and cooperation with international financial institutions. The city is also considering the possibility of issuing green bonds.

Rome, Italy

Rome has adopted a multifaceted approach to funding heat risk management initiatives, leveraging a mix of local, national and international resources. The city integrates traditional public funding with innovative financial instruments to implement sustainable urban resilience strategies. Rome has explored green bonds as a financing model to support long-term investments in urban resilience. These bonds are used to fund projects such as expanding urban green spaces, improving energy efficiency in public buildings and implementing smart infrastructure to reduce urban heat island effects.

The city also benefits from grants and subsidies provided by the national government and European Union. For instance, funds from the European Union's Green Deal and Horizon Europe programmes have been directed towards pilot projects focusing on heat mitigation and climate adaptation. These include urban reforestation initiatives, water management systems to combat heat stress and retrofitting public housing with energy-efficient cooling systems. Public-private partnerships have been instrumental in financing innovative solutions for heat management. Collaborations with private firms have facilitated the deployment of green roofing technologies, solar-powered cooling systems and sustainable construction practices in urban redevelopment projects. These partnerships often include shared risk and investment, ensuring mutual benefits for both the city and private entities.

Rome benefits from resources allocated through the European Union's Climate Adaptation Platform, which is designed to help cities improve their resilience to climate impacts. These funds have been instrumental in supporting the development of heat action plans, enhancing cooling infrastructure in vulnerable areas and expanding green spaces to mitigate the urban heat island effect. National funding programmes also assist public health services in responding to heatwaves and implementing early warning systems that alert local authorities and residents to impending heat events.

Tax incentives and rebates are offered to encourage businesses and residents to adopt sustainable practices. Homeowners who install energy-efficient cooling systems, green roofs or solar panels can benefit from tax deductions. Similarly, businesses implementing environmentally friendly cooling technologies receive subsidies to offset the initial costs.

Wroclaw, Poland

The city has utilised various financing models to support heat risk management initiatives, including local government budget allocations and grants from international projects. For instance, Wroclaw's participation in the GrowGreen project has provided funding for nature-based solutions to mitigate heat stress and flooding. Moreover, participation in the LIFECOOLCITY project aims to improve the management of greenery and adapt urban spaces to climate change.

One initiative designed to support funding for heat risk management is a programme run by the Urban Greenery Management Unit, which manages municipal green areas, and investment in their maintenance and planting on behalf of the city of Wroclaw. The Green Patronage programme encourages residents and businesses to sponsor green investments in the city. Thanks to Green Patronage, individuals can contribute directly to planting trees, shrubs and perennial beds across the city, as well as enrich public green spaces with small-scale architectural features or even create a pocket park.

The city adopted a resolution to provide property tax exemptions for residents of buildings on which green roofs and vertical gardens have been installed.

The resolution provides an exemption for properties with a green roof, as well as for those with vertical gardens installed on external walls. As defined in the resolution, qualifying green roofs must be long-lasting and overgrown with perennial plants on an adapted, multi-layer roof covering that allows them to grow in multiple seasons. Similarly, vertical gardens (green walls) must be planted with perennial plants on a suitable substrate that allows them to grow for many years.

2.1.5. Community Engagement

Amadora, Portugal

In Amadora, key stakeholders – including the Red Cross, local police and the Social Department – work together to enhance outreach, especially to vulnerable groups such as elderly and homeless people. The city's health and social services conduct twice-weekly summer visits to 3,000–4,000 residents, ensuring they receive the necessary support and information. The city has also made efforts to increase public awareness about the dangers of extreme heat. Educational campaigns and community engagement have helped residents understand how to protect themselves during heatwaves.

Kraljevo, Serbia

A visitor centre was built as part of a project with United Nations Development Programme and additional control points are planned across the city of Kraljevo. The centre, which monitors and manages forest complexes, is located within the protected area of the Studenica Monastery, a UNESCO World Heritage site.

Community Engagement – Milan

The city of Milan has engaged residents in developing and implementing its Air and Climate Plan, approved by Milan's City Council in February 2022, which aims to tackle air pollution, carbon emissions and the urban heat island effect. The plan calls for the creation of a permanent citizens' assembly on climate to evaluate the city's actions and propose new ones.[32]

Leova, Republic of Moldova

In the city of Leova, the primary support for the communication comes from local residents, who help

---

32   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package.
     See www.undrr.org/media/103947/download?startDownload=20250114

disseminate announcements, and the General Inspectorate for Emergency Situations. Residents play a crucial role in sharing information through informal networks, ensuring it reaches as many people as possible, including those who may not have direct access to online platforms.

Mykolaiv, Ukraine

Notifications from the regional Hydrometeorological Centre about forecasted periods of extreme heat are shared with the community. Alerts are communicated via local media (e.g., TV and radio), smart phone apps and the official social media pages of the city council, which publishes information about heat-related risks and relevant safety measures. During heatwaves, the city council issues public announcements via loudspeakers, particularly in densely populated areas.

Social protection workers inform elderly people and people with disabilities about the dangers of heatwaves, and provide additional support when necessary. Campaigns are organised through NGOs and volunteers to help homeless and other vulnerable people.

However, not all community groups have access to the internet or media, which limits the reach of warnings. Additionally, not all public spaces and buildings are suitable for cooling points or access for people with reduced mobility. These challenges require further improvement of early warning systems and closer cooperation with partners.

Wroclaw, Poland

The city of Wroclaw has launched the Catch the Rain and I Like the Rain programmes. Catch the Rain aims to increase the amount of rainwater collected and stored by residents, providing funding for rainwater gardens and tanks that improve water retention in the city. In addition to offering financial support for the purchase of pro-ecological installations, the programme has an educational impact, emphasising that rainwater is a valuable resource that can be retained and used in gardens or on balconies to support the development of a greener city.

I Like the Rain aims to raise awareness among children, young people and other residents about sustainable rainwater management in the city in an era of climate

change. The project involves the development of school rain gardens, complemented by educational workshops.

Local activity centres and neighbourhood councils support the work of the city and create local networks between neighbourhood stakeholders.

The activities of the local activity centres, in cooperation with neighbourhood councils, serve to integrate and strengthen the community, as well as foster lasting relationships between people from different backgrounds.

2.1.6. Support from National Government

Amadora, Portugal

The national government largely supports Amadora's heat risk management indirectly, with direct assistance, such as designated funding or policies specifically tailored to the city's needs, being limited. Instead, the national government's influence and resources flow through the Metropolitan Authority, which coordinates climate efforts across the 18 municipalities within the Lisbon Metropolitan Area, including Amadora, though Amadora must compete or collaborate with neighbouring cities to shape these initiatives.

Amadora has a strong relationship with the Metropolitan Authority, which has implemented the Climate Change Adaptation Plan covering heatwaves and has funded local projects (e.g., the development of urban parks), benefiting Amadora and neighbouring cities. This regional structure facilitates valuable collaboration and resource sharing, enabling Amadora to co-design projects that address both local and regional needs. However, it can sometimes slow the city's ability to address specific issues quickly, as resources and priorities are shared across the region rather than directly allocated to the city.

Bonn, Germany

The national government establishes legal guidelines, and provides advice and funding, such as through the federal programme Adaption of Urban Areas to Climate Change.

Through this programme, the federal state supports, among other things, climate-appropriate redesign projects in and around Bonn, such as the city centre of Bad Godesberg and Stiftsplatz. Meanwhile, the Programme for Sustainable Climate Protection in Municipal Areas supports the city in funding sustainable climate protection and adaptation measures, and strengthening biodiversity through, for example, tree planting and unsealing surfaces.

Leova, Republic of Moldova

The national government of the Republic of Moldova plays a crucial role in supporting heat risk management through policy guidance, technical assistance and financial support. The national government provides strategic direction through national climate adaptation plans, which guide local efforts in managing heat risks. The plans ensure alignment of local actions with Moldova's commitments to global climate initiatives and frameworks.

Institutions, such as the State Hydrometeorological Service, offer critical data on weather patterns, heat risk projections and early warning systems, which inform the city's planning and response efforts.

Funding from national sources, such as the National Fund for Regional and Local Development, supports the implementation of heat mitigation and climate adaptation projects.

The national government has established regulations and standards for urban development, green infrastructure and energy efficiency, which help mitigate urban heat risks.

National collaboration platforms encourage local authorities to share knowledge and experiences of climate risk management. However, they are not well promoted. Continued capacity-building support, more predictable funding mechanisms and enhanced local autonomy are needed to further strengthen the city's resilience to heat risks.

Rome, Italy

The national government of Italy plays a critical role in supporting Rome's heat risk management through various legislative frameworks, financial resources and policy guidance. Italy's national approach to addressing heat risk is aligned with broader climate adaptation and disaster management efforts, which directly benefit cities like Rome.

One of the primary ways the national government supports heat risk management is through the National Strategy for Adaptation to Climate Change (SNA), which was launched in 2015. This strategy provides cities across Italy, including Rome, with a structured approach to adapting to the impacts of climate change, particularly in terms of extreme heat. The SNA sets out key guidelines for urban planning, public health measures and infrastructure improvements aimed at mitigating the effects of heat. These directives are essential for shaping local policies and interventions, ensuring that cities are prepared for heatwaves and extreme heat. In addition to policy frameworks, the national government provides significant financial support through various funding mechanisms.

The national government collaborates closely with the Ministry of Health to provide technical and operational guidance for the development of heat health action plans in cities like Rome. These plans are essential for coordinating responses during heatwaves, such as establishing cooling centres, distributing water, and ensuring that vulnerable groups – including elderly people and people with pre-existing health conditions – are protected. The early warning systems funded and supported at the national level enable Rome to prepare in advance for extreme heat, helping to minimise health risks and improve public safety during heatwaves.

Italy's Climate Change Adaptation Law, enacted in 2021, further reinforces the commitment of the national government to supporting cities' adaptation efforts. The law requires cities to incorporate climate change adaptation strategies into urban planning processes, ensuring that climate resilience is a priority in all aspects of city development. For Rome, this has meant a more systematic approach to integrating heat risk reduction measures, such as increasing green spaces and improving the design of urban areas to combat the effects of extreme heat.

2.2. Urban Design and Planning

2.2.1. Built Environment and Land-Use Planning

Amadora, Portugal

Amadora has taken actions, such as integrating urban planning with emergency and contingency planning, to ensure that development aligns with resilience goals and building codes. These initiatives represent essential steps towards embedding heat risk reduction into the city's structural and strategic framework for sustainable urban resilience.

Bonn, Germany

City climate analyses have been conducted through the ZURES project in July 2018 and, based on these analyses, planning recommendation maps have been developed. Additionally, the MUTABOR project identified the city's technical and planning adaptation potential. The responsibility for both projects lies with the Environmental Office of the Department of Climate Adaptation.

Notable developments include the installation of drinking water fountains at several locations around the city. Additionally, new public buildings, such as schools, incorporate climate adaptation measures, including green roofs and rainwater management. In general, the greening of roofs and facades is required in building planning, while greening private house roofs and facades is financially supported. An integrated climate adaptation concept, funded by the Federal Ministry for the Environment, is currently being developed as a systematic superstructure for Bonn's climate adaptation activities.

Moreover, Bonn has developed a concept based on the sponge city principle to mitigate drought and excessive heat.[33] The natural water cycle will be strengthened by retaining rainwater rather than allowing it to rapidly drain into the sewage system, evaporate or seep away. The concept forms one of the three pillars of water-sensitive urban development – alongside heavy rainfall prevention and flood protection. Each pillar functions independently, while also generating synergistic benefits.

Leova, Republic of Moldova

Currently, urban design and planning strategies to reduce urban heat risk in Leova are limited, with annual tree-planting activities organised by the local authorities serving as the primary measure. While these efforts contribute to greening the city and providing some shade, they are not yet part of a comprehensive urban heat risk reduction strategy.

The city of Leova ensures that all constructions comply with the regulations and requirements outlined in the city's General Urban Plan (Planul Urbanistic General). While these regulations provide a framework for urban development, they do not explicitly integrate specific measures aimed at reducing heat risks.

Barcelona's Heat Shelters

The city of Barcelona in Spain has established one of the largest networks of climate shelters in the world, totalling 368 shelters in 2024 (compared to 70 in 2020). The shelters are accessible (indoor or outdoor) spaces, which offer relief for any resident in need during a heatwave and other extreme event. The shelters are located throughout the city – as libraries, parks, markets and churches comprise the dense map of cool spots – ensuring that 98 percent of residents can reach a shelter within a 10-minute walk. Barcelona plans to further increase the number of shelters so that, by 2030, all residents are able to reach one within a five-minute walk. Thus, Barcelona has successfully utilised existing city infrastructure, making the most of collaboration with various stakeholders, who also benefit from urban shading.[34]

33   www.bonn.de/medien-global/amt-67/projekte-zur-klimaanpassung/Schwammstadtkonzept-Bonn-Endbericht.pdf
34   More on the initiative could be found at: www.barcelona.cat/barcelona-pel-clima/en/specific-actions/climate-shelters-network

Mykolaiv, Ukraine

The city of Mykolaiv has implemented several urban design solutions. The use of reflective materials, and energy-saving technologies for roofs of new and renovated buildings is encouraged, while measures have been taken to increase the distance between buildings to ensure air circulation. Shading of public spaces has been introduced, for example, through the installation of canopies, gazebos and awnings in parks, playgrounds and near public transport stops. Fountains and water features have been strategically integrated into public spaces.

Zoning design and building standards have been adopted, ensuring a minimum level of greenery within each development site. New requirements for the thermal insulation of facades and roofs, which reduce the effect of heat load on buildings, have been introduced. Urban development in catchment areas and areas with valuable ecosystems has been prohibited.

Rome, Italy

Rome has adopted a variety of urban design and planning strategies to reduce urban heat risk. The city has focused on expanding green spaces, including parks, and tree planting to provide natural cooling and reduce the urban heat island effect. The promotion of cool roofs, which use reflective materials to lower surface temperatures, is another key measure. Shading through the strategic placement of trees and the construction of shaded areas in public spaces is commonly integrated into urban planning to protect residents from direct sunlight and reduce heat exposure.

Rome has adapted its building codes and land-use plans to incorporate heat risk reduction by mandating energy-efficient building practices. This includes the use of materials that mitigate heat absorption, and the integration of green roofs and walls into new buildings. The city encourages the development of buildings that are designed to reduce heat retention, improving thermal comfort. Land-use plans prioritise the creation of green corridors and urban parks, which help to cool the environment and provide residents with heat refuges.

Although Rome has taken significant steps with adaptive building codes, further work is needed to retrofit existing buildings to make them more resilient to heat. This includes improving insulation, increasing the use of reflective materials and enhancing natural ventilation. The construction of energy-efficient cooling systems in both residential and commercial buildings will be vital.

Wroclaw, Poland

Wroclaw has adopted a range of urban design strategies to mitigate heat risk. In terms of spatial planning, Wroclaw is pursuing long-term solutions at various scales to reduce heat risks. The Wroclaw Masterplan, which is updated every few years with a strong emphasis on greenery, serves as the basis for developing and revising local spatial development plans.

As part of municipal design and planning strategies under the 2018 Wroclaw Masterplan, Wroclaw established unites with dominant green uses spanning multiple urban planning units. In these areas, new construction is restricted, with the purpose of balancing urbanization, preserving nature, and mitigating the effects of climate change.

Recreational green zones are being developed within residential, service and industrial complexes to enhance these areas, and improve the microclimate, mitigate urban heat island effects and deliver a range of additional benefits associated with integrating greenery into urbanised spaces.

The Greenery Without Borders policy was developed to guide environmental and landscaping efforts. It defines three types of greenery zones: dominant zones, which prioritise the protection of natural values, ecological corridors and biodiversity; equivalent zones, which integrate greenery into the residential areas of various housing and service areas; and co-creative zones, which accompany industrial facilities, primarily serving as visual buffers and aesthetic framing for buildings.

Local development plans take into account the need to minimise the urban heat island effect. Specific measures include mandatory provisions for a minimum percentage of biologically active areas and the retention of natural (native) soil, defined per site, as well as requirements for a designated proportion of tall vegetation within each area.

New provisions require car parks to have at least one tree for every five parking spaces. Additional provisions are being drafted that would require the installation of green roofs, green walls and vertical gardens on building facades. Meanwhile, measures to support the modernisation of existing buildings, aiming to enhance their thermal efficiency and comfort, and reduce their carbon footprint, are under consideration.

Measures to enhance the attractiveness and accessibility of public transport are being developed, including the designation of new stops, the development of Park & Ride infrastructure, and the identification of potential sites for future bus and tram lines.

Seville's Policy of Shade

With high summer temperatures, Seville was the first city in Spain to assign names to specific heatwaves, similar to the naming of hurricanes and typhoons in the United States and Asia. The city has introduced the so-called Policy of Shade, installing awnings around the city to provide shading for residents. This initiative is complemented by other policies and measures, such as using reflective materials in construction, installing more public fountains and planting 5,000 trees per year.

Another notable initiative is CartujaQanat, a €5 million pilot project, 80 percent financed by the European Union. CartujaQanat aims to decrease average temperatures along one street by up to 10°C. The city administration has collaborated with various stakeholders, including the Universidad de Sevilla. The initiative replicates the 1,000-year-old Persian qanat system, constructing underground canals that transport water across a wide area to cool the surface above. The initiative will replace an older one from 1992, which relied on fossil fuel-powered engines, with a system powered entirely by renewable energy.[35]

2.2.2. Nature-Based Solutions

Amadora, Portugal

Amadora has adopted nature-based solutions, such as the creation of green corridors and urban parks, to enhance urban cooling and biodiversity. The city is also working on an ambitious tree-planting scheme, aiming to increase green areas by 50 percent over the next five years. This initiative emphasises community engagement, encouraging residents to participate in both the planning and implementation. Such participatory approaches not only improve the quality of urban design but also raise public awareness of the role green infrastructure plays in managing heat risks. Moreover, participatory approaches offer municipalities deeper insights into how urban heat impacts people at the community level.

Bonn, Germany

Bonn's efforts to implement nature-based solutions include increasing the proportion of green spaces, for example, by establishing pocket parks, planting mixed perennial beds, reducing mowing intervals in many parks, planting tree beds and strengthening the water cycle (e.g., by disconnecting rainwater and restoring canalised streams).

Mykolaiv fountains. Image: City of Mykolaiv

---

35   Bloomberg (2022) One of Europe's Hottest Cities Is Using 1,000-Year-Old Technology to Combat Climate Change.
See www.bloomberg.com/news/articles/2022-08-18/one-of-europe-s-hottest-cities-has-a-climate-change-battle-plan?cmpid=BBD082022_GREENDAILY&utm_medium=email&utm_source=newsletter&utm_term=220820&utm_campaign=greendaily

Green Infrastructure Solutions – Athens

In 2016, the city of Athens launched a Heatwave Action Plan, followed in 2017 by the adoption of a Resilience Strategy for 2030, both aiming to significantly curb CO_2 emissions, including through establishing green and blue corridors and increasing green spaces across the city, undertaking the necessary regulatory procedures for establishing new green public spaces, enhancing small urban framing boxes in school playground and develop urban farming in parks, and establishing sustainable water management and organic (green byproducts) waste management in all urban green areas, among other measures.[36] The Strategy aims to ensure: a 61 percent reduction of greenhouse gas emissions (compared to 2018); access of 70 percent of the population to a green area within 15 minutes of home; and that 30 percent of the city's surface should be covered by green areas.[37]

Measures already undertaken include retrofitting 14 schools with green roofs, remodelling the ancient Arch of Hadrian to irrigate a 24 km green corridor and an ongoing project to restore 24 deactivated fountains.[38]

with 7,000 seedlings being grown, seeds being collected and a mother plant in place. The nursery will supply zoned seedlings for landscaping within the city and surrounding areas, while providing residents with plants to green spaces their neighbourhoods. With the level of afforestation in the region just five percent, the Mayor's Office aims to maximise public involvement in landscaping as much as possible.

As part of a national programme, preparatory work aimed at restoring forest shelterbelts around the city's outskirts has begun.

Cleaning, deepening and partially concreting over problematic sections of rivers and canals in the municipality has been carried out.

Funding applications have been submitted to various programmes to support rainwater collection and utilisation in the municipal plant nursery and green areas. Additional proposals include planting of a climate-resilient, biodiverse lawn and developing an urban nature plan.

Mykolaiv, Ukraine

Mykolaiv has worked towards expanding existing and creating new green areas. Examples include the improvement of the city's central park and smaller green spaces. Greening city streets and alleys to create natural ventilation routes has also taken place. The city is developing projects to preserve natural water bodies, such as the coastal areas of the Southern Bug River. It has also initiated projects to develop green roofs and walls, starting with municipal buildings.

Ceadâr-Lunga, Republic of Moldova

The city of Ceadâr-Lunga has taken several steps to develop and implement nature-based solutions. For example, restoration of the Youth Park – a 10-hectare green area in the city centre – has begun, including the planting of 8,000 seedlings, and installation of a groundwater well and an irrigation system.

Furthermore, a municipal plant nursery is being established. Two hectares have already been prepared,

Ohrid, North Macedonia

Within the municipality, old trees are protected by law, as well as the Studenchta Swamp and Lake Ohrid Protected Area. Additionally, the municipality plans to plant trees

36   City of Athens & 100 Resilient Cities (2017) Redefining the City: Athens Resilience Strategy for 2030.
     See https://resilientcitiesnetwork.org/downloadable_resources/Network/Athens-Resilience-Strategy-English.pdf
37   This is Athens (2022) Climate Action Plan Approved by Athens City Council.
     See www.thisisathens.org/acvb/press-releases-climate-action-plan-approved-Athens-city-council
38   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package.
     See www.undrr.org/media/103947/download?startDownload=20250114

in public areas and require a specified percentage of greenery be developed or maintained within construction plots.

Wroclaw, Poland

In Wroclaw, the maintenance of most nature-based solutions falls under the responsibility of various municipal budgetary units in cooperation with the city. Notably, the Urban Greenery Management manages green areas and carries out maintenance and planting on behalf of the local authority.

In its day-to-day work, the Urban Greenery Management implements nature-based solutions. These include planting trees (approximately 2,500 per year), maintaining green spaces in a more sustainable way (e.g., less raking, leaving dead wood to decompose naturally on site, mulching under trees to loosen the soil and increase soil productivity, less frequent mowing, and defining no-interference zones in parks), conducting specialised treatments of mature and old trees (to increase not only safety but also their lifespan), and infrastructural measures (e.g., building rain gardens, deconstructing pavements and planting areas with vegetation, ranging from small interventions to very large ones).

All of the above-mentioned activities are ongoing. As part of this year's investment activities, for example, sections of pavement in designated green areas will be removed to make way for planting new trees.

The city of Wroclaw has implemented several key strategies to manage urban heat risks effectively. The city has redesigned and renovated courtyards in the densely populated Ołbin district, incorporating nature-based solutions such as swales, rain gardens and tree planting. These elements help manage rainwater, provide shade and reduce heat stress.

2.3. Early Warning Systems

Amadora, Portugal

Amadora has developed an early warning system with private sector support from Siemens to inform residents about heatwave risks and promote public safety.[39] The system primarily operates through SMS alerts, which provide timely warnings and recommendations based on data from the Meteorological Institute and health authorities. The Civil Protection Department coordinates these efforts, ensuring that information reaches residents quickly when heatwave conditions are expected.

When a heatwave warning is issued, Amadora activates a response protocol. Coordination meetings with partners are held to finalise strategies, assign responsibilities and craft clear messages. To maximise clarity, short templates with color-coded alerts and recommended actions are used, and disseminated via SMS, Facebook and other social media channels.

While largely effective, the early warning system still faces challenges such as the need for multilingual messaging to better serve non-Portuguese-speaking residents. Amadora acknowledges this gap and aims to provide critical updates in English and French to ensure inclusive access to information.

Bonn, Germany

The city of Bonn uses warning systems from the Germen Weather Service and disaster warning apps (NINA, Katwarn). Bonn does not have its own warning services, but it provides information through press releases and social media. The Centre for Adult Learning supports outreach for risk and resilience.

A survey was previously conducted in nursing and care homes by the health department. It showed that heat warnings are independently monitored, with corresponding measures (e.g., adjusted diet and hydration) implemented in the facilities. For vulnerable groups, reaching out to multiplicators (e.g., support persons, caregivers and

---

39   https://www.cm-amadora.pt/pt/protecao-civil

custodians) and strengthening neighbourhood support systems is essential.

Ceadâr–Lunga, Republic of Moldova

The city does not have an early warning system and local authorities use all available means to inform residents. Information about abnormal weather conditions is posted on the official page of the Mayor's Office, on social media and in online forums (e.g., a Viber group for residents of the municipality). Social assistants also help inform vulnerable groups.

Kraljevo, Serbia

Early warnings are disseminated by the national early warning system. Most warnings are transmitted through television and electronic services. The Civil Protection Department is conducting a wide-ranging campaign focusing on people with disabilities, as well as people from other vulnerable and marginalised groups.

Leova, Republic of Moldova

Currently, the city of Leova does not have a specific early warning system in place for heatwaves. The only warnings available are meteorological alerts provided by the local administration, which are distributed online and accessible to residents. These alerts typically inform the public about weather conditions, including heatwaves. However, there is no dedicated early warning system designed specifically to address heatwave risks or to provide more targeted information.

Vulnerable groups – such as elderly and homeless people, and people with disabilities – do not always have access to online resources, posing challenges for their timely awareness.

Rome, Italy

Rome has established a comprehensive early warning system for heatwaves as part of its broader Heat Health Action Plan, which is closely aligned with national efforts to mitigate the health impacts of extreme heat. This system relies on meteorological data from the National Meteorological Service and local weather monitoring agencies, including the Regional Meteorological Agency of Lazio. The system uses advanced weather forecasting to predict heatwaves and their intensity several days in advance. Once a heat event is identified, the system issues alerts based on specific thresholds, such as temperature and humidity levels, that are known to pose health risks to vulnerable groups. These alerts are categorized by severity levels, ranging from yellow (moderate risk) to red (severe risk), helping local authorities prepare and respond accordingly.

The communication of heatwave warnings in Rome is managed through a multi-channel approach to ensure widespread reach. General public warnings are broadcast through traditional media, including television, radio and newspapers, as well as digital platforms such as social media, websites and smart phone apps. However, Rome takes additional measures to ensure that vulnerable groups – such as elderly and homeless people, and people with disabilities – receive timely and actionable information. Social service agencies, local health departments and NGOs play a key role in this aspect by providing personalised alerts through phone calls, SMS and, in some cases, door-to-door visits. Special outreach efforts are made in areas with high concentrations of vulnerable residents, such as senior housing complexes and shelters for the homeless, to ensure they are well prepared for heatwaves. Additionally, city officials collaborate with organisations that work with people with disabilities to ensure that information is accessible, for example, through sign language interpreters and audio alerts.

Volunteers from local communities and organisations are also crucial to direct outreach, ensuring that the most vulnerable are reached and that appropriate responses are mobilised. The private sector, including energy providers and healthcare companies, contributes to the system by providing cooling solutions, such as air conditioning and temporary shelters, and ensuring the reliability of essential infrastructure during extreme heat events.

Ub, Serbia

Three meteorological stations have been installed to monitor heat conditions across different areas of the municipality, and messages are shared with the public through local media and the official website of the municipality.

Wroclaw, Poland

The city of Wroclaw uses notifications from the Institute of Meteorology and Water Management. Information about hazards is addressed to all city residents and visitors through several information channels.

The city operates a system to warn the public of potential hazards. The system consists of a control panel and alarm points equipped with electronic alarm sirens, which are installed on the roofs of buildings in specific locations around the city. In total, there are 41 alarm points with a sound power of 1,500W (the system is in the process of being expanded with the installation of more sirens).

All alarm points are managed and controlled by the Crisis Management Centre of Wroclaw. The alarm siren system is supplemented by a system for warning and informing residents of threats via the BLISKO application.
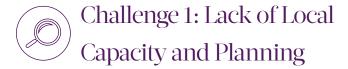

City of Leova, Republic of Moldova. Image: Shutterstock / Gagarin Iurii

Chapter 3:
Common Challenges
and Scalable Solutions

Responses from the 11 partner cities and municipalities surveyed, combined with findings from prior research, reveal that most challenges faced by local authorities are broadly similar. This chapter maps several of these challenges and matches them with scalable solutions. Most of the solutions were proposed by the respondents and are supported by proven methods drawn from additional sources.

Challenge 1: Lack of Local Capacity and Planning

A major obstacle to long-term planning and coordination is the lack of local heat strategies, whether standalone or integrated within wider disaster risk reduction and climate adaptation strategies, accompanied by implementation plans and dedicated resources.

Another prevalent challenge reported by most respondents was the lack of sufficient specialised personnel to operate the software and tools needed for effective heat management. Existing staff must often manage multiple roles and responsibilities, limiting their capacity to manage urban heat planning and activities effectively. Expertise, continuous capacity building and availability of dedicated personnel are essential for ensuring cities' resilience to rising temperatures.

> "Staffing shortages in key departments, such as urban planning and environmental management, limit the city's capacity to implement large-scale initiatives."

The lack of advanced climate modelling and heat mitigation technologies, allowing for the development of innovative solutions and integration of international best practices into the local context, were highlighted as important gaps by respondents. In places, limited access to training opportunities or knowledge-sharing platforms for city officials and planners was pointed out.

Solutions

One of the most important success factors, confirmed by a number of respondents, is the **strong and committed leadership shown by local government officials** to addressing climate change and urban heat, and ensuring that heat risk management remains a city priority. Political support for climate resilience – particularly through the development of a heat strategy or action plan, and a wider disaster risk reduction and climate strategy – is crucial in ensuring long-term focus on heat risk mitigation and linking it to overall climate adaptation efforts. Strong political leadership also helps secure funding and resources from both the public and private sectors to implement heat management measures. Cities that lack dedicated heat action plans struggle to coordinate efforts, involve key stakeholders and allocate resources effectively, leading to siloed approaches, and potentially to programming and budgetary overlaps.

A dedicated **focal point for heat management and climate adaptation** could support the coherent implementation and monitoring of activities, acting as a central coordinator, overseeing heat risk strategies, consolidating efforts from multiple departments and ensuring streamlined decision-making.

Urban heat strategies and action plans need to **include realistic objectives, clearly defined roles and responsibilities, indicators and timelines, budget lines for each activity, and defined monitoring mechanisms**. Regular updates and adjustments should also be envisaged. Critically, these efforts need to be integrated into long-term urban development and resilience planning, and be aligned with other existing and planned strategies and activities. Furthermore, heat and wider climate resilience should be considered in all major infrastructure projects, with an emphasis on reducing heat exposure and improving overall urban comfort. According to respondents, this could involve implementing more climate-responsive zoning regulations, encouraging sustainable land use and developing urban designs that prioritise resilience to extreme heat events.

The monitoring and evaluation of heat risk management will ensure the effectiveness of early warning systems, cooling strategies, infrastructure investments and

other measures, and that efforts are targeted, efficient and impactful. This data can also inform future decision-making and support better continuous adaptation to changing climatic conditions.

Specialist training for urban planners, architects and city officials, along with securing additional financial and technical resources for implementation, should be a priority for cities and municipalities. **Investing in ongoing capacity building** is essential for equipping administrators and other stakeholders with the skills, knowledge and tools required for the management of urban heat risks.[40] The facilitation of capacity-building initiatives – such as workshops, certifications and knowledge-sharing sessions – can be done in **collaboration with partners** such as academic institutions, regional and international organisations, local NGOs, community leaders, and private sector actors. Respondents highlighted successful partnerships with a range of stakeholders, including the Red Cross, local police and companies such as Siemens. Respondents also reported community engagement in international initiatives, including ICLEI Local Governments for Sustainability, the MCR2030 initiative and C40 Cities. These partnerships can support local governments in ways that are less of a burden on limited budgets, while ensuring broader outreach to different groups in society.

> "Amadora's involvement in the Making Cities Resilient initiative provided essential frameworks for assessing heat risk, completing a scorecard assessment and developing a disaster risk reduction plan that highlighted urban heat as a key vulnerability, guiding the city's resilience strategies."

National government support is crucial for the development and implementation of long-term strategies and capacity building. Local governments can actively seek guidance on planning, implementation steps and best practices, while advocating for the necessary resources to promote the prioritisation of urban heat mitigation within national planning and budget frameworks. A list of recommendations on how national governments can support local authorities is available in the Urban Heat Risk Management Resource Package, developed by UNDRR.

Challenge 2: Lack of Funding

Unsurprisingly, the issue of limited funding was reported by every respondent, and remains a prevailing challenge among cities across the region and beyond.

Cities primarily rely on local and national public budgets and grants, which are limited. Consequently, delays in project execution are common. Several respondents mentioned the difficulty in justifying public investment in urban heat-related initiatives, which a number of stakeholders still view as one-time seasonal anomalies. Meanwhile, external funding through grants from international institutions is a competitive process and cannot be relied on over the long term, as local ownership is key.

Long-term changes in urban design, building standards, infrastructure upgrades and land use planning require substantial investment, stakeholder agreement and active participation. Such initiatives are further hampered by lengthy regulatory processes, space limitations in dense areas and the challenges of retrofitting existing infrastructure. Addressing immediate needs often takes priority, which can delay broader, structural adjustments. Policies and projects with long implementation timelines and lagged visible outcomes often deter investment, as they are perceived as high risk, especially within the constraints of fixed political mandates.

Solutions

One of the first steps that mayors and local administrations can take is to comprehensively assess the needs, gaps, planned and ongoing initiatives, and respective budget allocations of departments. **Initial heat risk mapping** can be done in collaboration with academic institutions, local and international NGOs such as the Red Cross, and through community engagement in ways which are not cost heavy, and assist not only in identifying high risk

---

40   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package.
    See www.undrr.org/media/103947/download?startDownload=20250114

spots within the urban fabric, but also help build important partnerships, raise awareness and offer residents a sense of ownership. **Budget tracking and tagging help identify overlaps in spending, and can reveal links** between various civil protection, disaster and climate management, urban resilience, and sustainability initiatives. Strategies, planning and activities should be done in a coherent manner, and local strategies and action plans should clarify linkages to all stakeholders, streamlining funding to programmes. In turn, this can provide systemic benefits and avoid solving one issue while creating another.

One respondent suggested the creation of a **dedicated office to explore blended financing options**, such as green bonds, municipal revenue mechanisms, insurance products, public-private partnerships and international funds. Such an office could also serve as the main body monitoring the different funding streams for resilience programmes.

EU and other external funding can be used to kick-start initiatives, complemented by activities financed through other means. Cities benefit most when **various financing mechanisms are utilised simultaneously** for projects of different scales. Data collected during project implementation can support future funding requests, particularly once a track record of positive impacts – for example, on urban quality of life – has been established.

If initial funding is limited, cities can start with small-scale interventions. This can include **targeted design changes in high-risk urban areas**, including installing shading, greening public transport stops, and engaging communities in collaborative green activities with local NGOs, schools, neighbouring municipalities and international actors. These efforts can initiate dialogue around mitigating urban heat and provide early-stage evidence of the benefits such programmes can deliver.

Establishing cooperation with the private sector, for example, though public-private partnerships, can have the double effect of attracting private funding and encouraging businesses to operate in more sustainable ways. The private sector can contribute to extreme heat and wider resilience activities by incorporating climate change adaptation and extreme heat into business portfolios, for example, through decarbonising

operations and climate resilience focused corporate social responsibility.[41] Competing interests between public and private sector actors can be alleviated through specific policies, combining legal requirements and incentives. This would be especially valuable when working with building companies, as the initial cost for investment in green solutions is higher. Public-private partnerships can be leveraged to fund large-scale projects, such as district cooling systems and green infrastructure initiatives.

Specific **incentives can be offered to citizens** if they opt for green solutions, such as greening home roofs, using reflective materials and installing solar panels for energy saving.

Challenge 3: Stakeholder Coordination

Respondents reported limited and/or weak collaboration between local authorities, civil society and technical institutions for coordinating responses to heat risks. Ineffective cross-departmental communication, and an absence of clearly defined roles and responsibilities in addressing heat-related challenges further undermine efforts, and prevent cities from implementing coherent and comprehensive solutions. Frequent changes in the composition of governing bodies can also hamper project approvals and implementation. Meanwhile, limited funding sometimes leads to competition between different stakeholders. At the same time, public and private interests often diverge, and differing project timeframes for public and private sector projects make effective coordination challenging.
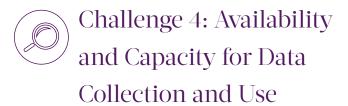
Solutions

Aligning the diverse objectives of various stakeholders requires **effective communication and strategic planning**. Solutions to this challenge already exist within

41 Nissanka, S. et al (2025) Challenges of Built Environment's Stakeholders in Climate Change Adaptation. Springer International Publishing AG. DOI: https://doi.org/10.1007/978-3-031-75826-3_6

local planning frameworks, capacity-building efforts, and funding for urban heat and wider resilience initiatives. **Political support and leadership from the highest level** is essential to drive transformative action and build partnerships, as leaders have the convening power to align stakeholders, coordinate across departments and mobilise resources. Mayors and governing bodies need to engage stakeholders, and **highlight the economic, social and health impacts of urban heat, as well as the co-benefits of action**.[42] Increasing heat puts pressure on the private sector, with higher costs for cooling and infrastructure damage disrupting routine operations. Bridging diverse perspectives and recognising opportunities for collaboration are key to tackling heat and climate challenges in a comprehensive and effective way.

Overcoming coordination obstacles involves **fostering a shared understanding of goals, establishing clear communication channels and developing processes that align the interests of all parties** involved. Developing a **local strategy and action plan** with clear roles for stakeholders, appointing a dedicated focal point or coordination body, and introducing policies that incentivise resilience actions can provide a robust framework on which different stakeholders orientate themselves.

Challenge 4: Availability and Capacity for Data Collection and Use

The lack of capacity for localised climate and environmental data collection, and especially of disaggregated data, for risk analysis and early warning is a prevailing issue among cities. A number of local authorities depend on national-level data, which may not adequately capture urban-specific heat risks. Without robust and integrated data systems, a city's ability to make risk-informed decisions, and attract funding and support are diminished, as national bodies and financial institutions often require project proposals to be evidenced by data and analysis.[43]

Solutions

Conducting a **city baseline heat risk assessment and mapping** can be an important first step to address data gaps and support early city action planning. This can be done in collaboration with academic and research institutions, regional and international organisations, and the community itself. Enhancing collaboration with healthcare institutions and private stakeholders, such as receiving data on hospital admissions and insurance information, will allow cities to better understand heat impacts on residents and to develop more targeted interventions that support the needs of the most vulnerable people. Such partnerships require less resources, while at the same time provide for a more comprehensive understanding of urban heat risks and vulnerabilities.

A number of examples regarding the **involvement of local communities** in identifying needs and solutions are already available. Specific activities and relatively low-cost interventions can include forming community roundtables, developing heat surveys, appointing heat ambassadors and steering committees, and establishing community centres.[44] Such efforts can be integrated into broader disaster risk reduction and climate adaptation efforts within a city or municipality, offering additional benefits such as raising community awareness, deepening understanding of local needs (especially of the most vulnerable groups) and facilitating the collection of community-driven solutions, making residents feel heard. Participatory approaches also cultivate a stronger sense of ownership and value of shared urban spaces among residents, encouraging greater care and stewardship of public property. Finding easy-to-understand ways to share the outcomes of initiatives with community members and strategic partners will ensure renewed commitment.

42   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package. See www.undrr.org/media/103947/download?startDownload=20250114
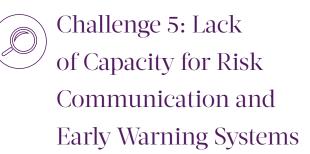
43   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package. See www.undrr.org/media/103947/download?startDownload=20250114

44   C40 Cities (2021) Neighbourhood level cooling: Experiences from C40's Cool Cities Network. See https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000MyWE/lnJB7Ej.5cyaDdo_ZZAXutOE9TkTTjDANA7EQ67aCiY

Other, more technical solutions can include the **installation of microclimate sensors** in high-risk places to measure changes in heat, assisting decision-making on the right measures to be implemented, and verifying the success of interventions and investments. Sensors can initially be placed in small areas to test the functionalities and results, and later scaled up to cover wider urban zones. Sensors can also be used to track other metrics such as air quality, noise and traffic.[45]

Cities can explore existing **guidelines and tools** to support comprehensive risk assessments and identify adaptation strategies that best serve their specific needs. Such tools include the UNDRR Disaster Resilience Scorecard for Cities[46] and the EU Urban Adaptation Support Tool.[47]

Challenge 5: Lack of Capacity for Risk Communication and Early Warning Systems

Respondents described several challenges in ensuring the effectiveness of early warning systems for heatwaves. Reaching all vulnerable populations is one of the most significant issues. While modern communication tools, such as smart phone apps and social media, can spread information rapidly, there are many residents, especially elderly people or people on low incomes, who may not have access to these platforms or may have limited digital literacy. This is particularly true in areas where there is a high concentration of elderly residents, immigrants and low-income earners, all of whom may be more vulnerable to heat risks.

Furthermore, a lack of infrastructure, technology, protocols and local capacity hamper effective risk communication. General weather forecasts and updates, which are often used in place of dedicated heat warning systems, are unable to provide the localised, actionable information needed to safeguard communities.[48]

Solutions

Several cities have addressed the lack of technical capacity through **effective collaboration with multiple sectors** – urban planning, public health, environmental protection, social services and emergency response. For example, respondents noted that collaboration between municipal authorities, health organisations and NGOs had facilitated the delivery of targeted support to vulnerable groups during heat events.

Traditional methods of sharing information should be considered alongside more technical solutions. Local radio, community hubs, interest clubs and gatherings can be utilised to share knowledge about heat responses and disseminate warnings. Heat ambassadors can be appointed to engage with communities, and partnerships with local NGOs, refugee centres, hospitals and care homes can be established to reach the most vulnerable groups in society.

Respondents also discussed plans to develop **multi-lingual risk communication** in order to provide warnings for all residents and tourists, ensuring that everyone is protected.

---

45   C40 Cities (2021) Neighbourhood level cooling: Experiences from C40's Cool Cities Network.
     See https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000MyWE/lnJB7Ej.5cyaDdo_ZZAXutOE9TkTTjDANA7EQ67aCiY
46   Available at: https://mcr2030.undrr.org/disaster-resilience-scorecard-cities
47   Available at: https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-ast/step-0-0
48   UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package.
     See www.undrr.org/media/103947/download?startDownload=20250114

Challenge 6:
Lack of Awareness

For many cities, urban heat has only become an issue in recent years. Furthermore, for many, the urban heat effect has for a long time represented a cyclical condition to be mitigated by increased air conditioning, rather than as a systemic issue requiring comprehensive, long-term solutions. Increased energy demand for air conditioning, however, only exacerbates the issue by generating additional waste heat and greenhouse gas emissions.[49] Respondents reported that attention to urban heat is usually only present during an acute heatwave and less during the rest of the year. Urban heat and climate adaptation still play a secondary role in municipal planning and should be given more attention. In many places, the legal foundations for climate adaptation are yet to be clarified and strengthened.

Moreover, public perception of warnings can be inconsistent, as some residents may not take heatwave alerts seriously, particularly when they have not experienced extreme heat previously or when a heatwave is not as severe as forecasted. Public trust in the system, therefore, remains a challenge and more educational campaigns are needed to ensure that residents understand the importance of taking the necessary precautions when warnings are issued. Where low living standards and incomes prevail, residents tend to focus on personal challenges aimed at survival.

Lastly, the financial sustainability of maintaining and enhancing early warning systems remains a concern. As the frequency and intensity of heatwaves increase due to climate change, demand for improved technologies and infrastructure to monitor, predict and respond to these events also increases. Ensuring that the necessary resources are available requires continued investment from both the public and private sectors.

Increasing awareness of the full range of available solutions also takes time, as it involves adapting traditional practices, and expanding knowledge and capacity around innovative, climate-resilient strategies.

Solutions

Cities can implement a diverse set of solutions to target different groups in society. But first of all, where necessary, **city officials need to be sensitised** to the issue of urban heat and other climate challenges. Capacity-building and educational programmes, regular meetings with relevant public servants, and appointing an urban heat focal point to coordinate engagement and input can enhance understanding and change perceptions. Representatives from different departments and sectors – such as infrastructure, waste, energy, urban planning, construction and finance – need to work together. The success of solutions requires **active, cross-sectoral participation**.

An **engagement mechanism** can be developed that enables local governments to openly discuss ideas and plan interventions with interested private companies, academic bodies and community leaders. Academic and research institutions can be instrumental in nurturing skills and knowledge, and disseminating extreme heat, and climate and disaster-related information.[50] By expanding educational campaigns and encouraging community input from the outset, cities can ensure that residents are well informed and empowered to take protective measures during extreme heat events. The engagement or participatory mechanism should be embedded in city action plans to ensure continuation and monitoring of efforts, and in a way that considers inclusivity and equity.

Starting with small, immediate, low-cost changes – such as installing awnings and shading; and acting as an example through, for instance, greening public buildings and public transport stops – can show the way for other stakeholders and residents, and build trust for longer-term solutions, which require more resources.

Public health campaigns, especially those targeting vulnerable groups such as elderly and homeless people,

49 UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package.
     See www.undrr.org/media/103947/download?startDownload=20250114
50 Nissanka, S. et al (2025) Challenges of Built Environment's Stakeholders in Climate Change Adaptation. Springer International Publishing
     AG. DOI: https://doi.org/10.1007/978-3-031-75826-3_6

have successfully raised awareness about the importance of hydration, staying cool and using public cooling centres during extreme heat events.

Including heat and overall climate adaptation awareness in school curriculums or after-class activities can prepare the next generation of community members for changing conditions, providing children and young people with important skillsets to tackle the impacts of urban heat and prevent incidents.

> "The major transformation Bonn – like all cities – is undergoing can only be mastered if it has the support and ownership of the people. On our pathway towards Climate Neutrality 2035, we are working with so-called climate districts – these could also present an opportunity to advance self-preparedness and swift reaction in case of heat incidents."

Challenge 7: Space Constraints for Nature-Based Solutions in Densely Populated Urban Areas

While nature-based solutions provide improved cooling, enhanced biodiversity and stronger community engagement, some cities face obstacles in allocating space for greenery within dense urban environments.

Additionally, land-use conflicts can arise, particularly in areas where new green spaces or infrastructure may displace existing developments. Balancing economic development policies and environmental aspects with the need to preserve green spaces can be challenging. In historic cities, such as Rome, resistance to changing building codes and urban planning regulations, especially in historic areas where the preservation of architectural heritage is valid, the adoption of modern heat mitigation measures can be complicated. Another major challenge

is land rights, as many potential planting spaces in cities belong to private owners.

Some cities have reported that competing interests exist even between their own sustainability strategies. For example, expanding bicycle infrastructure requires space – not all of which can be reallocated from existing traffic infrastructure. The pressure on land use for housing drives increased densification, which negatively affects the urban climate. Requirements for climate adaptation, such as green roofs and facades, increase costs and, as a result, rents.

Solutions

Several solutions have been mentioned throughout the report, such as **introducing adaptive building codes, and integrating energy-efficient and environmental standards** into the construction of new buildings and modernisation of old ones. Specific measures can include the use of cool roofs, building insulation and green facades, as well as circular economy solutions to reduce energy waste. The higher initial cost can be compensated through **tax deductions or other incentives** provided by the municipality. The engagement of private sector representatives in the planning process can **raise awareness of the co-benefits** of investing in green solutions, such as improving building energy efficiency, and cutting cooling and heating costs.

Household and neighbourhood-level interventions can also be encouraged through incentives and community engagement.

In historic sites, other non-nature-based solutions, such as additional shading and cooling spots, may be more appropriate. Cities should retain the **possibility to mix and match various solutions that correspond to specific contexts and needs**.

To tackle competing interests, cities will first need to conduct a comprehensive overview of risks, needs and gaps. Risk mapping and engaging a wide variety of stakeholders, as well as different public departments, can help bring divergent opinions closer and find compromises that benefit most parties. All solutions should be planned and implemented in a manner that is **sustainable over the long term and does not contribute to the creation of other risks**.

Conclusion

Responses to the survey of cities in Europe and Central Asia show that the development and implementation of urban heat management policies varies significantly across localities. Nonetheless, a common denominator among all responses is urban heat, including the urban heat island effect, which is increasingly impacting human health, food security, infrastructure and services. Consequently, urban heat and the urban heat island effect are now recognised as key risks, requiring immediate short and long-term solutions.

Among the challenges identified by respondents and documented in the literature, the most prevalent include the lack of established urban heat action plans and designated coordinating bodies, insufficient human and financial resources, limited public awareness, inadequate early warning capacity, and diverging stakeholder interests.

Addressing these challenges requires a combination of measures and sustained financing. Above all, lasting progress requires unwavering political commitment and consistent, strong leadership. Embedding urban heat management in wider climate adaptation and disaster risk reduction policies and strategies, and ensuring coherence and alignment between documents and initiatives are critical for providing a clear governance framework. This process needs to be complemented by the development of context specific and realistic action plans, with identified stakeholders and responsibilities, timelines and

dedicated budget lines for each activity covering short, medium and long-term objectives. Several respondents recommended establishing a focal point or designated coordinating body for urban heat management as a good practice to mitigate siloed working among administrative bodies. Coordination with the respective national government was also reported to be a decisive element for success.

Stakeholder engagement and coordination were also identified as key steps towards enhancing resilience, involving academic institutions, the private sector, cultural and religious centres, neighbouring municipalities, and broad networks such as the MCR2030 initiative, ICLEI Local Governments for Sustainability and C40 Cities. The meaningful community engagement is essential for designing policies and measures that correspond to actual needs, and assists in smoothing out different viewpoints and conflicting interests. Community engagement can also serve as a valuable vehicle for the implementation of appropriate actions, creating a sense of ownership among residents. Special attention should be given to vulnerable groups, and both their needs and capacities to contribute.

All respondents stressed that dedicated, predictable budgets are crucial to safeguard long-term gains and implement larger-scale solutions. Cities benefit most if various financing mechanisms are utilised simultaneously

for different scale projects. In this regard, the support of national governments is pivotal, but it can be accompanied by other funding opportunities, such as international aid and private sector support. Special policy measures can be included to target private sectors – these can include a combination of obligations and incentives for investing in and integrating resilience measures. Moreover, public-private partnerships can have the double effect of both securing private funding and encouraging businesses to operate in more sustainable ways.

Conducting risk assessments and collecting quality disaggregated data should be the basis for all planning and policy development, as measures need to be backed by a comprehensive understanding of the risk landscape. Importantly, the implementation of one measure should not negatively impact other risk areas, and long-term vision and planning are essential in this regard. Conducting a city baseline heat risk assessment and mapping can be an important first step to address data gaps and support early city action planning. This can be done in collaboration with academic and research institutions, regional and international organisations, and the community itself.

For many cities, urban heat has only become an issue in recent years, with not only residents but also institutions insufficiently aware of the risks involved. Capacity building, educational programming, regular meetings with relevant public servants, and appointing an urban heat focal point to coordinate engagement and input can enhance understanding and change perceptions. Representatives from different departments and sectors – such as infrastructure, waste, energy, urban planning, construction and finance – need to be brought together. Public health campaigns, especially those targeting vulnerable groups such as elderly and homeless people, have been successful in raising awareness about the importance of hydration, staying cool and using public cooling centres during extreme heat events. Finally, collaborating with local media, telecommunication service providers and the community can increase the effectiveness of early warning messages and systems, providing vital communication that can save lives.

A library of additional resources, alongside further case studies from around the world and targeted recommendations for national governments can be found in the Urban Heat Risk Management Resource Package, developed by UNDRR and the MCR2030 initiative.

References

Stone, B. Jr. (2024) Ancient Rome had ways to counter the urban heat island effect – how history's lessons apply to cities today. PreventionWeb.
www.preventionweb.net/news/ancient-rome-had-ways-counter-urban-heat-island-effect-how-historys-lessons-apply-cities-today

Sanibel Air and Electric (2025) Ancient Cooling Techniques: Exploring Creative Methods of Staying Cool in Ancient Civilizations.
https://sanibelair.com/ancient-cooling-techniques-exploring-creative-methods-of-staying-cool-in-ancient-civilizations

Copernicus (2024) C3S seasonal lookback: summer 2024. European Commission.
https://climate.copernicus.eu/c3s-seasonal-lookback-summer-2024#:~:text=Summary&text=Summer%20 2024%20was%20the%20warmest,substantial%20 heatwaves%20during%20the%20season

European Environment Agency (2024) The impacts of heat on health: surveillance and preparedness in Europe.
www.eea.europa.eu/en/analysis/publications/the-impacts-of-heat-on-health#:~:text=For%20example%2C%20 for%202022%2C%20it,et%20al.%2C%202024

European Environment Agency (2024) European Climate Risk Assessment. ISBN: 978-92-9480-627-7

Reyer, P.O. et al (2015) Climate change impacts in Central Asia and their implications for development. Climate Analytics.
https://climateanalytics.org/publications/climate-change-impacts-in-central-asia-and-their-implications-for-development

World Bank (2023) Cities Across Central Asia Can Unlock Full Economic Potential by Implementing Low-Carbon and Climate-Resilient Development Strategies.
www.worldbank.org/en/news/press-release/2023/09/27/cities-across-central-asia-can-unlock-full-economic-potential-by-implementing-low-carbon-development-strategies

Trading Economics (2025) European Union – Urban Population (% of Total).
https://tradingeconomics.com/european-union/urban-population-percent-of-total-wb-data.html

Sweco (2024) Building heatwave resilience in European cities.
www.swecogroup.com/wp-content/uploads/sites/2/2024/06/Building-heatwave-resilience-in-European-cities_webb_240620.pdf

Barcelona Institute for Global Health (2023) Europe: Trees could prevent 30% of deaths caused by urban heat islands. PreventionWeb.
www.preventionweb.net/news/europe-trees-could-prevent-30-deaths-caused-urban-heat-islands

Dengler, S. et al (2020) 3 ways to beat the heat in European cities. World Bank Blogs.
https://blogs.worldbank.org/en/sustainablecities/3-ways-beat-heat-european-cities

Limb, L. (2024) Madrid, Frankfurt, Vienna: How are European cities adapting to heatwaves? EuroNews.
www.euronews.com/green/2024/06/13/madrid-frankfurt-vienna-how-are-european-cities-adapting-to-fiercer-heatwaves

Ministry of Public Administration and Local Self-Government of the Republic of Serbia and Swiss Agency for Development and Coordination (2025) West Morava Basin Platform.
https://riskzm.rs

Department for Civil Protection Works within the Framework of the City Administration of the City of Kraljevo (2023) The process of creating a disaster risk assessment.
http://civilnazastitakraljevo.rs/the-process-of-creating-a-disaster-risk-assessment

Department for Civil Protection Works within the Framework of the City Administration of the City of Kraljevo (2017) Climate Adaptation Plan City of Kraljevo.
http://civilnazastitakraljevo.rs/PDF/FinalDraft_Kraljevo_LAP.pdf

Department for Civil Protection Works within the Framework of the City Administration of the City of Kraljevo (2021) Disaster Risk Reduction Plan for the Period 2021-2023 – City of Kraljevo.
http://civilnazastitakraljevo.rs/PDF/PSRK_grad_Kraljevo.pdf

Bonn Network International Civil Protection and Disaster Risk Reduction(2025).
www.bonner-netzwerk-int-kats.org/en-gb

UNDRR, Making Cities Resilient 2030 (2024) Flames of Change: Innovating Heat and Wildfire Governance for Inclusive Communities.
www.undrr.org/media/94985/download?startDownload=20250403

UNDRR, Making Cities Resilient 2030 (2025) Urban Heat Risk Management Resource Package.
www.undrr.org/media/103947/download?startDownload=20250114

Barcelona for Climate (2025) Climate Shelters Network.
www.barcelona.cat/barcelona-pel-clima/en/specific-actions/climate-shelters-network

Bloomberg (2022) One of Europe's Hottest Cities Is Using 1,000-Year-Old Technology to Combat Climate Change.
www.bloomberg.com/news/articles/2022-08-18/one-of-europe-s-hottest-cities-has-a-climate-change-battle-plan?cmpid=BBD082022_GREENDAILY&utm_medium=email&utm_source=newsletter&utm_term=220820&utm_campaign=greendaily

City of Athens & 100 Resilient Cities (2017) Redefining the City: Athens Resilience Strategy for 2030.
https://resilientcitiesnetwork.org/downloadable_resources/Network/Athens-Resilience-Strategy-English.pdf

This is Athens (2022) Climate Action Plan Approved by Athens City Council.
www.thisisathens.org/acvb/press-releases-climate-action-plan-approved-Athens-city-council

Nissanka, S., Malalgoda, C., Amaratunga, D., Haigh, R., Mawitigodage, N., Gonzalez-Pardo, M. M., Ayerbe, I. A., Hamza, M., Fernando, N., Rajapakse, L., Borg, R. P., & Borg Axisa, G. (2025) Challenges of Built Environment's Stakeholders in Climate Change Adaptation. In C. Malalgoda, D. Amaratunga, R. Haigh, S. Nissanka, N. Fernando, R. P. Borg, & M. Hamza (Eds.), Climate Change Adaptation in the Built Environment: Transdisciplinary and Innovative Learning (1st ed., pp. 125-142). Springer International Publishing AG.
https://doi.org/10.1007/978-3-031-75826-3_6

C40 Cities (2021) Neighbourhood level cooling: Experiences from C40's Cool Cities Network.
https://c40.my.salesforce.com/sfc/p/#36000001Enhz/a/1Q000000MyWE/lnJB7Ej.5cyaDdo_ZZAXutOE9TkTTjDANA7EQ67aCiY

UNDRR, Making Cities Resilient 20230 (2025) Disaster Resilience Scorecard for Cities.
https://mcr2030.undrr.org/disaster-resilience-scorecard-cities

Climate Adapt, Covenant of Mayors for Climate & Energy Europe (2025) Urban Adaptation Support Tool.
https://climate-adapt.eea.europa.eu/en/knowledge/tools/urban-ast/step-0-0

Appendix I – Stakeholders Questionnaire

Stakeholder contributions were collected through the following questionnaire:

1. General Urban Heat Risk Management

1. What caused urban heat risk to become a priority for the city? What effects of extreme heat on urban infrastructure, public health, and ecosystems have you observed thus far?

2. Governance and Financing

1. Can you explain how urban heat risk management is organized in your city? Specifically, who leads the coordination, how responsibilities are divided among city agencies?

2. Is there a dedicated office or focal point for heat management in the city? How does it coordinate efforts across city departments and with external partners like the national government, private sector, or international organizations?

3. Is there a monitoring mechanism in place and how does it function?

4. What financing models or incentives has the city explored or used to fund heat risk management initiatives (e.g., green bonds, public-private partnerships, international loans and grants, local government budget allocations, tax rebates, grants and subsidies)?

5. What are the main institutional challenges the city faces in managing heat risks, such as issues with staffing, funding, technical expertise or data management?

6. What role does the national government play in supporting your city's heat risk management? Could you share details on any support that has been essential to the city's success?

7. How are your heat risk reduction strategies connected to broader disaster risk reduction and climate change adaptation plans? Can you give examples of how these strategies support each other?

3. Anticipatory Actions for Long-Term Heat Risk Reduction (linked with long-term changes in the urban design, building design, enhancement of infrastructure, land use planning).

1. What urban design or planning strategies and measures/innovative solutions have been adopted to reduce urban heat risk (e.g., cool roofs, tree planting and shading)?

2. How has the city adapted its building codes or land-use plans to incorporate heat risk reduction?

3. Have nature-based solutions been implemented? If so, what types (e.g., parks, green walls, wetlands or green corridors)?

4. What are the key challenges when it comes to carrying out with long-term changes in, for example, urban design, building design, enhancement of infrastructure and land-use planning?

4. Early Warning Mechanisms

1. What early warning systems does the city currently have in place for heatwaves?

2. How are these warnings communicated to the public and vulnerable populations (e.g., elderly, homeless, persons with disabilities)

3. What partnerships support your early warning system and how (e.g., communities, national agencies, NGOs, volunteers, private sector)?

4. What are the key challenges in ensuring the effectiveness of these systems?

5. Support and Collaboration

1. What support/collaboration has the city received from other stakeholders (e.g., civil society, international organisations and other cities) to address urban heat risks?

2. How do you collaborate with private sector actors (e.g., construction, developers, energy companies, public private partnerships, consultation and technical assistance)?

3. What challenges have come up when working with different stakeholders on heat risk management, such as differing priorities, timelines, resource competition, or coordination issues?

6. Success factors

1. What are the key success factors that have enabled your city to manage urban heat risks (e.g., strong political leadership and commitment, cross-sectoral collaboration, adaptive building codes and planning regulations)?

2. What are the most important next steps to ensure heat risk reduction in your city?