

TeMA

Journal of
Land Use, Mobility and Environment

The climatic, social, economic and health phenomena that have increasingly affected our cities in recent years require the identification and implementation of adaptation actions to improve the resilience of urban systems. The three issues of the 15th volume will collect articles concerning the challenges that the complexity of the phenomena in progress imposes on cities through the adoption of mitigation measures and the commitment to transforming cities into resilient and competitive urban systems.

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THE CITY CHALLENGES AND EXTERNAL AGENTS.
METHODS, TOOLS AND BEST PRACTICES

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The cover image shows a sea glacier ice that melts away.

TeMA. Journal of Land Use, Mobility and Environment offers researches, applications and contributions with a unified approach to planning and mobility and publishes original inter-disciplinary papers on the interaction of transport, land use and environment. Domains include: engineering, planning, modeling, behavior, economics, geography, regional science, sociology, architecture and design, network science and complex systems.

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REVIEW NOTES – Urban planning literature review

Climate adaptation in the Mediterranean: Heat waves

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Abstract

Starting from the relationship between urban planning and mobility management, TeMA has gradually expanded the view of the covered topics, always remaining in the groove of rigorous scientific in-depth analysis. This section of the Journal, Review Notes, is the expression of a continuous updating of emerging topics concerning relationships between urban planning, mobility and environment, through a collection of short scientific papers written by young researchers. The Review Notes are made of four parts. Each section examines a specific aspect of the broader information storage within the main interests of TeMA Journal. In particular, the Urban planning literature review section aims at presenting recent books and journals, within global scientific panorama, on selected topics and issues.

This contribution aims at delving into the most severe effects due to heat waves and presenting three interesting and significant scientific books and journal that present effective adaptation strategies to limit climate crisis and improve Mediterranean resilience towards more frequent and severe heat waves. The second contribution of the Review Notes for TeMA vo. 15 highlights the need for integrated action to address the climate crisis in the Mediterranean region, bringing together the strengths and weaknesses of its shores, despite social, economic and political differences. Moreover, the extreme weather events that are occurring throughout Europe, from the south to the north, show how the Mediterranean area is particularly sensitive to climate change-related events.

Keywords

Climate change; Heat-waves; Mediterranean.

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1 Introduction

“This could be the coolest summer of the rest of your life, get used to it”. This is what scientists claim and predict for the current summer, which began to hit cities all over the world with intense, frequent and long-lasting heatwaves, even before it began (Dubey & Kumar, 2022; Park & Jeong, 2022; Tomczyk et al., 2022). June and July 2022 recorded extensive wild-fires, extreme temperatures, accompanied by unprecedented drought events which are still severely hitting communities in southern Europe (Fig.1). Thus, England, Germany, Norway and the Netherlands are not spared either.

The Global Annual to Decadal Climate Update (World Meteorological Organization, WMO, 2022) also reveals a 93 per cent likelihood of at least one year between 2022 to 2026 becoming the warmest on record, thus knocking 2016 from the top spot. The chance of the five-year average for this period being higher than the last five years, 2017-2021, is also 93 per cent. These statistics show that the chance to get closer to the 1.5°C threshold is getting closer and measurable. The limit of 1.5°C is not some random statistic but rather an indicator of the point at which climate impacts will become increasingly harmful for people and indeed the entire planet (ISPRA, 2022; Räisänen, 2022). The chance of temporarily exceeding the 1.5°C threshold has risen steadily since 2015, according to the WMO report. Back then, it was close to zero, but the probability increased to 10 per cent over the past five years, and to nearly 50 per cent for the period from 2022-2026.

The Mediterranean hot spot cannot be saved from these statistics, nor the consequences they entail: in July 2022, the *mare nostrum* recorded an unpreceded increase of 4°C.

In the Mediterranean Basin, human societies and their environment have co-evolved for several millennia, adapting to significant climatic variations. From very early on, cities were established on the coast and prospered thanks to trade with the surrounding countryside and especially with other Mediterranean cities. This has resulted in the Mediterranean specificity that makes it the most popular tourist destination in the world. But is this specificity threatened by global changes?

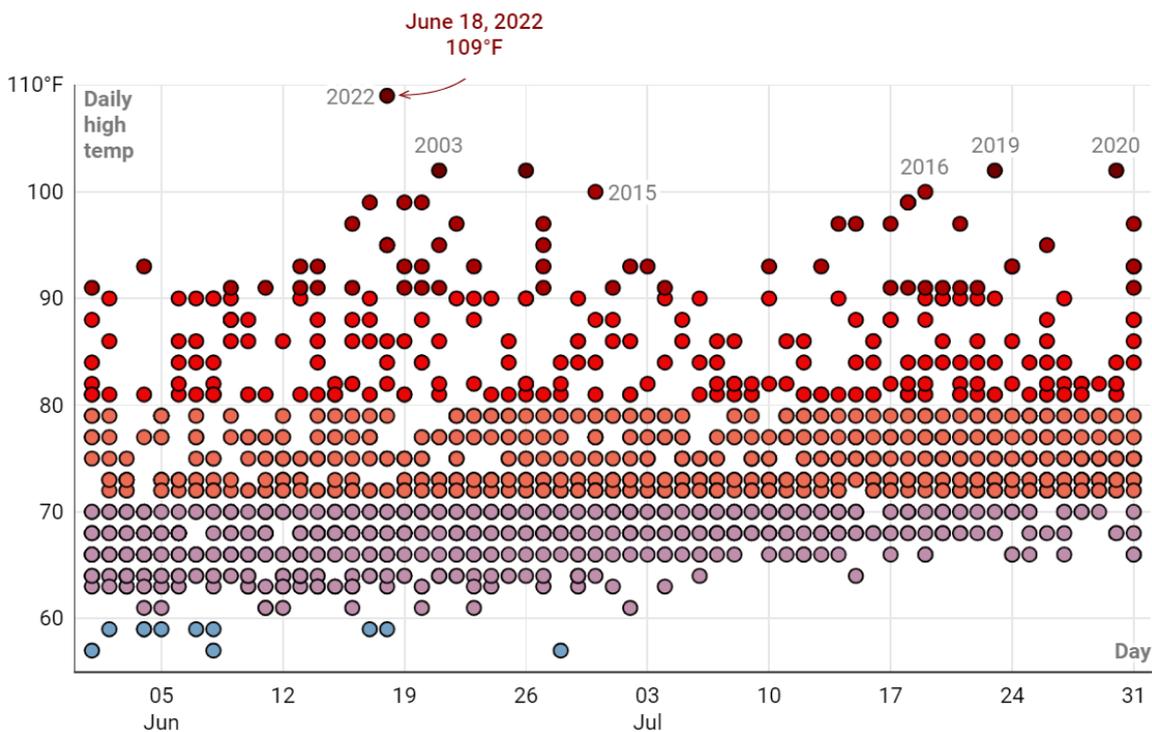


Fig.1 Daily highest temperatures in Nice (France), since 1997 (chart by Emily Barone – Weather Underground data elaboration)

The average annual temperature is rising very fast in the Mediterranean, especially in the cities where the majority of the population lives.

In view of these facts, adaptation to global changes is of particular importance for Mediterranean cities. Few Mediterranean cities have local climate plans that consider mitigation and adaptation together. Sharing knowledge and promoting ambitious actions should enable new approaches to urban development. As densely populated Mediterranean cities are huge sources of green-house-gases emissions, there is an urgent need to implement sustainable urban growth models and develop low-carbon green cities. This contribution aims at delving into the most severe effects due to heat waves and presenting three interesting and significant scientific books and journal that present effective adaptation strategies to limit climate crisis and improve Mediterranean resilience towards more frequent and severe heat waves.

2 Heat-waves effects on urban environments

Older cities with their narrow streets, small openings and reflective white buildings usually mitigate the effect of heat peaks. Modern cities made of concrete and glass, on the other hand, can only protect against them at the cost of powerful electric air conditioning, inducing a positive feedback loop on the climate. Heat waves are responsible for high mortality rates resulting in tens of thousands of premature deaths, particularly in large cities and among the elderly (Harmay & Choy, 2022).

In fact, among all natural disasters, the occurrence of extreme temperatures is the main cause of climate change-related mortality in urban areas. The compact layout of cities, the dependence on infrastructure systems as well as the high concentration of population and economic activities make cities particularly vulnerable to the risks associated with the occurrence of extreme heat waves (Zittis et al., 2016). Considering the projections of the heat wave phenomenon summarised in the previous paragraph, cities in the Mediterranean basin will have to face the succession of increasingly frequent and intense heat waves in the coming years. At the same time, in the global landscape, cities are hot-spot locations, because they are characterised by generally higher temperatures than surrounding areas, due to specific urban characteristics, their limited green spaces, GHG production from their infrastructures, etc. (Giorgi & Lionello, 2008; Garcia-Nevado et al., 2021).

The Mediterranean basin is subject to a significant increase in temperatures, with hotter and longer summers, more frequent, longer and more intense heat waves and, at the same time, a reduction in rainfall events (the current summer is precisely witnessing the effects of this dangerous combination of climatic events). Therefore, just as the dangerousness of these phenomena is increasing exponentially, in terms of greater intensity and frequency, so the vulnerability of the Mediterranean population to extreme climatic events is growing considerably, exacerbated by the socioeconomic discrepancies between the southern and northern shores and between the nations that compose them, measured in terms of population growth and migration rates, the demand for drinking water and the risks associated with the outbreak of wild fires.

While there are slight differences between cities on the Mediterranean coast with respect to the hazard and exposure to heat waves, demographic trends, gender differences, geographical location, socioeconomic status, employment rate, quality of healthcare facilities and housing conditions in urban environments are among the characteristics that contribute to differentiating the vulnerability of the population, even within the same urban context, to the effects of climate change.

With a closer look at cities and their physical, functional and anthropogenic structure, it becomes evident that cities are not the same in all their parts, and that many are particularly vulnerable to heat, due to both structural and socio-economic characteristics. An in-depth analysis of the relevant scientific literature, conducted by the CMCC Foundation (Euro-Mediterranean Centre for Climate Change) and Ca' Foscari University of Venice (Bagli et al., 2021), has shown that heat does not kill in the same way in every corner of the earth, nor in every neighbourhood of the same city.

The elderly population is particularly at risk to the negative impacts of climate change due to reduced mobility and more vulnerable health conditions, which result in limited accessibility to land resources and urban services. These conditions inevitably limit the adaptive capacity of the elderly population. More in detail, with

respect to heat-related climatic events, e.g. heat waves, groups of the elderly population are particularly at risk due to dysfunctional thermoregulatory mechanisms, chronic dehydration and the daily use of medication (Zampieri et al., 2009; Hochman et al., 2021). Indeed, people with pre-existing health problems, such as cardiovascular or pulmonary diseases, or with chronic diseases, such as diabetes, obese or with cognitive deficits, are the most vulnerable. In addition to differences of a collective nature, such as physical condition and state of acclimatisation to heat, certain social factors, such as heterogeneity in coping with social isolation, which tend to be greater among men than among women, could represent additional risk factors during heat waves. The scientific literature recognises certain psycho-physical factors governing these differences, such as women's tendency to sweat less or a natural thermoregulatory mechanism that could explain the greater impact of heat on women than on men.

Many studies show that significant variability in the effects of climate change, in terms of mortality and morbidity, can be observed with respect to the geographical location and sensitivity of the population to extremes of both heat and cold, the level of urbanisation of the cities affected, and the distance of population centres from health infrastructures. In this regard, it has been shown that the population residing in rural areas is at higher risk for the transmission of climate change-related diseases through vectors (such as insects, for example). The vulnerability of the population to high temperatures and the occurrence of increasingly intense and long-lasting heat waves will be affected not only by climate change but also by socioeconomic factors (Echevarria Icaza et al., 2016). In socially disadvantaged groups, the effects due to such phenomena are five times more pronounced among the poor, socially isolated people, drug addicts and the homeless. Migrants, refugees and displaced persons may already suffer from pre-existing conditions of vulnerability such as malnutrition, chronic diseases that are not adequately treated due to lack of access to medical care, and lack of shelters that provide adequate protection. All this would predispose these population groups to more severe physical and social consequences when extreme climate events occur (Galderisi et al., 2016).

The 2018 IPCC report on the consequences of an average global warming scenario of 1.5°C shows that 2°C warming would pose much more significant risks to human health, with varying levels of risk at the regional level. The risks associated with phenomena such as heat-waves and hot-days could be particularly high for mortality and morbidity, heat stress, ground-level ozone accumulation and malnutrition. With regard to disease transmission through vectors, the risks are more variable from area to area since warmer temperatures could make some regions inhospitable because they are too hot and/or dry. Many studies related to mortality caused by extreme heat do not take into account the socio-economic conditions of the population.

A 2018 study by Mayrhuber et al. showed the contribution of these aspects to mortality due to rising temperatures for the European population. As of today, 11% of Europeans are at risk of heat stress, but this percentage is expected to grow steadily in the years to come: from +0.4% to 20.3%, 32.6% to 48.5% in 2050 (Mayrhuber et al., 2018), depending on the combination of scenarios and unless significant policy changes are adopted to steer the current socio-economic development pathway towards sustainability, mitigation and, necessarily, adaptation (Diaz et al., 2002). However, the impact of heat on mortality will be more influenced by socioeconomic factors than by exposure to higher temperatures. The effects of extreme heat-related mortality will vary considerably across Europe, with the Mediterranean region being the most affected.

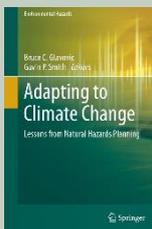
The increased frequency and intensity of heat waves in scenarios RCP4.5 (GHG emissions curbed, but their concentrations in the atmosphere increase further over the next 50 years, without reaching the +2°C target) and RCP8.5 (most dramatic scenario, in which no climate protection measures are taken and GHG emissions increase continuously) will mainly affect the south-eastern region of the basin (Earth Observatory, 2020).

In particular, for the mid-21st century, between 2035 and 2064, the mortality rate attributable to global warming will increase to 1.8 (for the RCP4.5 scenario) to 2.6 (for the worst-case RCP8.5 scenario), compared to the period 1971-2000. At the same time, mortality due to heat waves will rise by a factor of 3 (RCP4.5) to 7 (RCP8.5). Heat waves will not only affect Mediterranean cities in terms of life and health, but also labour

productivity will be affected. In addition, significant damage to the infrastructure of the urban environment, e.g. roads or the railway network, could occur due to the intense heat. At the same time, heat waves are predictable risks. The impacts on both citizens' health and urban systems can be reduced by simple and cost-effective technologies, strategies and actions (Saaroni et al., 2003; Galderisi & Ferrara, 2012; Harpaz et al., 2014; Benmartina et al., 2015; Gargiulo & Lombardi, 2016; Founda et al., 2019; Rodrigues & Antunes, 2021; Roberts, 2021).

The following section summarises three scientific references that delve into best practices, contextualising them in their respective application scenarios. Very heterogeneous case studies have been studied and selected, cities that are as physically distant as they are culturally and socially different, but which share a holistic and integrated approach to the planning and governance of urban and territorial transformations.

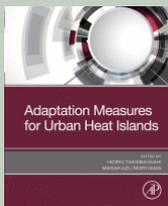
Adapting to climate change: Lessons from natural hazards planning



Authors/Editors: Bruce Glavovic & Gavin P. Smith
Publisher: Springer
Publication year: 2014
ISBN code: 978-940178631-7

This book identifies lessons learned from natural hazard experiences to help communities plan for and adapt to climate change. Written by leading experts, the case studies examine diverse experiences, from severe storms to sea-level related hazards, droughts, heat waves, wildfires, floods, earthquakes and tsunamis, in North America, Europe, Australasia, Asia, Africa and Small Island Developing States. The lessons are grouped according to four imperatives: (i) Develop collaborative governance networks; (ii) build adaptive capabilities; (iii) invest in pre-event planning; and (iv) the moral imperative to undertake adaptive actions that advance resilience and sustainability. This book represents a major contribution to the understanding of natural hazards planning as an urgent first step for reducing disaster risk and adapting to climate change to ensure sustainable and equitable development. The book provides a theoretically rich and empirically grounded analysis of the interface between disaster risk management and climate change adaptation, comprehensive yet accessible, and very timely.

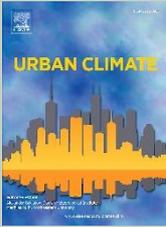
Adaptation Measures for Urban Heat Islands



Authors/Editors: Hideki Takebayashi & Masakazu Moriyama
Publisher: Elsevier
Publication year: 2020
ISBN code: 978-0-12-817624-5

Adaptation Measures for Urban Heat Islands helps the reader understand the relative performance of these adaptation measures, methods and analysis relating to their creation and maintenance, evaluation methods, and the role of policy and governance in implementing them. A suite of case studies is included on these urban or metropolitan areas that are significantly warmer than their surrounding rural areas due to human activities. In recent years, a suite of adaptation measures has been developed to mitigate the urban heat island phenomena. The second chapter is dedicated to the review of adaptation strategies and based on several examples of the effects of adaptation measures obtained by demonstrative experiments, it shows that shielding of solar radiation to pedestrians is a more effective method of lowering mean radiant temperature and standard effective temperature. The fourth chapter, divided into four sections, delves into a significant case study: the adaptation strategy of Osaka (Japan). The authors introduce implementation examples and future visions in Osaka as a city where mitigation and adaptation measures for heat island countermeasures are deployed. Hence, the book provides a range of concrete implementation methods; it assesses relative performance of adaptation measures and countermeasure technologies. Moreover, it establishes methods for human thermal environmental interventions and reviews adaptation cities selected for excellent energy performance and thermal comfort indicators.

Urban Climate



Editors-in-Chief: Alexander Baklanov and Peter J. Marcotullio
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Urban Climate serves the scientific and decision-making communities with the publication of research on theory, science and applications relevant to understanding urban climatic conditions and change in relation to their geography and to demographic, socioeconomic, institutional, technological and environmental dynamics and global change. Targeted towards both disciplinary and interdisciplinary audiences, this journal publishes original research papers, comprehensive review articles, book reviews, and short communications on topics including, but not limited to, urban meteorology, climate and pollution, Adaptation to global change (urban drivers of climate change, urban vulnerability to climate hazards and climate change, urban infrastructure systems, flood control, energy supply, urban ecosystems and urban water), urban economies and social issues. The journal supports manuscript that provides theory modeling and decision support tools and monitoring analysis. All the issues of the journal collect interesting case study and adaptation and mitigation best practices all over the world, focusing on their effectiveness, replicability and scalability, as well as on their weaknesses.

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