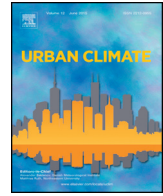




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Urban Climate

journal homepage: <http://www.elsevier.com/locate/uclim>

Reasons to adapt to urban heat (in the Netherlands)

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ARTICLE INFO

Article history:

Received 30 May 2016

Received in revised form 12 September 2016

Accepted 21 October 2016

Available online xxxxx

Keywords:

Urban heat

Climate adaptation

Urban vulnerability

Urban heat island effects

Urban governance

ABSTRACT

The future will be warmer with more tropical days, heat stress and related impacts for the healthy and liveable city. This is clear from many scientific studies and papers. Yet many local governments in the Netherlands claim to have insufficient understanding of the importance of these impacts in order to make the necessary step to climate adaptation and to take practical actions to manage the risks associated with rising heat levels. They struggle with defining the urgency of heat stress and finding good arguments for the need to adapt urban environments to rising temperatures. In order to provide urban professionals with reasons to adapt their urban environments to heat, we analyzed the potential impacts of urban heat from international policy reports and scientific literature. We summarized the impacts in a mind map. This map visualizes the large number and variety of heat-related risks. They can be subdivided into risks for health, open space, liveability, water and infrastructure networks. We believe that this mind map provides useful insight into the reasons to take heat adaptation actions. It can also be a helpful visual for urban professionals in outlining the reasons to take action for heat adaptation.

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1. Introduction

Climate scenarios project more warm days and an increase in the frequency of heat waves in the Netherlands (KNMI, 2015) and Europe (Russo et al., 2015; Meehl and Tebaldi, 2004). This poses serious risks on human health, and has adverse consequences for productivity and infrastructure networks (e.g. EEA, 2012; Chapman et al., 2013). Urban areas will be particularly vulnerable to heat waves and hot days because of the urban heat island effect (Oke, 1982).

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During the heatwaves of 2003, 2006 and 2007, many European countries faced the impacts of extreme heat. In particular, the health impacts received recognition among many European countries and resulted in various health action and climate adaptation plans (EEA, 2010). Also in the Netherlands, these heat waves raised political awareness (Boezeman and Kooij, 2015) and resulted in considerable research into the causes of urban heat and the possible adaptation measures to reduce heat risks (e.g. Albers et al., 2015; and Boezeman and Kooij, 2015). From these studies, the need to take heat adaptation actions in cities became evident. It was decided at a national level that the Netherlands must be as climate-proof as possible by 2050 (Delta Programme, 2015). This implies that greater effort should be made at the planning stage to keep cities cool during hot summers and to take adaptation plans to reduce urban heat stress. However, at the local (municipal) level, taking heat adaptation actions is not yet realized. Urban professionals at Dutch local governments have indicated that urban heat is hardly perceived as an urgent problem (Runhaar et al., 2012), and that they need arguments and appealing examples to convince others of the urgency to anticipate increased urban heat risks.

With the aim to provide urban professionals with reasons to adapt the built environment to the risks of urban heat and to help them to get the message across, we reviewed national and international policy reports as well as scientific literature. We outlined the major impacts of urban heat including the reasons to take adaptation actions. The question that we expected to answer in this study is: 'What are the major impacts of urban heat for cities to start anticipating?' The study was carried out within the framework of a Dutch applied research project 'Urban climate resilience - Turning climate adaptation into practice' that supports urban professionals to build and design climate resilient cities. The paper describes an overview of urban heat impacts and presents the results of a discussion with a group of Dutch urban planners to investigate the usefulness of this overview for local practice. Additionally, the paper visualizes the most important impacts of urban heat in a mind map to support urban professionals in communicating the reasons to adapt cities to heat stress. This paper can therefore be regarded as an applied and descriptive research paper, rather than a comprehensive review article. It is a step towards answering the larger research question: 'How is the urgency of heat stress and adaptation to urban heat assessed?'

2. Reasons for adaptation to heat stress in urban areas

We reviewed national and international climate adaptation strategies and reports and scientific literature to identify the reasons why cities need to adapt to urban heat. The reasons strongly link to the impacts of urban heat, which are often supported by facts and numbers from scientific research. Reasons, impacts and supporting facts and numbers are presented in the next paragraphs separately for the Netherlands, Europe and countries outside Europe.

2.1. Reasons in the Netherlands

As has been mentioned in the introduction, the urgency for a climate-proof Netherlands has been stated in the Dutch Delta Programme (2015). This programme states that built-up areas in the Netherlands may be

Table 1

Top 10 natural disasters by number of deaths for 2006.
(Source: UNISDR, 2007).

Hazard type	Country	Number of deaths
Earthquake, May	Indonesia	5778
Typhoon Durian, December	Philippines	1399
Landslide, February	Philippines	1112
Heat wave, July	Netherlands	1000
Heat wave, July	Belgium	940
Typhoon Bilis, July	China	820
Tsunami, July	Indonesia	802
Cold wave, January	Ukraine	801
Flash flood, August	Ethiopia	498
Typhoon Samoai, August	China	373

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