

Introduction

Coping with Flooding and Urban Heat Islands: Resilience Strategies for the City of Hanover developed during the Summer School

Lena Greinke, Kendra Menking, Filip Śnieg

Institute of Environmental Planning

Leibniz University Hannover

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Global climate change, as well as economic and social changes, pose new challenges to urban and regional development worldwide. Rapidly changing climate, economic and social trends require adaptation and address several uncertainties and complexities to enable proactive action. Therefore, cities and regions around the world face the challenge of exploring flexible and innovative forms of governance that address specific local vulnerabilities and commit to development of capacity for future change - the resilient city as a planning goal.

From the 22nd to the 26th of July 2019, the summer school within the research project “HeKriS – Challenges of resilience in European Cities” took place in Hanover, Germany. It discussed the topic “Governance of Resilience: Environmental Challenges in European Cities” within the greater urban complex of Hanover. The emphasis was set on the risk of the occurrence of extreme events in the urban area of the Hanover Region, especially urban heat islands and seasonal flooding and their consequences for humans, the built environment as well as all kinds of infrastructures and services within the city and the region. Dealing with such shocks and events enhances crucial characteristics from architects and urban planners to develop resilient cities and city-regions – now and in the future. The germinal question to be examined during the Summer School was how to deal with climate change induced extreme events, in terms

of governance, as planners or architects to aim at resilient, liveable cities for future generations. This summer school aimed at encouraging the participating students to get an integrated perspective on the phenomena of urban heat islands and flooding in specific areas of Hanover. This includes not only aspects about the built environment (like the location of buildings, density of housing, fresh air corridors, etc.), but also raises questions about planning processes and creation of awareness on the local level, as well as about dealing with uncertainty and complexity and reflecting on the roles of different stakeholders. The participants were asked to analyse given neighbourhoods and develop strategies for resilient urban areas in the city of Hanover by identifying, understanding and applying crucial elements and factors to create sustainable urban environments. The results are five strategies providing solutions for reduced vulnerabilities occurring from urban heat islands and flooding in respective areas.

The scope of work of the Summer School

Urban heat islands and flooding are one of the challenges that might become a real threat in the future for the city of Hannover due to continuously rising temperatures and prevailing weather unpredictability induced by climate change. Hence, five groups of German and Greek students, together in interdisciplinary and international groups, were required to carry out and conduct research activities on the aforementioned topics located in an urban area of Hanover city. The participants were introduced to the issues by valuable keynotes of local and foreign experts and practitioners on urban resilience. Additionally, information material such as maps and literature were provided, and the organisation team offered scientific support during the analysis and strategy-making development processes. During the summer school, the groups analysed their specific neighbourhoods according to urban heat islands or flooding risks and answered the questions: Where could you potentially find them? What characterises the local context (built environment, societal dimension, and environmental aspects)? How are the surroundings affected by heat islands/risk of flooding? Accordingly, after the detailed analysis, the groups presented their ideas and approaches to dealing with the respective challenges and eventually introduced their innovative, sustainable and resilient solutions to the organisers and other participants.

**Five concepts
of the Summer
School**

The five developed resilience concepts were presented and discussed on the last day of the summer school. The students combined governance approaches as well as practical solutions; they experimented in particular with design concepts such as the planting of trees, unsealing of paved surfaces, introducing green canopies, green roofs and facades as well as creating planned flooding zones. Importantly, the groups did not only focus on their single tasks but also came out with excellent, innovative ideas and concepts on how to cope with flooding and urban heat islands in different resilience strategies for the city of Hanover. The final ideas of each group on how to deal with given topics are presented in the five following articles:

The concept **Tr-Island - Combating Urban Heat Islands in the City Centre in Hanover** presents a proposal for dealing with the issue of urban heat islands in the city centre of Hanover. By utilising the old tram infrastructures in the area, the proposal unifies the area and creates a more attractive public realm network. In the urban areas, water elements and vegetation were introduced to reduce the heat island effect significantly. The paper further emphasises the importance of a comprehensive urban governance implementation process and recommends the introduction of a resilience action programme to achieve sustainable urban development in Hanover.

HannOVER heat - Steintor's heat islands focuses on the north-western parts of the city centre of Hanover, which are profoundly affected by higher temperatures compared to less-urbanised and less-densely built areas. The paper promotes different level solutions in order to defuse the challenge of heat islands. The suggested ideas include proposals of governance as well as more operative solutions, like the expansion of the existing vegetation, the creation of shading and the unsealing of pavements.

The concept **Coping with the heat island of Raschplatz and surroundings in Hanover** analyses the challenges in Raschplatz area in terms of heat islands. With the help of a site observation physical and socio-ecological urban contexts as heat affecters were explored. In order to improve the current heat island situation of the Raschplatz area, the concept suggests

creating green spaces, roof greening, the greening of vertical structures as well as heat isolation of buildings and creation of water surfaces.

In **Double Trouble**, the authors focus on flood risks in a specific neighbourhood in the city of Hannover. The concept discusses historical events and actions implemented by the municipality, as well as the study of data provided by it. With the help of research and discussion, the paper aims to develop guidelines and propose design strategies to address flood threats on the study case site.

Resi² Rick: Flood Resistance and Resilience in Ricklingen, Hanover explores how factors of flood resistance and resilience are addressed within the development of an area in Ricklingen, a hydro-geologically vulnerable district in the south-west of Hanover. The already existing dyke as a flood control and resistance measure offers protection against fluvial floods but does not offer protection from pluvial or flash floods and further intensification of extreme weather events. To adapt to climate change, the concept proposes the establishment of ditches that relieve stress from the drainage system and ponds and green roofs to evacuate intense rainfalls. In addition, the proposal foresees awareness-raising campaigns, resilience meetings and supplemental incentive schemes to encourage civil initiatives and actions such as the instalment of ponds on private property.