Graduation Plan

Master of Science Architecture, Urbanism & Building Sciences

Graduation Plan: All tracks

The graduation plan consists of at least the following data/segments:

Personal information	
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Studio	
Name / Theme	Urban Metabolism
Teachers / tutors	dr. ir. Frank van der Hoeven dr. ir. Marcin Dabrowski dipl. ing. Alexander Wandl
Argumentation of choice of the studio	In general I believe one of the biggest challenges in urbanism is gaining a better understanding of the relation between the city and its local, regional and global environment. This in order to cope with climate change, increasing world population and scarcity of finite resources and raw materials. A better understanding of such relation must lead to a more sustainable way of organizing our cities in relation with our environment. Safe guarding the future and prosperity of mankind of today and future generation. Urban Metabolism analyses and visualizes materials and energy flows of the city. Subdivided by; demographics, air, water, food, biota, mobility, cargo, building materials, waste and energy. The UHI is related to this because it's all about energy. The city by warms up due to the sun's energy and anthropogenic activities. This increases the temperature of the city surface and air temperature compared to its rural surroundings. There is plenty of research on the UHI and how through design the negative effect can be mitigated or adapted. However in literature review is suggested that their remains limited understanding of the effects of UHI connected to social-economic and environmental justice dimensions like poverty, inequality and opportunity in continental Europe. My master thesis deal with this issue by research the relation between Rotterdam's socially deprived neighborhoods and the urban heat island.

Graduation project	
Title of the graduation project	Hot town, summer in the city! … but for whom?

Goal	
Location:	Rotterdam area
The posed problem,	See below
research questions and	See below
design assignment in which these result.	See below

Hot town, summer in the city! … but for whom?

A research on the relation between the urban heat island and environmental justice in the city of Rotterdam

Problem statement

Due to climate change mean temperature globally will change. It's expected that this century the temperature will rise between 0,3 °C and 4,8 °C. (Collins et al., 2013). The general opinion is that mean temperature globally will rise which will intensify the UHI effects. Within the Netherlands the increase of temperature during summer with a drier and warmer climate will have an exacerbating effect on the UHI (KNMI, 2015a).

People from a lower social lower status and elderly are more vulnerable for the effects of UHI. They are less able to adapt to urban heat. The build environment of these groups contributes positively to the UHI with negative effects for their wellbeing. They suffer more from extreme weather events such as heat waves and are disproportionately exposed to the effects of UHI. (Harlan et al., 2006; Harlan & Ruddell, 2011; Huang et al., 2011; Pearsall & Pierce, 2010; Ruddell et al., 2010; FD van der Hoeven & Wandl, 2015)

Within the Dutch context the UHI is recognized as a hazard that will affect vulnerable groups (Climate Proof Cities consortium, 2014; RCP, 2013; F. van der Hoeven & Wandl, 2013; FD van der Hoeven & Wandl, 2015). However within the Dutch context there is no notion to be found of the vulnerability to UHI by socially-economic deprived groups and there is no clear picture if there is any form of environmental injustice.

In the Netherlands Rotterdam suffers from intense UHI, has a high population density and a high share of low income groups. Such a condition has the potential of being a serious issue of environmental justice where people are disproportionate exposed to the hazard of UHI.

Research goal

Thus the research goal of this master thesis is to discover the relation between the UHI and environmental justice in the city of Rotterdam.

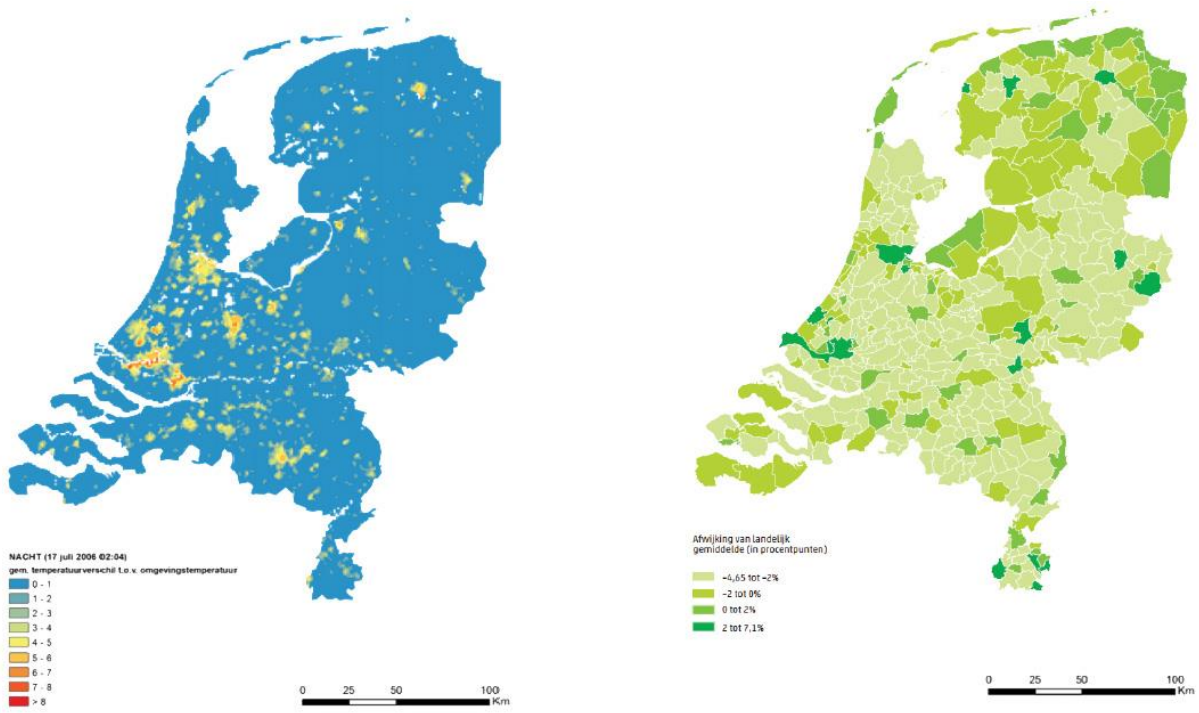

Figure 1. UHI of 17 July 2006 (left) and the deviation of average income (right) in the Netherlands.

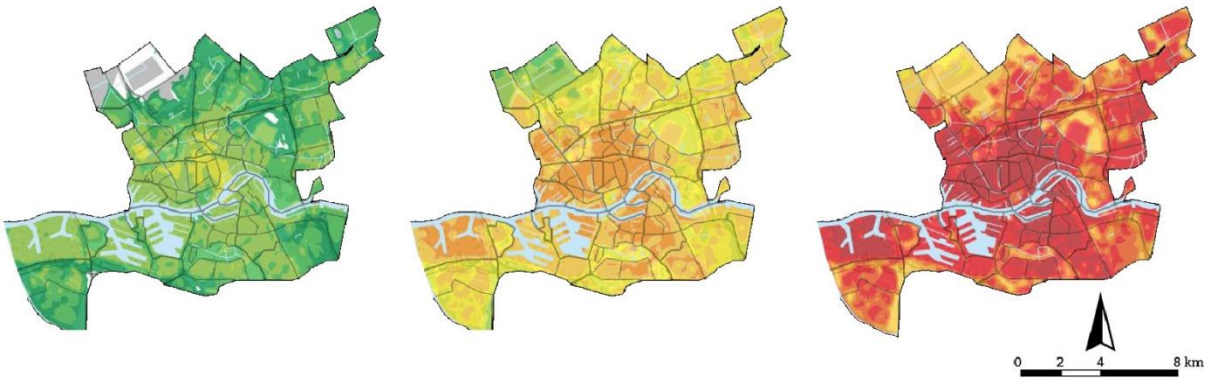

Figure 2. The expected increase of UHI according to KNMI scenario's for 2050. Left current situation, middle scenario W_L and right W_h.

Figure 3. The distribution of the leefbarometer (left), the distribution of the annual income per household (right) and the distribution of land surface temperature of 9 September 2015.

Research questions methodology

This paragraph described the research methodology. Starting with the main research questions and sub questions. Then the intended end products and each method are described. Concluding with an overview of the research questions, research method and intended end products.

A total of three main research questions and 7 sub questions have been defined.

Main research questions

How are people in socially deprived neighborhoods exposed to UHI effects?

How do similar urban typologies in Rotterdam preform in terms of the surface temperature, urban and population characteristics.

How can UHI adapting and mitigating design principles be applied to reduce the effects of UHI in socially deprived neighborhoods of Rotterdam.

Sub questions

What is UHI and what are its effects?

What is the relation of UHI and environmental justice?

What characteristics of the urban fabric have an exacerbating effect on UHI?

What urban typologies are more exposed to UHI

What are environmental justice indicators on neighborhood level

How does UHI influences quality of life of people living in socially deprived neighborhoods?

What are UHI adapting and mitigating design principles?

Design goal

Main design goal is to propose a design to mitigate and adapt to the effects of UHI to improve the quality of life in socially deprived neighborhoods in the Rotterdam area.

Process

Method description

The intended research approach is a mixed used of different qualitative and quantitative methods research method are being used also known as methodological triangulating. Main reason is to come to more accurate conclusion by minimizing weakness of relying on one particular source or method.

Research question	Method	Intended end product
How are people in socially deprived neighborhoods exposed to UHI effects?	• Risk assessment • Literature study	• Paper review • Theoretical framework
How do different neighborhood typologies in Rotterdam preform in terms of the surface temperature, urban and population characteristics?	• Analysis of the urban characteristics	• Overview of the performance of different neighborhoods in Rotterdam
How can UHI adapting and mitigating design principles are applied to reduce the effects of UHI in socially deprived neighborhoods?	• Literature study • Interviewing • Analyses of the urban fabric • 3D modeling	• UHI mitigating and adapting strategy for neighborhoods in Rotterdam
What is UHI and what are its effects?	• Literature study	• Literature review of the theoretical background of UHI.
What is the relation of UHI with climate change, urbanization and environmental justice within a global and European context?	• Literature study	• Literature review of UHI in relation to urbanization and climate change
How can a city on neighborhood level be analyzed for its relation between UHI and socio-economic aspects?	• Literature in risk assessment methodology • Interviewing	• Risk assessment methodology report
How does UHI influences quality of life of people living in Rotterdam's socially deprived neighborhoods?	• Interviewing • Literature research • Risk assessment	• Spatial heat risk assessment of UHI and socioeconomic characteristics of yet to be determined case • Literature review on the relation between UHI and quality of life

Literature and general practical preference

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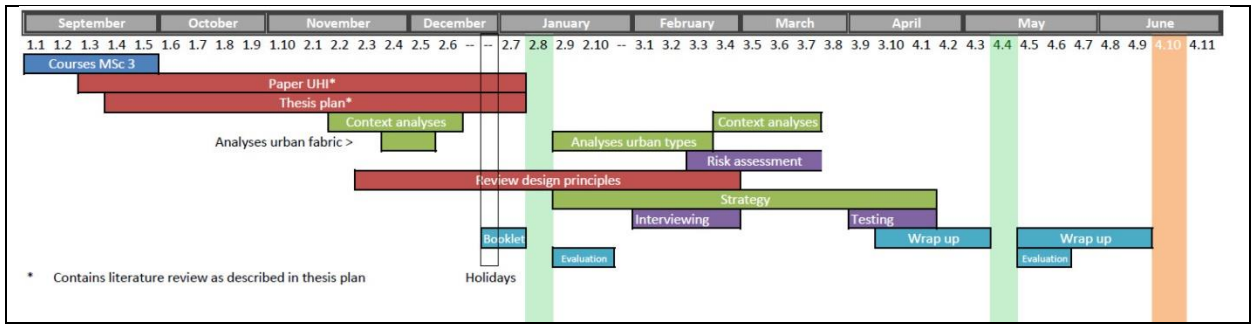
Reflection

Relevance

Vulnerable groups such as elderly and lower income groups are more exposed to the effects of urban heat island. Mortality rates during heat waves show that elderly are more vulnerable due to factors like urban form and building age. (Dousset et al., 2011; FD Van der Hoeven & Wandl, 2015) The effects of UHI are exacerbated in socially deprived neighborhoods and the combination between lack of adequate housing, shade and green open areas. This makes people more vulnerable for heat stress and mortality. (Harlan, Brazel, Prashad, Stefanov, & Larsen, 2006; Ruddell, Harlan, Grossman-Clarke, & Buyantuyev, 2010)

There is still a limited understanding of the effects of UHI connected to social economic dimensions like poverty and opportunity in continental Europe. Although a lot studies in sociology, health, and epidemiology have investigated the link between risk of heat related death and socioeconomic status, only a few of them have examined the land surface temperatures (LST) pattern at the neighborhood scale in direct relationship with the socioeconomic characteristics of the human population. And thus there is no widespread consensus on the overall relationship between heat related death and social characteristics. (Duneier, 2004, 2006; Huang, Caenasso, & Zhou, 2011; Johnson & Wilson, 2009; Klinenberg, 2004; Wilhelmi, Purvis, & Harriss, 2004)

Time planning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Courses MSc 3
Paper UHI*
Thesis plan*
Context analyses
Analyses urban fabric >
Context analyses
Analyses urban types
Risk assessment
Review design principles
Strategy
Interviewing
Testing
Booklet
Evaluation
Wrap up
Wrap up
Evaluation
* Contains literature review as described in thesis plan
Holidays