Project **Theme 4 | Urban Climate Design Engineering**

Description of research

The objective is to develop urban design concepts responding to the effects of climate change in Dutch neighbourhoods, especially in terms of heat and water. More specifically, this research aims at the integration of adaptation measures derived from specialist disciplines and adding specific solutions resolving from urban design. The aim is also to combine the utilisation of climate change in the energy and water system. The developed design principles should incorporate solutions for increasing building densities. Measures proposed will be evaluated on the impact on the urban climate, consequences and expected repercussions in human health, energy consumption and ecological, economic and cultural aspects.
The impact on the urban climate will be simulated by microclimate models.

Research question

Which urban design principles can be applied in specific Dutch neighbourhoods to respond to the effects of climate change, especially in terms of urban comfort and water management?

The most important conclusions

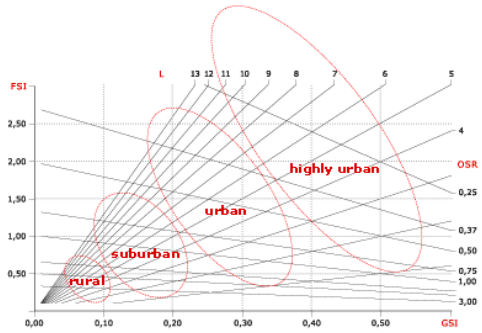
- The hypotheses we based on literature correspond in most cases with simulation results. The tested hypotheses are the following:
  - Trees have a cooling effect above pavement
  - The lighter the roof at 9 meter height, the cooler the air temperature at 2 meter height
  - Asphalt increases air temperatures more than concrete pavement
  - Combining all changes that lead to temperature increase, results in extra up heating compared to all changes alone
  - A higher H/W ratio in a wide street (H/W=0.23) lead to temperature decrease
- The hypotheses that did not correspond with simulation outcomes are:
  - The lighter the facade, the cooler the temp at 2 meter height
  - Combining all changes that lead to cooling, results in extra cooling capacity compared to all changes alone

  The effect of façade albedo will be studied more thoroughly
- Stimulating winds to alleviate heat stress turns out to be negative for cold periods. During both, heat waves and cold waves in the Netherlands, the predominant wind direction is from the North-East. Flexible solutions might be an option here. A better solution could be to create air flow through thermal stratification when there is a low wind speed. Further research will be done to research this.

Possible applications from the project

- In common street layouts and neighbourhood typologies the effect of some adaptation measures are better predictable
- Adding and counteracting combinations will make it easier for designers and policymakers to take decisions
- The factsheets are developed will be a handy and complete tool for urban designers and policymakers to assist them in different stages of the development of an urban area.

Kennis voor Klimaat
Knowledge for Climate



Bottlenecks of the project

- Measurement data from fixed stations, traverse bike measurements and air plane flights might not be available (on time) or in a useful format to be combined with the results of this research
- All simulation programs have limitations, therefore it might be necessary to use different models. Using different models does make it more difficult to analyse and compare results.
- Not all neighbourhood typologies can be studied due to time and computer restrictions

Opportunities for the poject

- In the collaboration with other researchers extra value is created by sharing knowledge and information
- If specific design solutions can be tested through a physical model this will increase the vlue of the factsheets significantly
- If the factsheets are ready on time, it would be valuable to test them among designers and policy makers.

More information

For more information about this project please contact

Laura Kleerekoper
TU Delft
l.kleerekoper@tudelft.nl