Summary

How to make cities climate proof? The thrust of this proposal is to build up a multi-scale (from the level of buildings via neighbourhoods to city agglomerations) quantitative knowledge base on urban climate, on the vulnerability of cities to climate change, on expected impacts of possible future changes in climate, on the technical and economical effectiveness of adaptation measures, and on the governance required to achieve this adaptation. To understand the effectiveness of measures, fact finding on the interaction of the city and the local climate (including urban heat islands) is essential. Based on the various impacts in cities and possible adaptation measures, an overview can be provided of costs and benefits of taking adaptation measures in various scenarios for the development of the global climate. This will be linked with an in-depth understanding of the governance processes needed for implementation.

Research will be executed in a number of case studies to be agreed upon with the hotspots. Case studies will link research projects that are organized in five workpackages. Research Alliances and Communities of Practice will be organized for science-science and science-stakeholder interactions at all stages of the programme. Regular reporting of interim results in a policy relevant way is foreseen, using integrated assessment theory and frameworks.

Overview of main research questions on three levels

The main research question for the **whole programme** is: How can Dutch cities prepare for the impacts of climate change?

Main research question **workpackage 1**: How does the urban climate system function in the Netherlands?

Wp1, project 1: How do meteorological variables, including flux parameters, vary over time and space in Dutch cities?

Wp1, project 2: To what extent can we reproduce in a model the main characteristics of the urban climate in order to simulate the effect of measures in Dutch circumstances?

Wp1, project 3: To what extent can we reproduce in a model the main characteristics of the urban climate on the level of the detailed urban geometry?

Main research question **workpackage 2**: What are the sensitivities of Dutch cities for climate change, what are the possible impacts of climate change and how can we characterize the vulnerability of parts of Dutch cities to climate change?

Wp2, project 1: What are the potential impacts of climate change on the indoor environmental performance of buildings? Can we generate a general vulnerability classification of buildings?

Wp2, project 2: What is the actual heat strain on a vulnerable group (elderly) and what are the effects on health and mortality?

Wp2, project 3: Can we quantify for cities as a whole the sensitivity to changes in extreme climate and water conditions?

Wp2, project 4: Using the information of wp2, project 3, can we develop a typology for Dutch city neighbourhoods for characterizing their vulnerability to climate change? What is the influence of urban morphology and building styles on climate robustness and resilience?

Main research question **workpackage 3**: How can we utilise future climate characteristics optimally in urban and building design?

Wp3, project 1: How do green elements contribute to the climatic improvement of Dutch cities?
Wp3, project 2: How can buildings and streets contribute to rainfall interception and storage, and how can stored rainwater be used for cooling of the indoor and outdoor environment?
Wp3, project 3: How can drainage from urban areas best be released to receiving water systems, and what is the best discharge control strategy to utilise the storage capacity in both systems in an optimal way? How to use excess water from the drainage system beneficially?
Wp3, project 4: Can we develop a water-based energy transport infrastructure that provides heat and cold to buildings?
Wp3, project 5: What passive adaptation measures can be used at the level of the building envelope to improve the indoor environmental performance of buildings even when the climate changes?
Wp3, project 6: How can urban planning and design contribute to avoidance of negative impacts of climate change or even lead to an improved urban climate in general?
Wp3, project 7: Can we formulate different spatial scenarios for the further development of the Randstad that would be beneficial for the urban climate?

Main research question **workpackage 4**: How can climate change adaptation be introduced into the existing urban planning processes?

Wp4, project 1: To what extent can climate adaptation strategies as external priority be successfully integrated and implemented in urban planning, and which tools can be of assistance?
Wp4, project 2: How can self organization of citizens be stimulated for enhancing sustainable and climate proof development of cities?
Wp4, project 3: What kind of governance concepts and building process models can support climate robust production and renovation of houses?
Wp4, project 4: How can climate adaptation measures be successfully implemented in urban restructuring processes?
Wp4, project 5: How can climate adaptation measures be successfully implemented in the sustainable development of industrial estates?

Main research question **workpackage 5**: What is the impact of global and regional climate change scenarios on Dutch cities, in other words, “what would it cost if we would do nothing?”; what are appropriate adaptation strategies in each of these scenarios, and how much would these cost; and what would be needed to implement these measures and strategies?

Wp5, project 1: What will be the impacts of the new global and regional climate change scenarios on Dutch cities, and which adaptation strategies would be needed to cope with these impacts?

Summary

Wp5, project 2: How can we, using stakeholder involvement, improve the policy relevancy of the outcomes of this research programme? Which tools can be used to support this aim?
Wp5, project 3: The aim of this project is to provide regular integrated assessment reports to the stakeholders of the progress in knowledge within this programme, answering the questions listed for wp5 above.