CRC for
Water Sensitive Cities

Program B: Water Sensitive Urbanism | Project B3.2 | Project duration: January 2015 - January 2019

The design of the public realm to enhance urban microclimates

Overview

The trend toward excess urban warmth in Australian cities in combination with global warming and the impact this can have on human mortality and morbidity, means that new mitigation and adaptation strategies for excess urban heat are required as a matter of priority. Thoughtful design of the public realm can create thermally comfortable, attractive and more sustainable urban environments by enhancing positive natural and man-made features through architecture, planning and landscape design. This project links closely to Project B3.1 (Cities as water supply catchments – Green cities and microclimate) which explores how green infrastructure and water sensitive urban design at the household- to neighbourhood-scale can modify the urban microclimate.

This project is designed to examine the processes linking urban climate, water sensitive urban design (WSUD), green infrastructure and health from street- to city-scales. The project aims to address how water sensitive cities (WSC) and their communities can benefit from green infrastructure and climate sensitive design. It will also determine the effectiveness of different heat mitigation strategies on climate and hydrology of selected Australian cities.

Key outcomes

The project outcomes include a better understanding how WSUD and green infrastructure can positively affect the microclimate of our cities and the health of their communities. Building on the findings of Project B3.1, a key outcome of this project is the evaluation of various urban design scenarios at the street- to city-scale to assess the impacts on urban climate. Having understood the potential cooling effects of different WSUD elements, informed design scenarios can be developed. This will inform and support urban planners and designers in the development and implementation of strategies that mitigate excess urban heat.

Microclimate modelling at the street-scale is currently lacking in the scientific community and the project will provide appropriate tools to address the aspects of small-scale design to derive optimal strategies for the implementation of WSUD. The base of knowledge and data developed in Project B3.1 will be used in validating urban climate models in this project. It is critical that urban climate models are performing correctly and capturing the important processes that drive urban climates.

Urban design scenarios at the neighbourhood- to city-scale will be linked to heat-health outcomes to determine the effectiveness of WSUD strategies in reducing heat related illnesses. Urban design scenarios will also provide insights into the climate sensitive design options that reduce heat stress. While the outcomes of this project will be relevant to all urban landscapes, the implementation and effectiveness of WSUD and green infrastructure in general will depend largely on the climatic zone.

Early insights into microclimatic benefits of WSUD

While the project does not commence until January 2015, some initial urban climate modelling research is beginning to highlight the effectiveness of urban greening and WSUD on urban microclimate in the Australian context at a range of scales.

- Research using the SOlar and LongWave Environmental Irradiance Geometry (SOLWEIG) model is demonstrating the effectiveness of trees in reducing radiant temperature which is the dominant contributor to the human heat budget during warm and sunny daytime conditions. After validating the model using data collected at Mawson Lakes in Adelaide, South Australia, scenarios of increased tree canopy cover have shown extensive reductions in radiant temperatures, leading to positive benefits for human thermal comfort.
- After validating the Community Land Model – Urban with data obtained in Melbourne, Victoria, CRCWSC's researchers are exploring the adoption of biofiltration systems throughout the urban landscape. Results are promising with results showing an increase in neighbourhood-scale evapotranspiration rates, which is anticipated to have a positive benefit on urban climates.

An Australian Government Initiative

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Project design

This project utilises a combination of observational and modelling approaches from street- to city-scales to understand the processes linking urban climate, WSUD and human health. At the street-scale, micrometeorological observations will continue to quantify the efficiency of green infrastructure in improving urban climate with a particular focus on street trees.

The relationships between urban vegetation, water and urban climate will also be evaluated for selected cities through numerical modelling approaches. In addition, remote sensing and GIS techniques will be used to identify the multiple ecosystem service benefits and values of green infrastructure such as reduction of urban heat and stormwater runoff, increase of carbon sequestration and improvement of air quality. The effectiveness of different urban climate mitigation strategies, such as implementing different urban vegetation, will also be assessed using an urban land surface model. Finally, the potential health benefits of green infrastructure and WSUD, like reduced heat related stress and mortality, will be quantified by utilising a range of data sources including state government hospital admission records and Bureau of Meteorology climate data for Australian capital cities.

Outlook

This project commences in January 2015, however, it is already evident from the current Project B3.1 that WSUD and stormwater reuse comprise potentially powerful and effective approaches to mitigate the effects of urban excess heat and global climate change and to dramatically enhance urban resilience. In addition, WSUD and stormwater harvesting and reuse will positively influence urban water runoff, infiltration, drainage and soil moisture that interacts with urban stream water regimes and vegetation dynamics.

Outputs that this project will produce include:

- toolkits to provide guidance for fit-for-purpose and fit-for-place (i.e. locally appropriate considering climate) green infrastructure
- new microclimate modelling approaches for use in the evaluation of WSUD and green infrastructure at the household-scale.

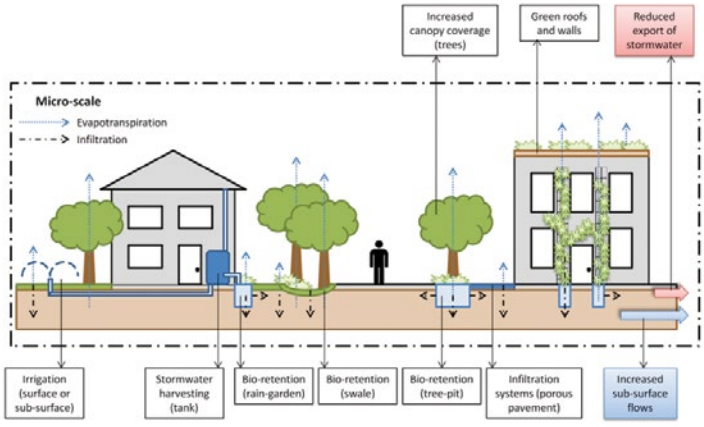

Figure 1. Conceptual design of integrating microclimate aspects and WSUD (© Coutts et al 2012)

About the Cooperative Research Centre for Water Sensitive Cities

The Cooperative Research Centre for Water Sensitive Cities (CRCWSC) brings together interdisciplinary research expertise and thought-leadership from Australia and the world to address current urban water management challenges facing our cities and regions. In collaboration with over 80 research, government and industry partners, it develops and synthesises knowledge into powerful tools and influences key players aiming to achieve sustainable, resilient and liveable water sensitive cities.

Further information

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