RP2005

THERMAL RESILIENCE AND URBAN MICROCLIMATES

Research Question

In order to investigate the heat-activity interactions in public space, the following key research questions are explored:

RQ1- What outdoor activity patterns are sensitive to heat stress in public space and to what extent do they correlate with the urban microclimate key contributors? When do changes start and how do changes fluctuate?

RQ2- What attributes of public space can facilitate resilience to heat stress?

RQ3- To what extent can heat resilient public spaces reduce anthropogenic waste heat and the need for energy consumption in low carbon cities?

Figure 1: Some hard urban surfaces such as asphalt, concrete and paving store heat in their thermal mass and make the public space a dangerous place to attend during heatwaves (Riverbank Plaza, Adeladie, FLIR 6 thermal image taken by E. Sharifi).

Methodology

Two intertwined concepts of Spatial Thermal Resilience (indicating physical ability to maintain thermal environment close to humans' thermal comfort) and Activity Thermal Resilience (indicating ability to maintain normal activities in the thermal discomfort conditions) are proposed and tested in three case studies in Darling Quarter (Sydney), Federation Square (Melbourne) and Hajek Plaza (Adelaide). Data collection includes thermal photography, climate measurement and direct observation (air temperatures range: 16-42°C; surface temperatures range: 10°C- 65°C). The data is analysed via correlational and regression analysis and findings are triangulated via a closed questionnaire survey. .

Results

Results indicate that necessary, optional and social activities in public spaces with soft landscapes (facilitated by urban greenery and controllable surface water) and smart shadow coverage have higher STR values. Optional activities (including preferred and adjustable activities) start to decline after the apparent temperature reaches the threshold of 28-32°C. However, necessary activities (including vital and habitual) and social activities (including simultaneous, managed and cultural) have a higher neutral thermal threshold of 36°C.

Every 10% increase in the urban greenery can effectively decrease the precinct temperature by 0.6°C and enables local communities to have extended public life outdoors.

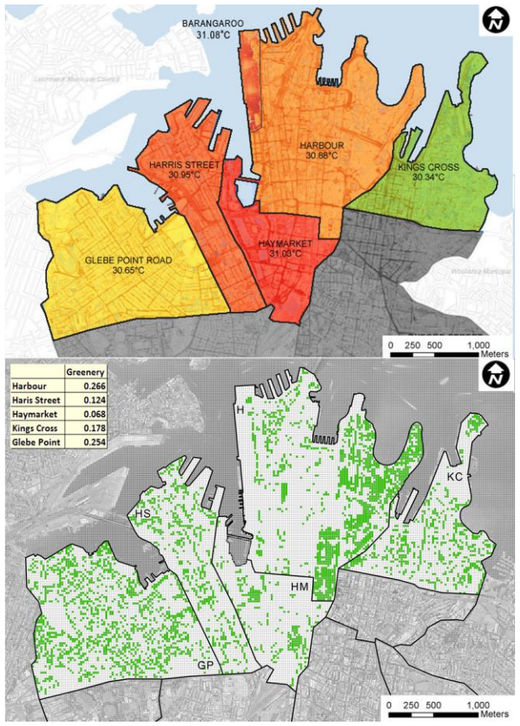

Figure 2: Higher ratio of urban greenery correlates with lower precinct average temperatures and extend outdoor activities in more inhabitable urban settings (Aerial thermal imagery, City od Sydney 2009; Greenery distribution via ENVI by E. Sharifi).

Conclusions

Higher spatial heat resilience in public space correlates with the increase in tree canopies, softer landscapes and shadow coverage. Increased greenery leads to extended thermal comfort, which increases resilience to heat stress. Decreased thermal load on outdoor participants in heat resilient public spaces results in more vibrant and healthier public life in Australian cities.

Research findings propose heat resilience as a quality indicator for public space and support the application of urban greenery in low carbon cities. The neutral thermal threshold (NTT) is the targeted benchmark for public life vitality assessment at high temperatures since it indicates the extent of public life resilience to heat stress.

Anticipated impacts

In the context of climate change, heat resilience in public space can support more vibrant, healthy and safer urban environments in existing and future cities. Local city councils, major urban design and development firms benefit from heat resilience principles to enhance public life in urban regeneration and transformation projects.

Heat resilient public spaces can save low carbon public life during heat stress conditions

For more information visit:

http://www.urbanclimates.org

http://www.lowcarbonlivingcrc.com.au/research/program-2-low-carbon-precincts/rp2005-urban-micro-climates

Contact

Ehsan Sharifi

University of South Australia

ehsan.sharifi@unisa.edu.au

Twitter @EhsanSharifi57