US-IALE Abstract

Title: Bicycle-based measurement of the intra-urban heat island: effects of landscape context on fine-scale summer air temperature in Madison, WI.

Authors: Carly Ziter, Christopher J. Kucharik, and Monica G. Turner
Affiliations: University of Wisconsin-Madison

Topics:
1) Urban Landscapes
2) Ecosystem Services

Keywords:
1) Urban heat island
2) Urban forest
3) Ecosystem services
4) Land cover
5) Climate change

Abstract

Mitigation of the urban heat island (hotter temperatures in cities) is an important ecosystem service provided by urban greenspace. Yet while broad-scale causes, magnitude, and spatial extent of urban heat islands are frequently studied, little is known about drivers of temperature variation within cities. Improving climate adaptation strategies in cities is increasingly important as climate warms, and understanding how spatial variation in temperature aligns with residents' lived experience, especially during the hottest portions of the day, is required. We asked how impervious surfaces and canopy cover interact to influence urban air temperature at fine scales (e.g. 10s to 100s of meters) in Madison, Wisconsin. A custom-developed mobile temperature sensor mounted on a bicycle was used to complement a fixed *in situ* network of 150 temperature sensors. Throughout summer 2016, we conducted repeated sampling along 10 urban transects (mean length 7 km) that spanned a wide range of impervious and canopy cover – collecting observations of air temperature approximately every 5 meters. Maximum daily temperature for Madison averaged 29°C on sampling days (range: 22 – 34°C). Intra-urban air temperature varied significantly with fine-scale variation in land cover and was coolest where canopy cover was high. Air temperature increased with impervious cover, but canopy cover moderated this effect. Mean daytime air temperature differed by 3.5°C between the hottest and coolest parts of the city (range: 1.1 - 5.7°C), whereas temperature differed by only 0.3°C on fixed sensors during the same measurement periods. The temperature difference within the city was comparable to the broad-scale temperature difference between Madison and its surrounding rural areas, suggesting that urban forestry can enhance temperature regulation services within cities. Our results offer guidance for using land cover within urban landscapes to reduce energy use impacts, and enhance the health and wellbeing of urban residents.