# Urban Heat: Rising Temperatures and Population Vulnerability in Cities

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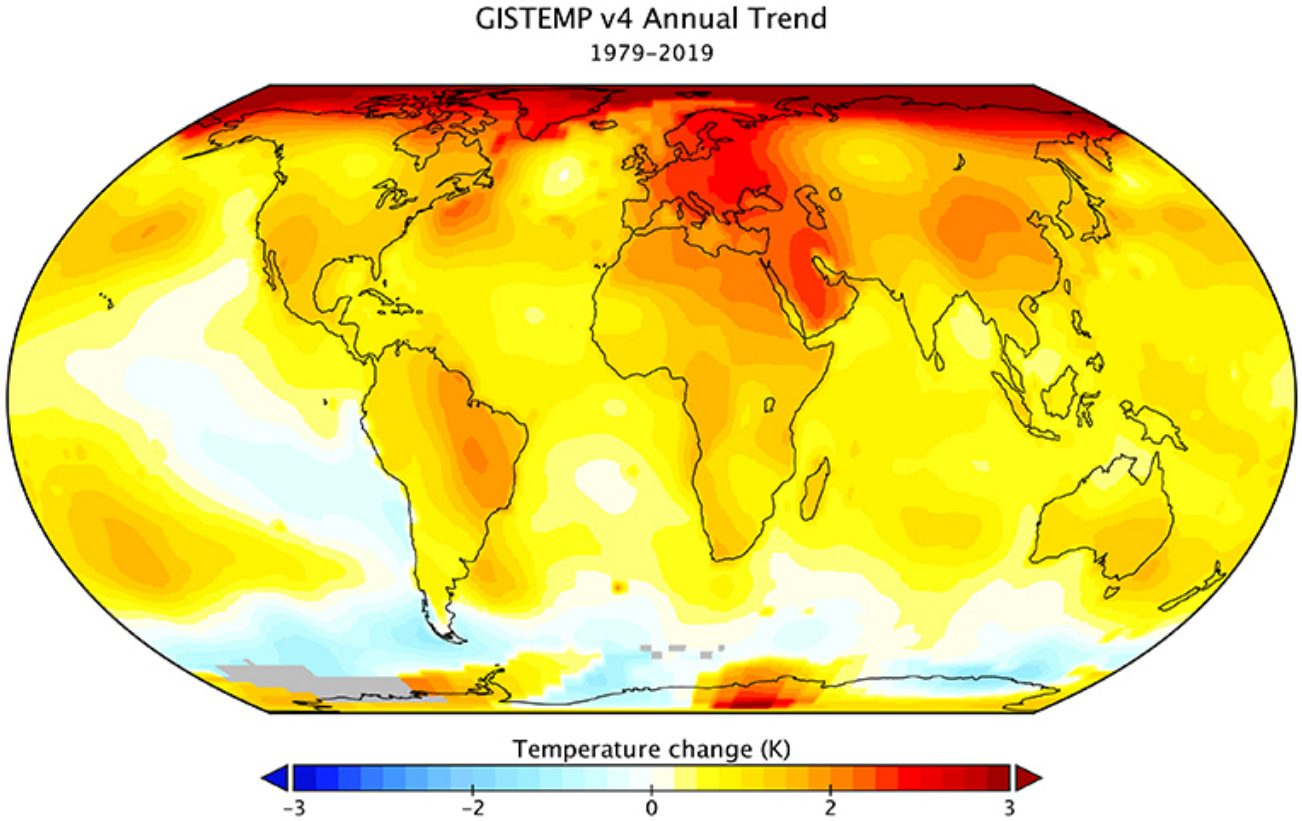
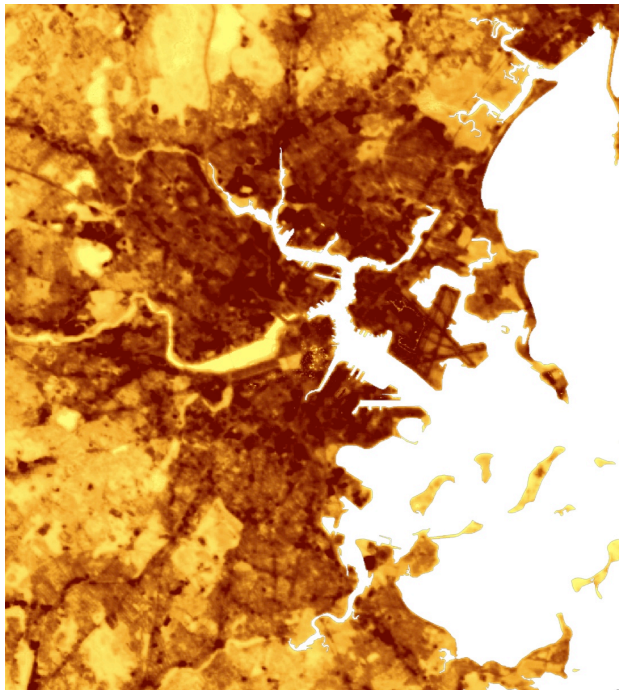
# Global climate change and warming is uneven across the globe




NASA GISS Surface Temperature Analysis (GISTEMP v4) trend map of observed global surface temperature change

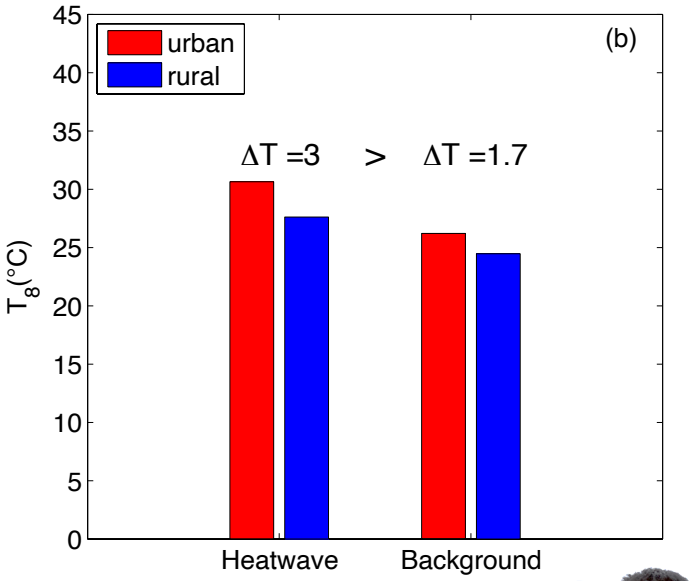
# Global climate change and warming is uneven across the globe

Land Surface Temperature



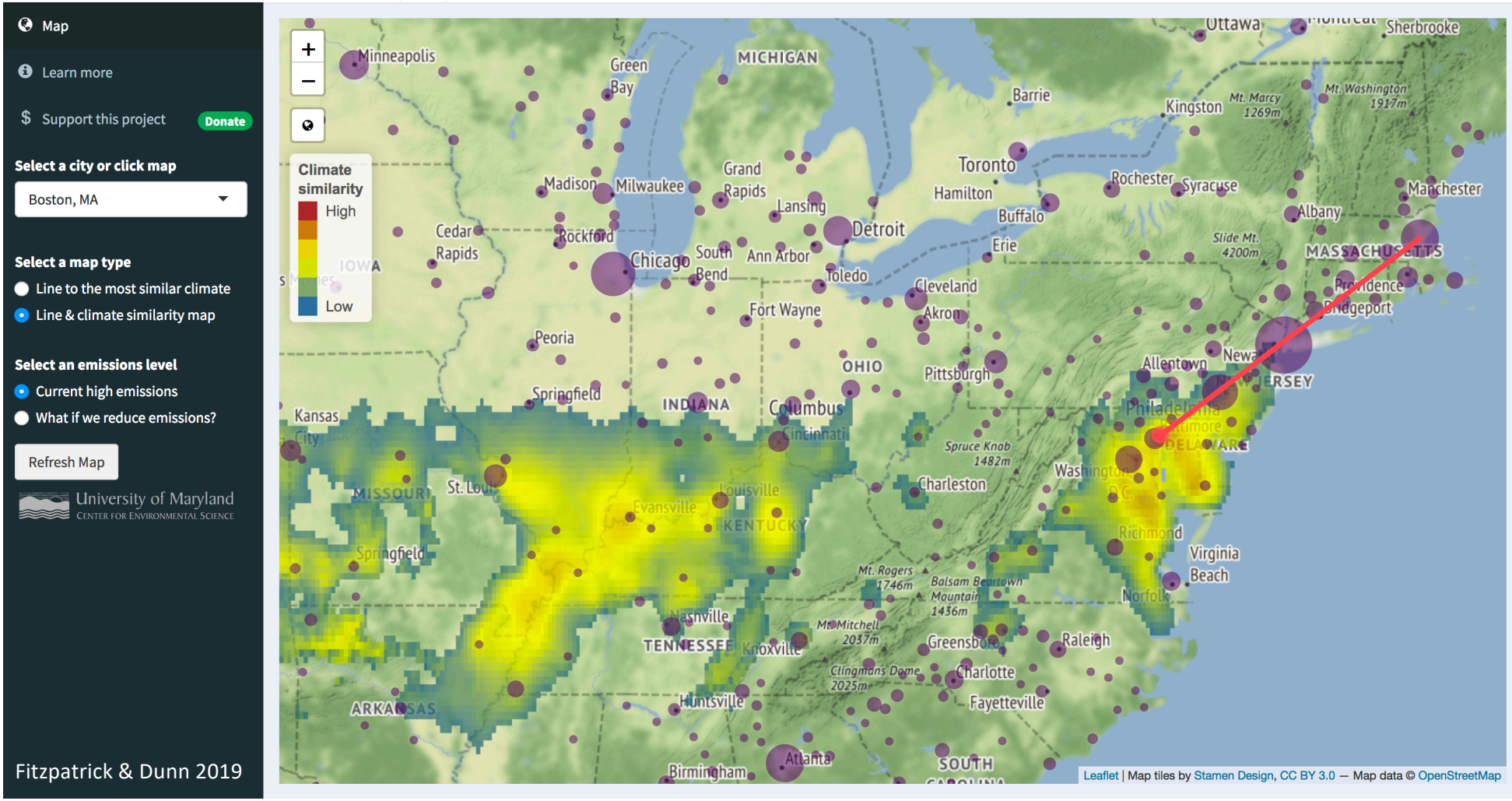
Canopy Cover

Cities are hotter than rural areas, particularly during heat waves




Professor Dan Li
(Earth & Environment)

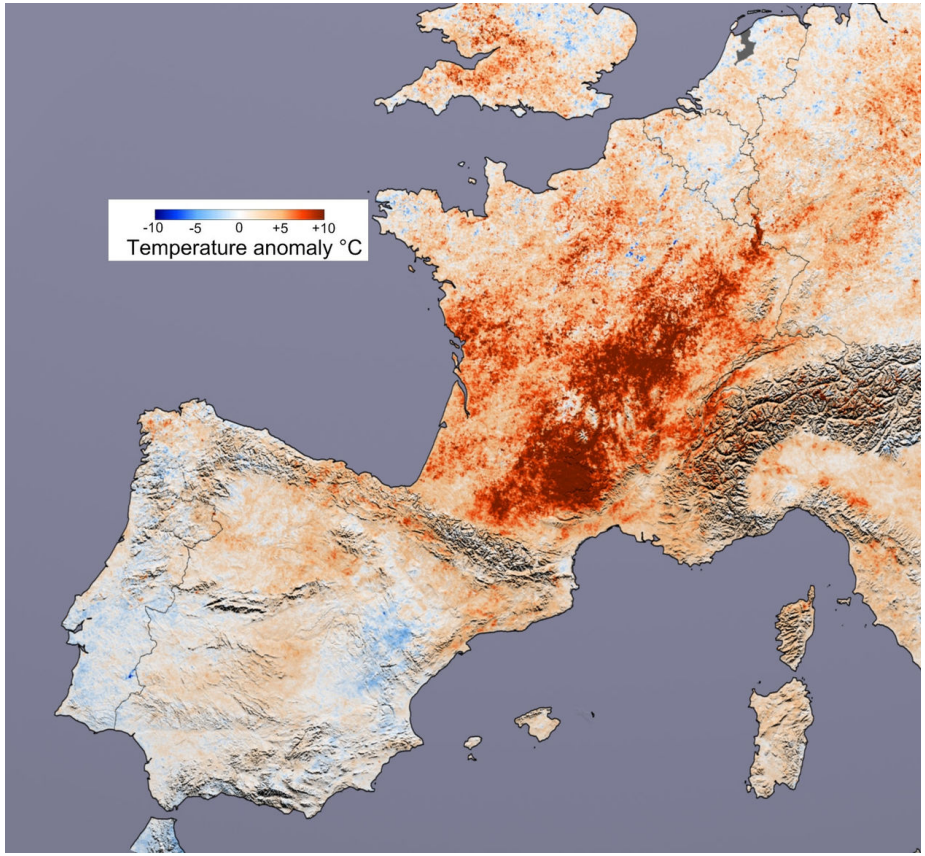
# The weather in Boston is expected to look like Washington by 2050



# Global climate change and warming is uneven across the globe

The **2003 European heat wave** led to the hottest summer on record in Europe since at least 1540.

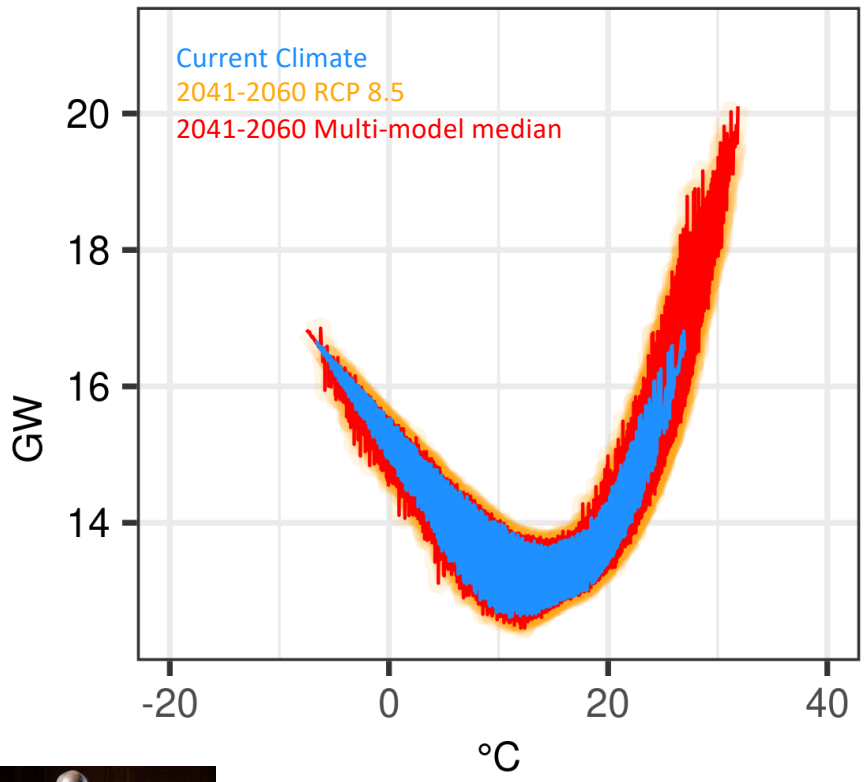
8 consecutive days with T > 104 °F. Over 30,000 deaths, fires, agricultural losses. In France alone, 14,802 heat-related deaths occurred during the heat wave.



# How to we tackle the urban heat problem?

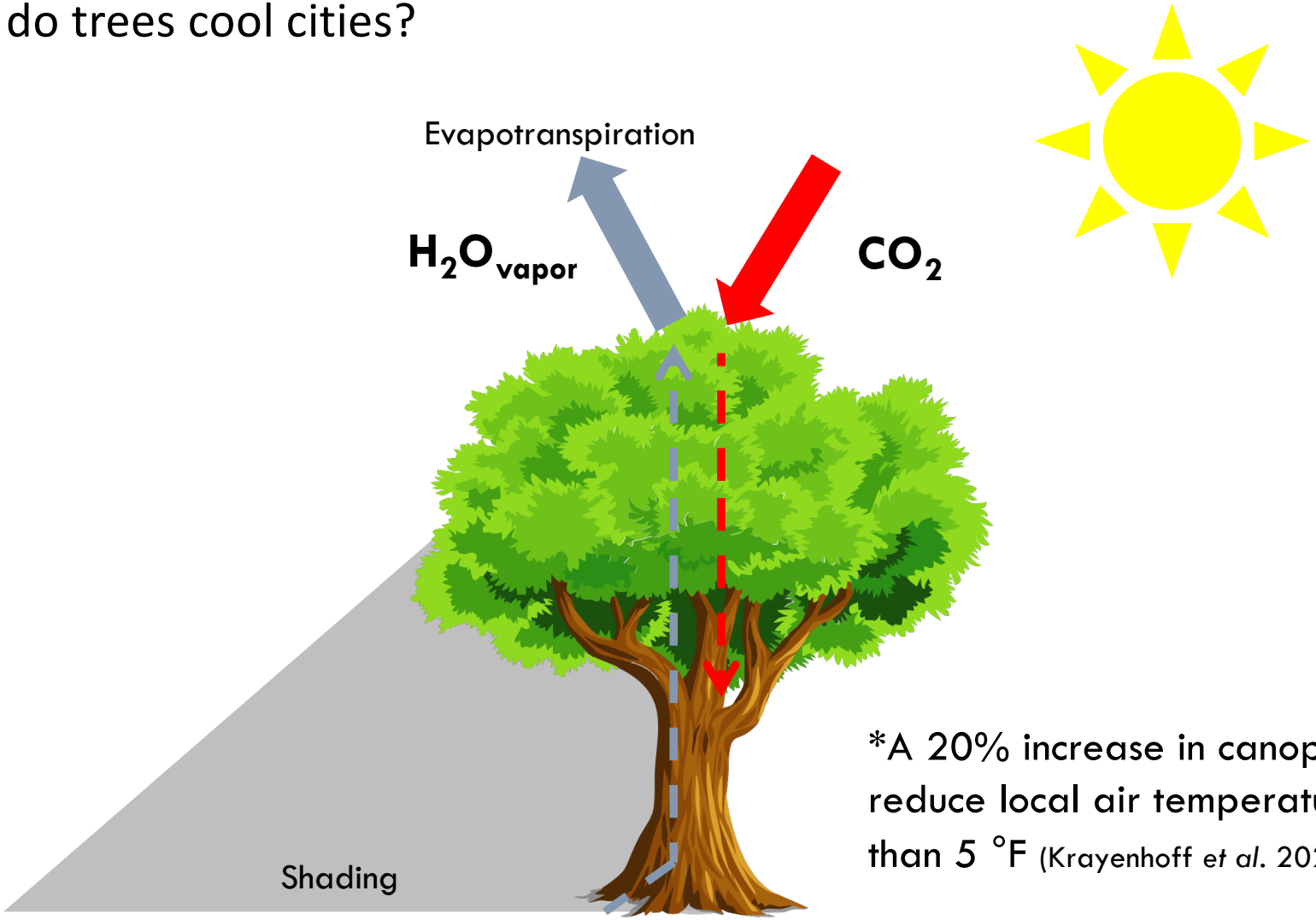
1. Reduce GHG emissions and tackle the fundamental problem
2. Increase use of air conditioning
3. Green infrastructure to cool
4. Cool building materials (high reflectivity, low absorption)
5. Shade

# Warming climate means more electricity demand



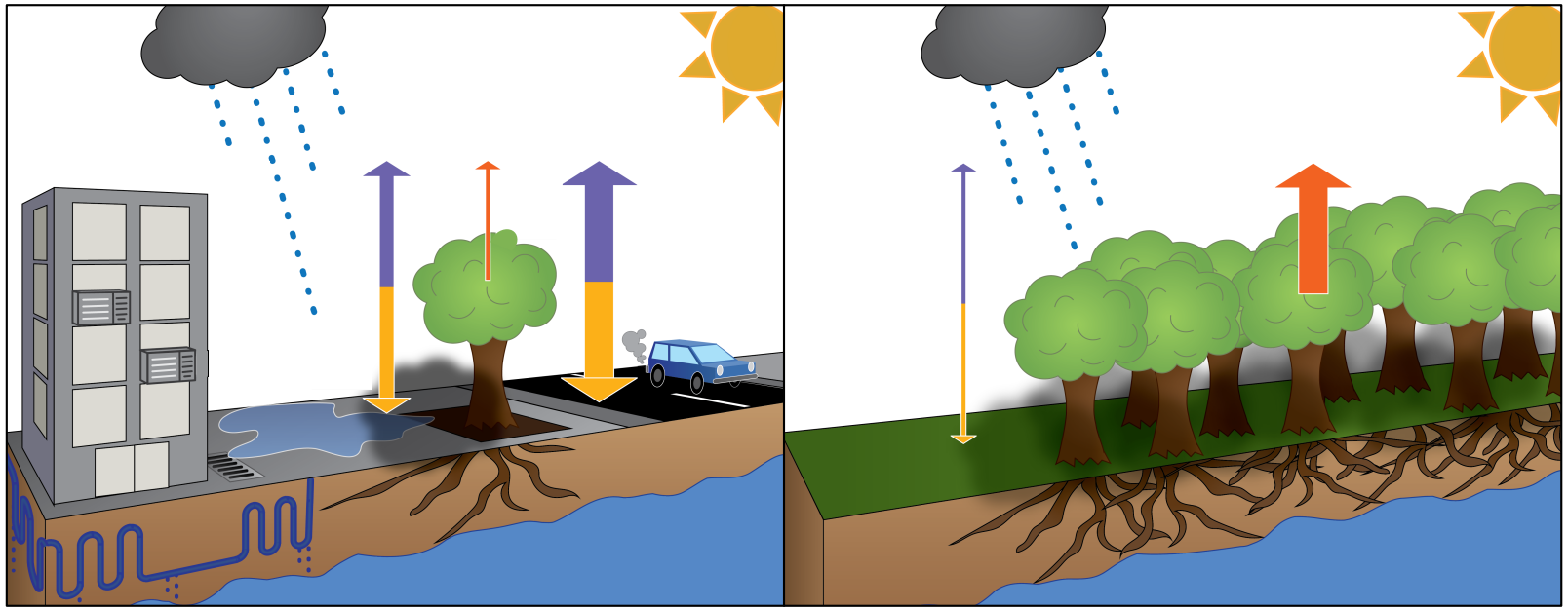

Professor Ian Sue Wing (Earth & Environment)

How do trees cool cities?




*A 20% increase in canopy cover can reduce local air temperatures by more than 5 °F (Krayenhoff *et al.* 2021)

How do we cool cities?



Winbourne et al. 2020

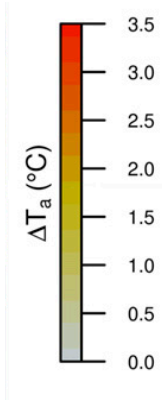
**Ground Heat Flux:** Warming of surface and soil

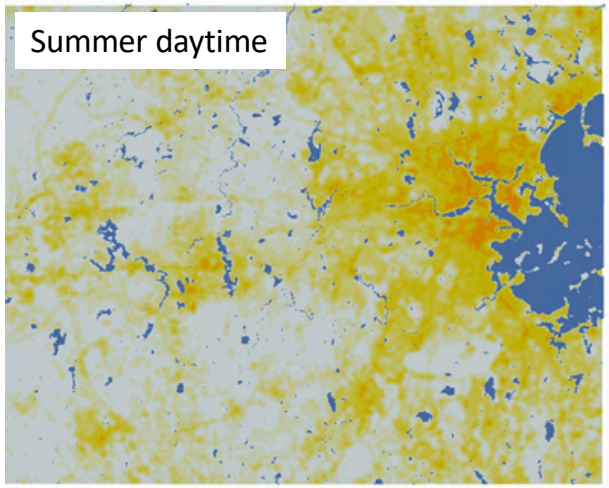
**Sensible Heat Flux:** Warming of air near surface

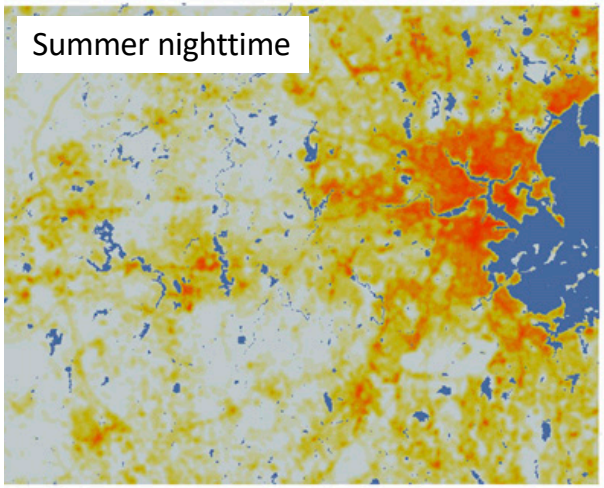
**Latent Heat Flux:** Cooling effect

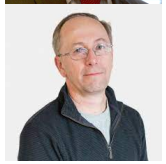
These must balance!

# Within cities, warming and vulnerability are not evenly distributed

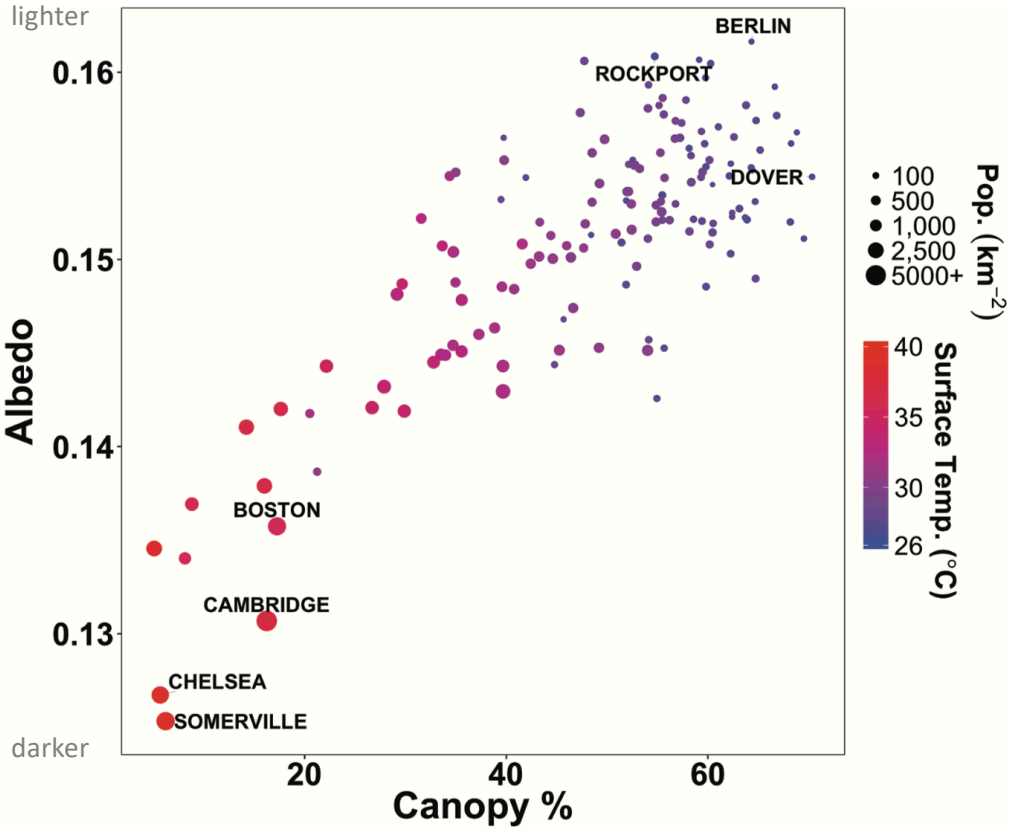


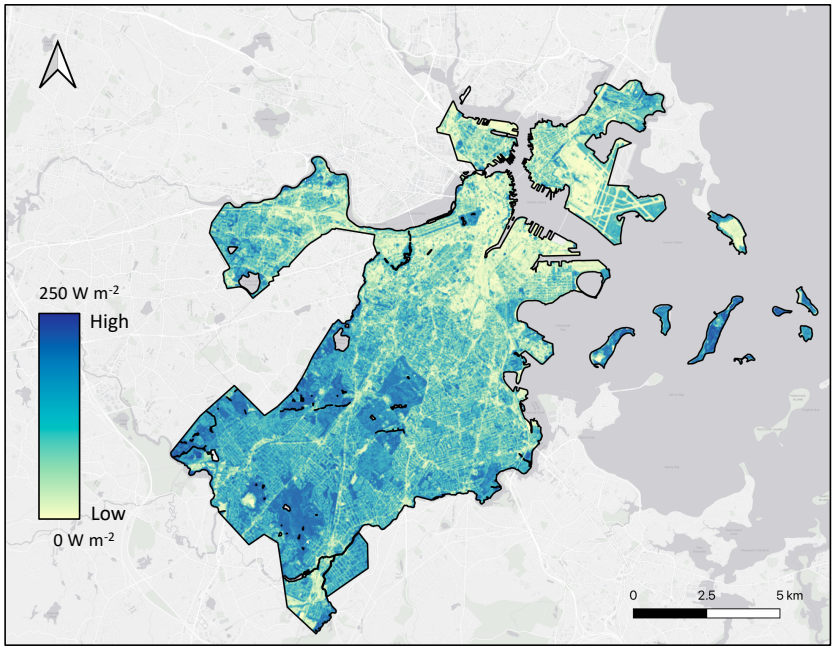
Wang et al. 2017 (Profs Friedl, Li, Hutyra)



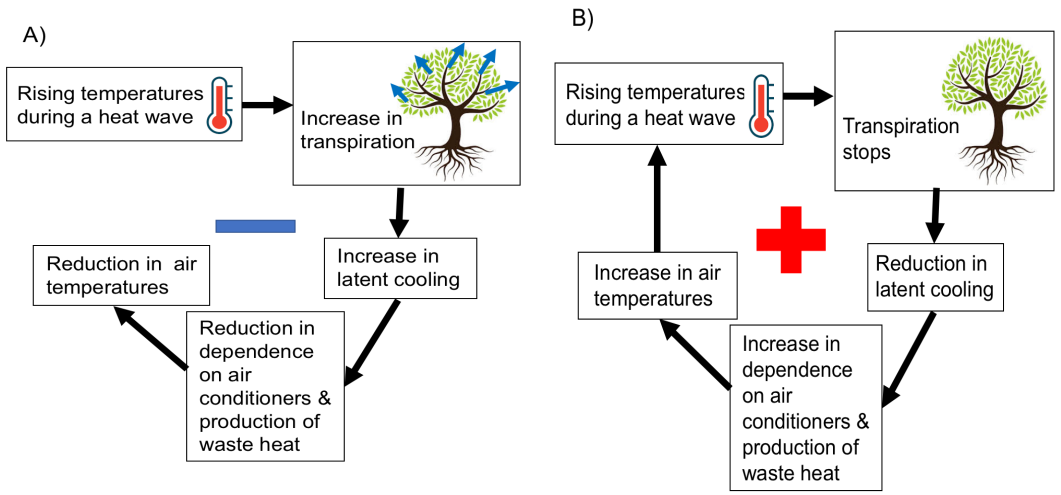

Trlica et al. 2018 (Prof. Hutyra)

# Will we continue to receiving cooling benefits from trees?

Current supply of cooling by trees




Smith et al. in review; Tieskins et al. in review




Winbourne et al. 2020

Boston's temperatures may look like DC in 2050, but will our vegetation look like Phoenix?

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There is no magic bullet to fix the problem, we need multiple solutions