Cooling the Campus: Understanding Urban Heat Islands at UNC and Harnessing Tree Canopy for Effective Mitigation

Sustainable Carolina

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Background

Urban Heat Islands:

- When urban areas are hotter than surroundings because of more impervious surfaces and lower albedo surfaces
- Can have severe public health implications

Trees:

- Provide shade and decrease temperatures
- Manage stormwater and enhance water quality
- Support biodiversity
- Improve human health and wellbeing
- Reduce energy/AC consumption

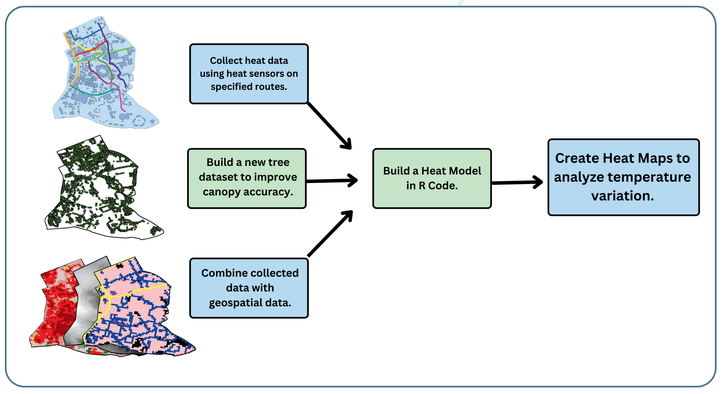
Objectives

What opportunities exist on UNC Chapel Hill's campus to mitigate heat vulnerability due to urban heat island effect through tree canopy and placement?

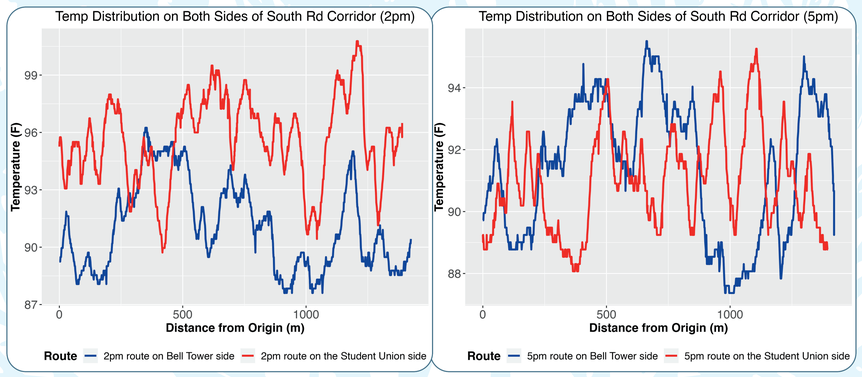
- Identify locations where urban heat island effect is most prominent on UNC's campus
- Determine where tree canopy coverage is most valuable
- Uncover the relationship between heat vulnerability and tree coverage and its importance in resilient design

Methodology

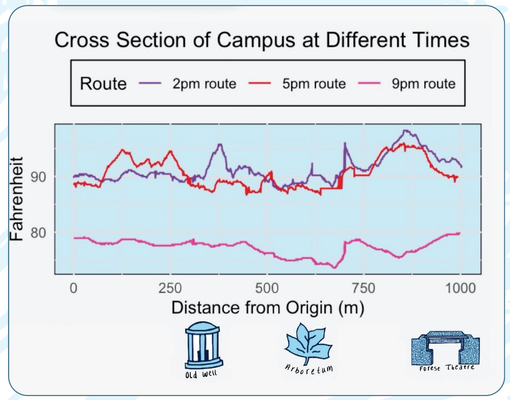
1. Collect data along 10 transects using **Pocketlab sensors**
2. Build a new tree dataset using iTree Canopy
3. Build **heat model** in R code
4. Compare tree canopy and heat data



Variation with Time



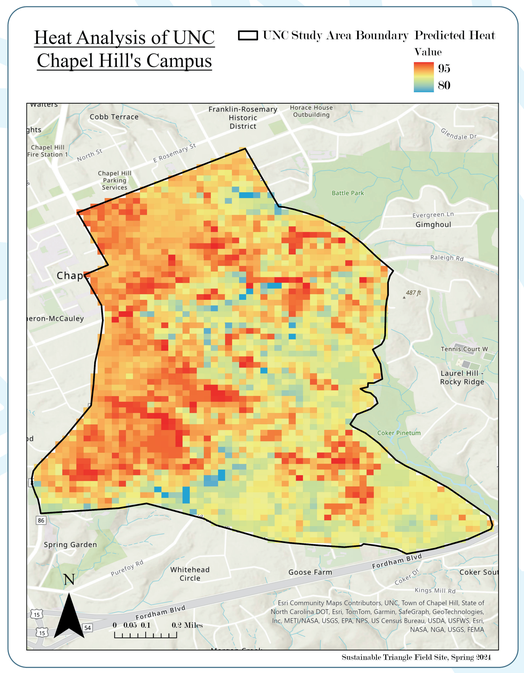
Heat sensor data collected from both sides of South Road at 2:00 PM (left) vs. 5:00 PM (right).

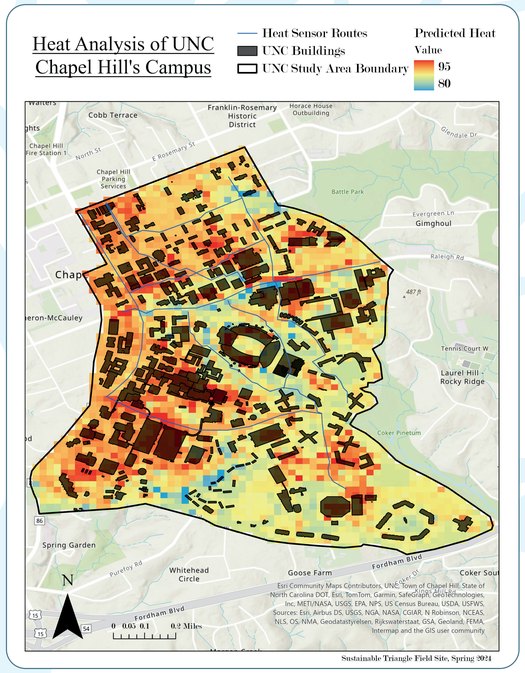


Heat sensor data collected at different times across same campus route.

Final Heat Analysis

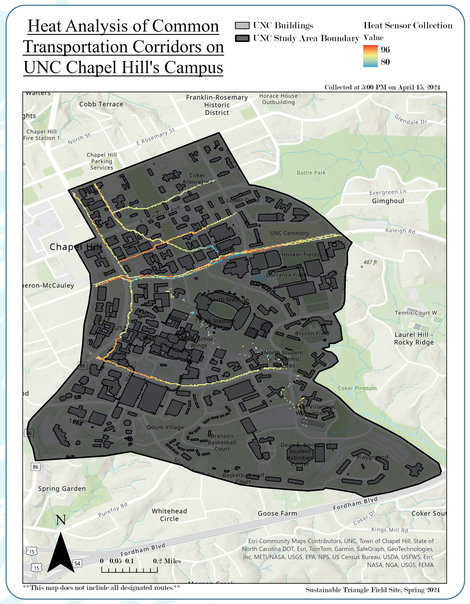
Heat analysis of UNC Chapel Hill's campus with (right) and without (left) building structures & heat sensor walking routes





- Areas with greater tree canopy coverage have cooler temperatures.
- Areas in closer proximity to buildings are at greater risk for the Urban Heat Island Effect.
- Intersections more heavily trafficked by automobiles are more susceptible to high temperatures.
- Impervious surface areas are at greater risk for trapping heat.
- Temperature can vary greatly depending on road side due to canopy shade, surface type, and time of day.
- Locations with older trees have larger canopies and more shade, reducing temperatures.
- Time of day and sun the position of the sun can alter temperatures greatly.

Heat routes



Policy Recommendations

To mitigate the UHI effect on campus, UNC should implement smart growth practices, taking into account building design, transportation, and creating green corridors.

Some ways to mitigate UHI include:

- Energy Efficient Buildings
- Green Roofs and Cool Roofs
- Permeable Pavement
- Heat Reflective Pavement
- Tree Canopy Cover and Shade
- Sustainable Transportation

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