Urban Heat Island Mapping in Raleigh and Durham, North Carolina

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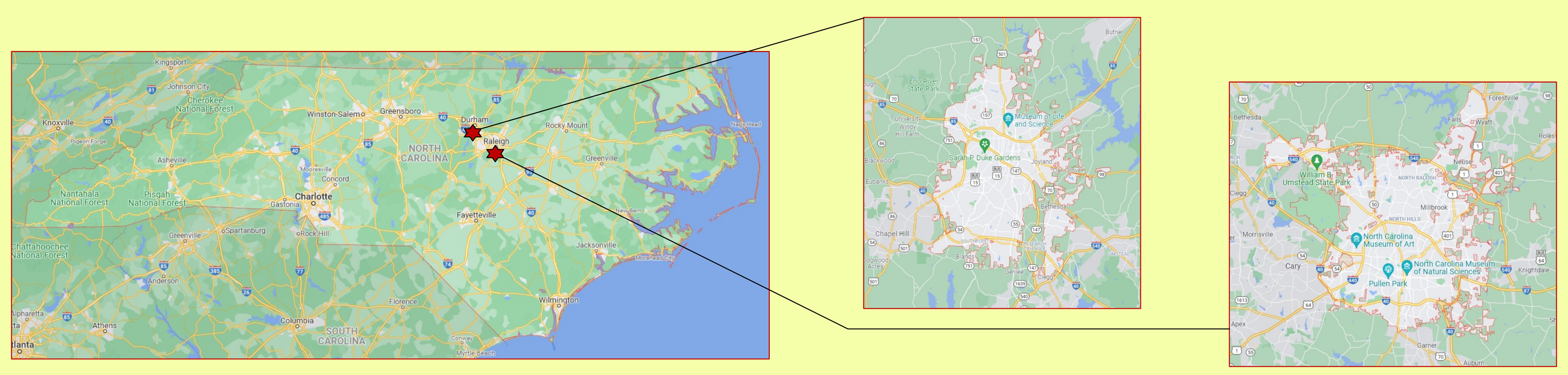
The National Integrated Heat Health Information System (NIHHIS, a consortium of NOAA, CDC, and other agencies) and Climate Adaptation Planning and Analytics (CAPA) Strategies, along with other partners, conducts Urban Heat Island Mapping (UHIM) Campaigns each year in several cities across the US. Detailed, street-level readings of temperature and humidity are measured three times a day on one designated campaign day in the summer.

The purpose of the UHIM Campaign is to engage local partners and citizen scientists to map and understand how heat is distributed in their communities. The resulting maps can aid city planning, public health, and urban forestry, as well as raising awareness of the impacts of extreme heat and the factors influencing uneven heat impacts in cities.

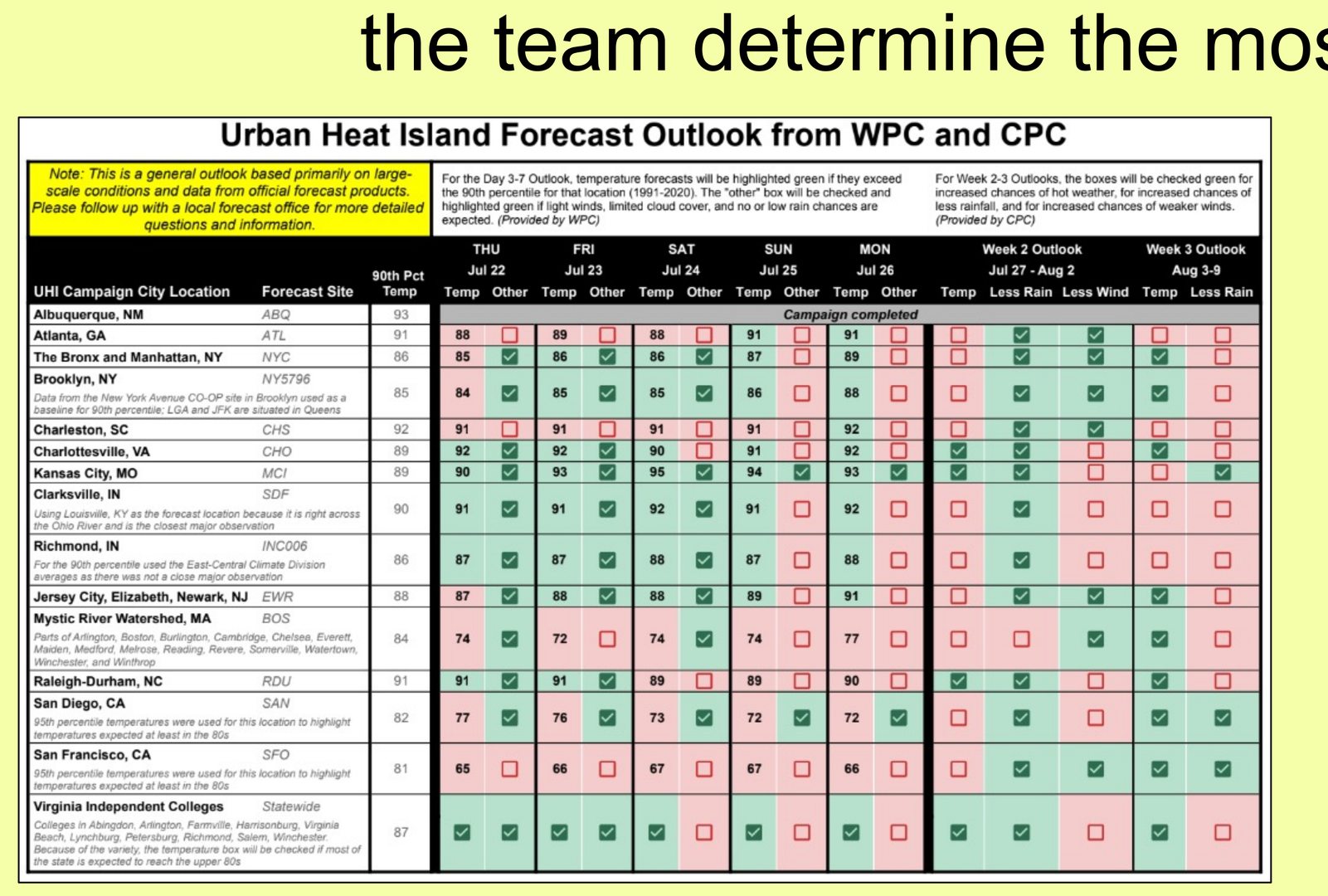
The Planning Process

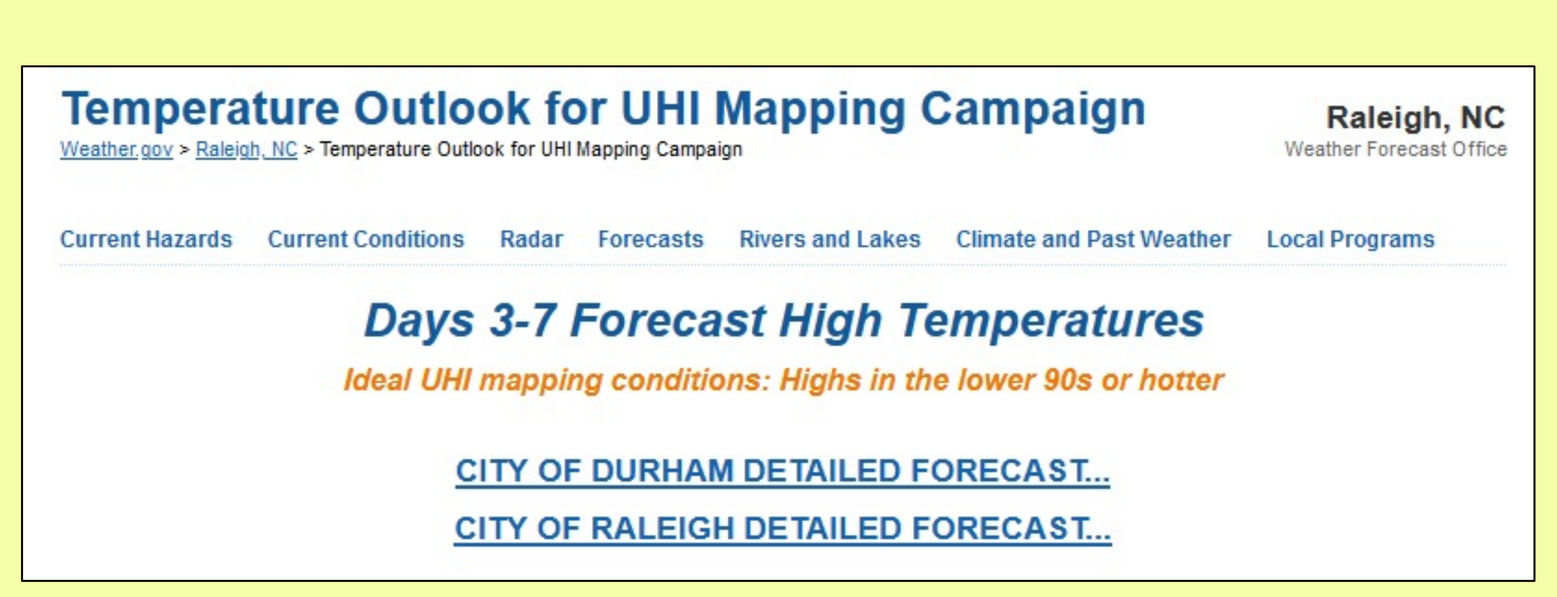
The 2021 UHIM Campaigns, in its 6th year, included both Raleigh and Durham, cities in central North Carolina a little over 20 miles apart.



Planning began the moment Raleigh and Durham were selected, in February 2021. Officials from the NC Museum of Life and Science, the NC Museum of Natural Sciences, the city of Raleigh, Durham County, the State Climate Office of North Carolina, the National Weather Service in Raleigh, and the non-profit Activate Good all worked with community leaders to gather volunteers, identify mapping routes, produce instructions and documentation, and identify an ideal campaign day. Due to the coronavirus pandemic, all planning was done vie email and video calls.

Identifying an optimal day was a challenge. We needed a day that was hot (max temp > 80F) but also free of clouds, rain, and strong winds, each of which could introduce artificial non-uniformity across the study area and skew the results. (Smoke advecting into the area from western U.S. wildfires also complicated the selection process.) The NWS's Weather Prediction Center and Climate Prediction Center provided twice-weekly outlooks for the campaign cities, and the local NWS Forecast Office in Raleigh provided local detailed predictions and a tailored webpage to help the team determine the most ideal campaign day.

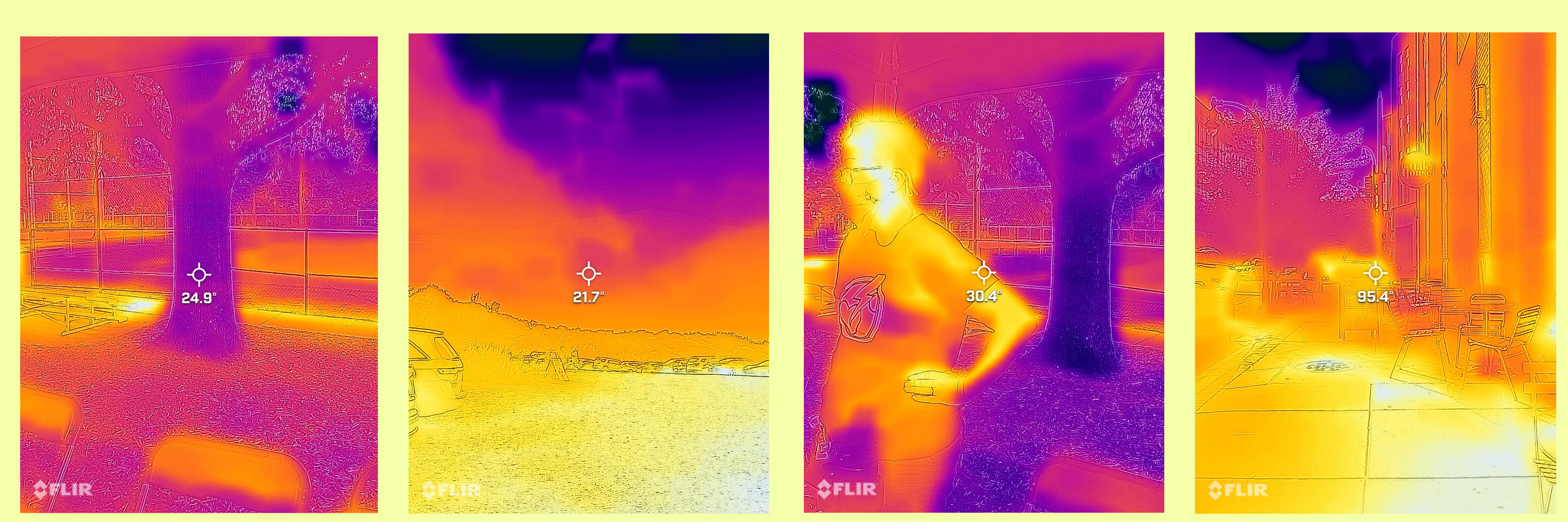




The Campaign Day

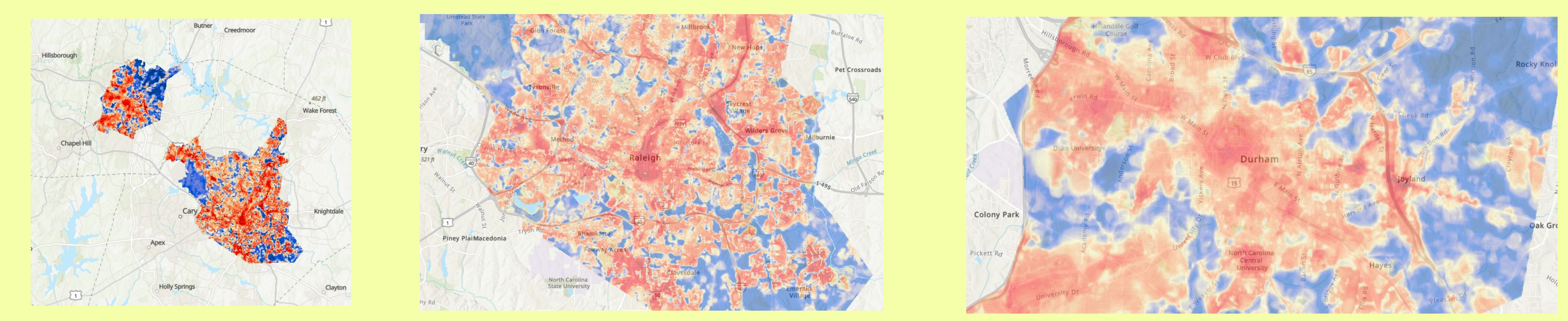
On Friday, 23 July 2021, over 250 volunteers, leaving from 5 locations, took temperature and humidity readings across Raleigh and Durham during the hours starting at 6 AM, 3 PM, and 7 PM. CAPA sensors were attached to volunteers' vehicles and bicycles. Readings were recorded every second over the pre-determined routes.

In addition, FLIR (Forward Looking Infrared) cameras attached to smartphones allowed volunteers to record thermal images on walking routes, and handheld PocketLab weather sensors were used on walking routes through parks and other pedestrian areas.

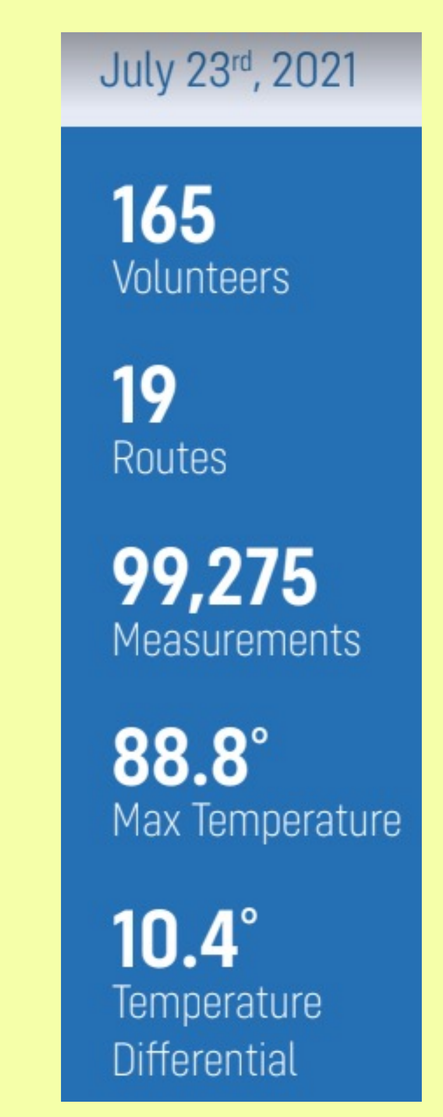


The Results and What Comes Next

Campaign data and satellite imagery were used as a basis for a machine-learning process to produce high resolution maps of air temperature and humidity over the study areas during the three tours on campaign day.



These maps, broken down by census tract and displayed via GIS systems, identify areas of each city where temperatures were warmer than the areal mean and where residents are more vulnerable to the dangers of extreme heat. Most of these hotter areas contain neighborhoods subjected to past redlining practices and other inequities.



Full results of the campaign will be unveiled to all citizen-scientist volunteers during a webinar in February 2022. Volunteers will get a chance to view and explore the vast amounts of data produced by the campaign, as well as share their ideas for how to combat the effects of extreme heat.

Our next steps will be largely determined through meetings and collaboration with community leaders. Future plans may include: working with NWS on including specific high-impact neighborhoods and communities in NWS heat alerts; informing vulnerable groups on heat dangers and warning signs; improved urban planning for more trees and shade and greater ventilation in particularly vulnerable areas; facilitating cooling assistance programs, especially in areas with high energy costs; and considering "smart" weather sensors that would detect extreme heat and display calls-to-action and recommended behavior adjustments.

Communities interested in future campaigns can learn about the application process by scanning this QR code:

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