Community Science Urban Heat Island Mapping Campaigns

Understanding and addressing extreme heat in our cities and counties

Hunter Jones
Climate and Health Project Manager
NOAA Climate Program Office
Modeled 2m Air Temperatures

Rock Creek Park
23, 30, 27 C

NOAA
26, 35, 32 C

Beltsville USCRN Station
TMAX: 33.3 C

Arboretum
USCRN Station
TMAX: 33.9 C

Eckington
27, 37, 34 C

28 August 2018
CAPA Strategies Heat Watch Evening Temperature Model

Satellite Image from Google

Jackson, Mississippi

From CAPA Heat Watch Report, 2020
Historical Housing Policies and Inequity in Urban Heat Exposure

Figure 2. HOLC classification and LST in Richmond, VA

Figure 3. Land Surface Temperature (LST) anomalies binned by HOLC classification
Many of the existing actions and interventions used to reduce the health impacts of extreme heat can be informed by detailed urban heat island information. They can be targeted to the hottest areas in the short-run, and cities can be better designed to manage UHIs in the long-run.
The National Integrated Heat Health Information System (NIHHIS)

- NOAA and CDC launched the National Integrated Heat Health Information System (NIHHIS) in June of 2015 to address heat risk planning, preparedness, and response.
- NIHHIS develops new integrative information products and coordinates programmatic activities with an interagency working group.
- NIHHIS has also launched local pilots and urban heat island mapping campaigns to understand local decision-making context and information needs, and to improve the information available for heat health risk mitigation.

Ongoing activities include:
- Prototyping new integrated climate-health products such as the NIHHIS extreme heat vulnerability tool, the climate and health monitor and outlook, and informative story maps.
- Developing Masterclasses through the Global Heat Health Information Network to increase capacity across the world.

NIHHIS will facilitate an integrated approach to providing a suite of decision support services to reduce heat related illness and death.
The Field Campaign

The day prior:
Volunteers collect the gear and receive training on how to install it and operate it. They also get a science lesson on UHI.

The day of:
Volunteers run their assigned transect routes in the morning, afternoon, and evening.

The sensors log the temperature and humidity every second, along with GPS location.

Later this year:
The CAPA Strategies team combines the transects & surface reflectance data from ESA Sentinel-2 via a machine learning (random forest) process to generate heat intensity surfaces.

Figure 2 Rendering of Sensor Setup. (A) Front of base; (B) Aspirator detail; (C) GPS unit; (D) Back of base; (E) Bottom of base; (F) Profile of device; (G) Front of device; (H) Approximate scale of device and GPS unit (GPS unit kept inside of vehicle).

From Voelkel and Shandas 2017; adapted with permission from Makido et al., 2016.

<table>
<thead>
<tr>
<th>Campaign City Location</th>
<th>NWS Site</th>
<th>WPC Forecast Maximum Temperature and UHI Weather Criteria Assessment</th>
<th>Average Summer High</th>
<th>Average Summer Record High</th>
<th>Average Annual 95°F Days</th>
<th>Average Annual 99°F Days</th>
<th>Average Annual 100°F Days</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seattle, WA</td>
<td>SEA</td>
<td>(Favorable)</td>
<td>74°F</td>
<td>92°F</td>
<td>4</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>San Jose/Santa Clara, CA</td>
<td>SJC</td>
<td>Outside Local Campaign Window</td>
<td>83°F</td>
<td>101°F</td>
<td>18</td>
<td>7</td>
<td>2</td>
</tr>
<tr>
<td>Las Cruces, NM</td>
<td>LRU</td>
<td>Local Campaign Complete</td>
<td>94°F</td>
<td>106°F</td>
<td>107</td>
<td>59</td>
<td>18</td>
</tr>
<tr>
<td>El Paso, TX</td>
<td>ELP</td>
<td>Local Campaign Complete</td>
<td>94°F</td>
<td>106°F</td>
<td>115</td>
<td>68</td>
<td>25</td>
</tr>
<tr>
<td>Austin, TX</td>
<td>AUS</td>
<td>Outside Local Campaign Window</td>
<td>94°F</td>
<td>104°F</td>
<td>114</td>
<td>64</td>
<td>21</td>
</tr>
<tr>
<td>Houston, TX</td>
<td>IAH</td>
<td>Outside Local Campaign Window</td>
<td>93°F</td>
<td>103°F</td>
<td>111</td>
<td>49</td>
<td>7</td>
</tr>
<tr>
<td>New Orleans, LA</td>
<td>MSY</td>
<td>87°F 88°F 88°F 89°F</td>
<td>90°F</td>
<td>98°F</td>
<td>86</td>
<td>17</td>
<td>0</td>
</tr>
<tr>
<td>Jackson, MS</td>
<td>JAN</td>
<td>93°F 94°F 93°F 92°F</td>
<td>91°F</td>
<td>103°F</td>
<td>86</td>
<td>28</td>
<td>3</td>
</tr>
<tr>
<td>Miami, FL</td>
<td>MIA</td>
<td>Local Campaign Complete</td>
<td>90°F</td>
<td>96°F</td>
<td>91</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Roanoke, VA</td>
<td>ROA</td>
<td>Outside Local Campaign Window</td>
<td>86°F</td>
<td>100°F</td>
<td>30</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Cincinnati, OH</td>
<td>LUK</td>
<td>82°F 93°F 83°F 87°F</td>
<td>84°F</td>
<td>100°F</td>
<td>22</td>
<td>4</td>
<td>0</td>
</tr>
<tr>
<td>Detroit, MI</td>
<td>DTW</td>
<td>Outside Local Campaign Window</td>
<td>82°F</td>
<td>98°F</td>
<td>13</td>
<td>2</td>
<td>0</td>
</tr>
<tr>
<td>Burlington, VT</td>
<td>BTV</td>
<td>Outside Local Campaign Window</td>
<td>79°F</td>
<td>95°F</td>
<td>8</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>Providence, RI</td>
<td>PVD</td>
<td>Outside Local Campaign Window</td>
<td>81°F</td>
<td>97°F</td>
<td>11</td>
<td>3</td>
<td>0</td>
</tr>
</tbody>
</table>

2020 Campaign Support from the NOAA Weather Prediction Center & Weather Forecast Offices
Why run these campaigns as community science initiatives?

From the 2020 Campaign:

Over 1 million measurements taken by 375 volunteer citizen scientists plying 173 transects in 13 communities.
Involvement and Outcomes

- 10,000 Trees Honolulu (NGOs)
- Houston Resilience Plan (city & county government)
- Worcester Polytechnic Institute Bachelor of Science Qualifying Student Project (educational institutions)
- Museum of Science Boston, Wicked Hot Boston (museums)
NIHHIS-Esri Extreme Heat Vulnerability Map Tool

combines CDC Social Vulnerability Index with Heat Projections at census tract scale