MC5 | Part 2 | Managing Heat Islands: Community Engagement & Action

Vivek Shandas, Portland State University
Jeremy S. Hoffman, Science Museum of Virginia
with David Sittenfeld, Museum of Science-Boston
Engaging public in science: expert vs. community

- Researcher(s)
- Community/Residents Make Observations
- LOW ENGAGEMENT
  "EXPERT MODEL"
- Asks question(s), designs protocol, data type, data interpretation
Engaging public in science: *expert* vs. *community*

**LOW ENGAGEMENT**

"EXPERT MODEL"

- Community/Residents Make Observations
- Asks question(s), designs protocol, data type, data interpretation

**HIGH ENGAGEMENT**

"COMMUNITY-ENGAGED"

- Community defines problem
- Co-creation of goals, protocols, interpretation, and next steps
- Researcher joins question
Expert model projects: key aspects

Bonney et al., 2009
Expert model projects: key aspects

- Science is central
- Volunteers are additional, non-expert lab members
- Volunteers are not included in the development of the science question or the dissemination of results
- Relatively low engagement in this respect

Bonney et al., 2009
Expert model projects: key aspects

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Box 1. Model for developing a citizen science project.

1. Choose a scientific question.
2. Form a scientist/educator/technologist/evaluator team.
3. Develop, test, and refine protocols, data forms, and educational support materials.
4. Recruit participants.
5. Train participants.
6. Accept, edit, and display data.
7. Analyze and interpret data.
8. Disseminate results.
9. Measure outcomes.

Bonney et al., 2009
Community-engaged projects: key aspects
Community-engaged projects: key aspects

- Highly place-based, community involved, honors local knowledge
- Researchers seen as extension of community's needs
- Focused on justice, community empowerment, and improving governance
- Community-driven question creation
Expert model project example: eBird
Expert model project example: eBird

- Volunteers train and make observations of birds in the area
- Data are uploaded to a database
- Researchers can leverage data in studies (dozens published in 2020 alone!)
- Extremely popular!

ebird.org
Community-engaged project example: Ixchel & AGU

https://thrivingearthexchange.org/project/ciceroberwyn-il/
Community-engaged project example: Ixchel & AGU

- “Assessing Flooding and Hydrodynamics for Community Revitalization”
- Stormwater and sewage regularly backs up into houses and basements.
- **Ixchel** is a grassroots organization that brings together and empowers Cicero and Berwyn residents to address and dismantle structural racism to ensure access to equitable education and environmental justice.
- Dr. Joseph Schulenberg, Civil and Materials Engineering Department at University of Illinois-Chicago

https://thrivingearthexchange.org/project/ciceroberwyn-il/
Community engagement as a spectrum

Level of Engagement

LOW  HIGH
Community engagement as a spectrum

Level of Engagement

LOW

“EXPERT MODEL”

HIGH

“COMMUNITY-ENGAGED MODEL”
Measuring Urban Heat: Three Methods

Satellite Based

Ground Stations

Mobile Traverses
Satellite Derived Heat Surfaces

**Strengths**
- Freely available across the world
- Seasonal availability
- Intra-urban variation detectable
- Extensive literature and research
- Potential connections to land use

**Weaknesses**
- Exaggerates temperature ranges
- Coarse pixel size (30m, 90m, 1km…)
- Rooftops as opposed to street-level
- Discrete differences between land covers
- Translation to policy remains unclear
Near-Surface Urban Heat Data

Strengths

- Engages community in their place
- Established ‘civic legitimacy’ of scientific process and results
- High resolution outputs (1m, 10m)
- Diurnal profile of air temperatures
- Policy applications are evident

Weaknesses

- Coordination of local community groups requires time and strategy
- Not free due to engagement and analysis
- Seasonal differences not [yet] available
- Clouds or rain can create delays
- Generalizable models are still forthcoming
Urban heat data as a spectrum

Robustness of Data

LOW  HIGH
Integrating Urban Heat Data and Community Engagement

A: People, Place, & Perspective: Consensus on goals, problems, and effective implementation

B: Expert Applications: Specialized knowledge without stakeholder involvement/support

C: Status Quo: Confrontational debate and no improvements

D: Mediated Discussion: Consensus on goals and problems with no help on how to achieve
Wicked Hot Boston:
Community Science for Building Extreme Heat Resilience and Addressing Public Health Disparities

David Sittenfeld
Museum of Science, Boston
Jul + Aug 2019
50 Citizen Scientists
10 routes
3 cities

Urban Heat Island Mapping
Ashmont, 102.6 degrees F
Our cat's favorite way to beat the heat :-)

79.3°F
CITIZEN SCIENCE IN BOSTON

In the summer of 2019, the Museum of Science led a citizen science project to map the air temperatures experienced by residents in the summer. Dark, dense materials like asphalt in cities absorb heat during the day and release it back into the air at night, a phenomenon known as the Urban Heat Island effect. Hot summer nights can exacerbate the health effects of daytime exposure to high temperatures by disrupting sleep and increasing stress and dehydration. With the help of the Museum of Science, volunteers attached temperature sensors to their cars and bikes to collect data in Boston, Cambridge and Brookline. Partner scientists are using the data to create a map of temperatures that residents experience in their neighborhoods.

GO BOSTON 2030
Reducing transportation emissions

Go Boston 2030 is the City’s long-term plan to transform Boston’s transportation system. In accordance with the 2014 Climate Action Plan Update, Go Boston 2030 adopted climate responsiveness as a guiding principle and set goals to make Boston a city where all residents have better and more equitable travel choices, where efficient transportation networks foster economic opportunity, and where the City has taken steps to prepare for climate change.

By emphasizing accessibility, safety and reliability, Go Boston 2030 will make it easier and more attractive for Bostonians to go car-free. Actions to shift travelers from driving alone to choosing shared and active transportation modes will make travel more efficient, reduce total vehicle miles traveled in Boston, and help decrease our transportation carbon emissions.

Since the plan’s adoption, the City has invested in 30 new staff positions and started implementing many of the projects it laid out, including new bus lanes along priority corridors, mobility hubs, and low bike infrastructure connections.
Socioeconomic data from Climate Ready Boston data archive, S. Atyia Martin, 2015 (Mapped by D. Sittenfeld)
The Effects of Historical Housing Policies on Resident Exposure to Intra-Urban Heat: A Study of 108 US Urban Areas

Jeremy S. Hoffman, Vivek Shandas, and Nicholas Pendleton, *Climate* 2020, 8(1)
Tree Canopy Assessment

Boston, MA

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Boston Parks and Recreation Department

September 2020

Tree canopy can help mitigate the heat island effect, particularly in densely urbanized and industrialized areas. In Boston, there is a statistically significant negative relationship between tree canopy, “Greenness,” and air temperature, indicating that areas with higher tree canopy and “Greenness” help reduce the urban heat island effect, as shown in Figure 22. The red color ramp corresponds to the percent impervious. Darker reds indicate higher amounts of impervious. The urban core and north-eastern parts of Boston, where there is low tree canopy, experience the greatest urban heat island effect.

Figure 22: Relationship between the 2019 Existing Tree Canopy percentage, “Greenness” percentage (right) and mean air temperature (T) in Fahrenheit and Heat Index (HI). The “Greenness” is from the Wildland Hot Boston Project researchers at the Museum of Science, Boston, and the Helmholtz Lab at Northwestern University. Temperature data was collected during four one-hour periods: 8am, 11am, 2pm and 7pm on 7/30/19 for East Boston and 7/21/19 for the rest of Boston.

Mean Air Temperature & Existing Tree Canopy Comparison

Figure 23: Heat island effect is exacerbated by 25% above normal, 2019 Existing Tree Canopy (right) and Mean heat index measured in Fahrenheit (left) for 3pm shows that areas with lower tree canopy experience increased heat.

University of Vermont Spatial Analysis Lab/City of Boston Parks and Recreation
Final activity - breakout rooms!

Remember your “animal” from earlier?

In your breakout groups, do these things:
1) one-sentence introduction
2) brainstorm ways to design community engagement for a fictional city together
3) be prepared for 30-second abstract share-out for everyone!
Mystic River Needs To Cool Off

The Wicked Hot Mystic Project, led by Arlington, will combat extreme heat in parts of the river.

http://www.mos.org/wickedhot
28 Science-to-Civics campaigns

In 2018, NOAA awarded the Museum of Science and its partners a 3-year grant to work with science centers across the U.S. to engage 28 science centers working with community and civic partners in projects connecting community science and deliberation to build community engagement and inform local resilience planning regarding four hazards:

- Heat Waves
- Sea Level Rise
- Extreme Precipitation
- Drought
The Science-to-Civics Process:

Citizen Science, Civics, and Resilient Communities (CSCRC) Project

Through forums and citizen science projects, museums engage the public in active learning and resilience planning around heat waves, sea level rise, extreme precipitation, and drought.

Opportunities for NISE Network partners

- Apply to be one of 20 sites that will be selected to receive a small stipend and support from the project team to organize and implement a science-to-civics campaign in your community.
- Dates and Deadlines: Applications for a CSCRC project stipend application must be submitted online using Qualtrics by January 15, 2021.
  - Optional: Watch an online workshop to learn more about the Citizen Science, Civics, and Resilient Communities project.
- Institution Eligibility and How to Apply: Find more information below.

The CSCRC process is mapped to "The Three Steps of Public Engagement" from Rowe and Frewer (2005).

https://www.nisenet.org/CSCRC
Thank You!
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Back to Mentimeter!
Percent Impervious Surface by Redlining "Grade"

Redline Grade | Mean Impervious Surface
---|---
A | 31.4%
B | 47.7%
C | 55.7%
D | 66.3%

Mapped by D. Sittenfeld, September 2020

Source Data: National Land Cover Database
<table>
<thead>
<tr>
<th>Redline Grade</th>
<th>Mean Tree Cover</th>
</tr>
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<tbody>
<tr>
<td>A</td>
<td>45.4%</td>
</tr>
<tr>
<td>B</td>
<td>31.9%</td>
</tr>
<tr>
<td>C</td>
<td>22.2%</td>
</tr>
<tr>
<td>D</td>
<td>12.0%</td>
</tr>
</tbody>
</table>

Legend

Percent Tree Cover

- 0 - 6.3
- 6.301 - 12.6
- 12.61 - 18.9
- 18.91 - 25.2
- 25.21 - 31.5
- 31.51 - 37.8
- 37.81 - 44.1
- 44.11 - 50.4
- 50.41 - 56.7
- 56.71 - 63

Mapped by D. Sittenfeld, September 2020
Source Data: National Land Cover Database