Metering Energy Justice

Centering Historically Disinvested Communities in a Warming Planet

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Acknowledgements
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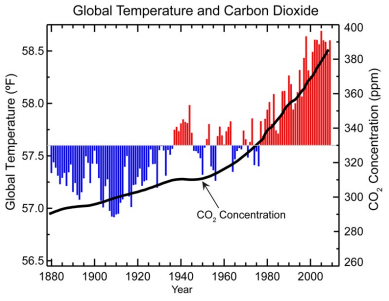
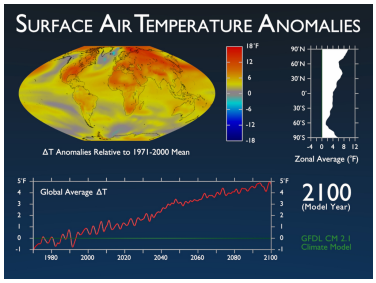
Why Energy Justice Matters

- Observable trends are underway
  - Rapid acceleration of temperatures and extremes
- Buildings amplify heat
  - Unaccounted for climate risks is the built environment
- Existing building mediate….
  - Current development strategies (n'borhoods)
  - Environmental processes
  - Private party decisions about internal/external processes
  - Extent of regulations, policies, and programs to address climate threats





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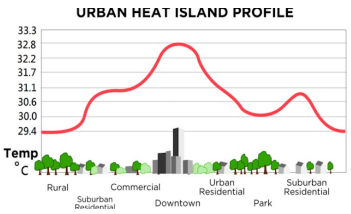
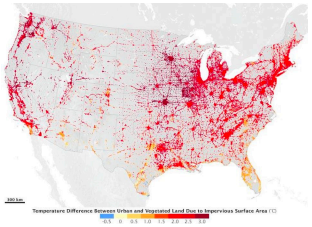
Common Descriptions of the UHI

1. Traditional use of a 'reference site' to assess urban temps
   1. Use of weather stations (spatial)
   2. Nighttime differences (temporal)
2. Satellite description of the land surface temperature (LST)
   1. Atmospheric brightness & emissivity
3. Integrating satellite with ground-based measurements
   i. Aim of developing a predictive model for air temperatures





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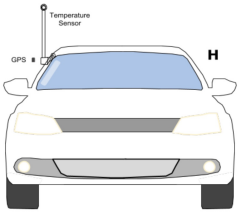
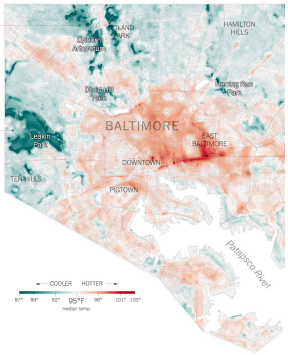
Field Campaigns for Hyper-Local UHI Data

- Volunteers affix temperature sensors to vehicles
- Drive pre-planned routes across city
- Near-surface air temp/humidity
- Precision at 10m (~90m for satellite images)



Volunteer team in Jackson, MS



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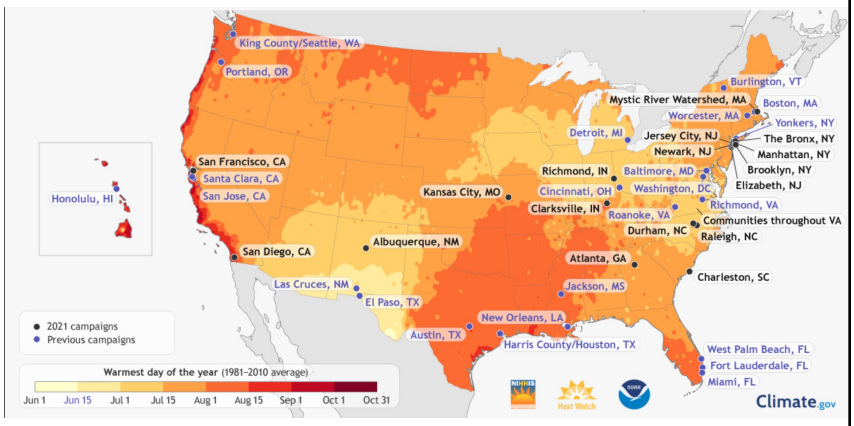
National/International Campaigns Underway



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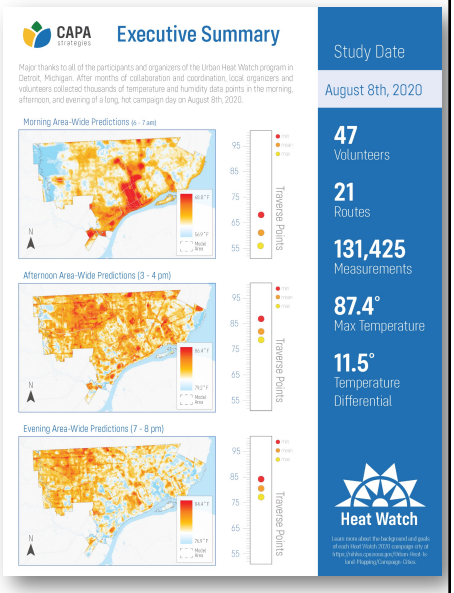
Advancing Cooling Interventions

- Spatial distribution of heat: Detailed maps at 10-meter resolution across the city.
- Social vulnerability: Which communities are exposed to higher or lower temperatures.
- Distribution of green assets: Do street trees, parks and water bodies result in lower temperatures? Evenly distributed?

- Built environment: Which structural types and design features correlate with high or low temperatures?
- Housing policy: To what extent can land use couple with technology (i.e. battery storage) to reduce vulnerability during rapid warming and extreme climate-induced events?



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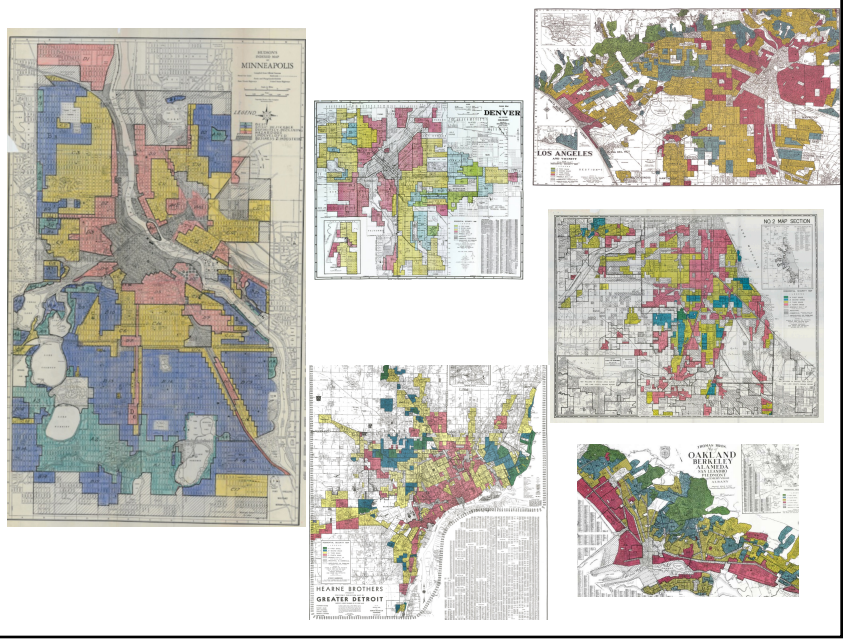

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Race, Economics & Climate Dynamics

HOLC "Redlining" Maps: The Persistent Structure Of Segregation And Economic Inequality

By Bruce Mitchell PhD., Senior Research Analyst and Juan Franco, Senior GIS Specialist, NCRC / March 20, 2018 / Research

Federal Reserve Bank of Chicago

The Effects of the 1930s HOLC "Redlining" Maps

Daniel Aaronson, Daniel Hartley, and Bhashkar Mazumder

August 3, 2017

WP 2017-12

**Working papers are not edited, and all opinions and errors are the responsibility of the author(s). The views expressed do not necessarily reflect the views of the Federal Reserve Bank of Chicago or the Federal Reserve System.*

Home Values Remain Low in Vast Majority of Formerly Redlined Neighborhoods

By Sarah Mikhitarian on Apr. 25, 2018

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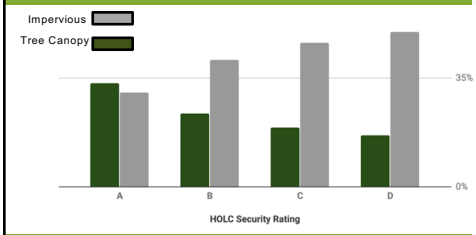
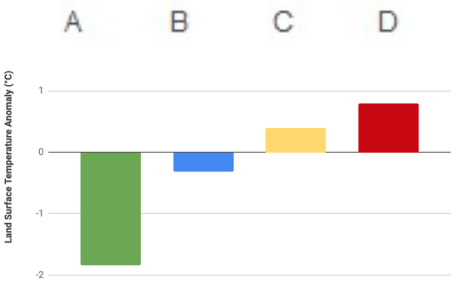
Landscapes And Temperatures





Conscious and Deliberate Planning

1. Greater amount of asphalt and pavement
2. Highway projects and big box stores
3. Large-scale housing projects
4. Industrial facilities
5. Lack of parks and green spaces

Hoffman, Shandas, & Pendelton, 2020

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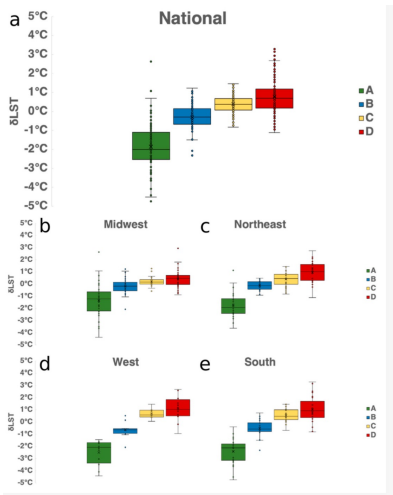
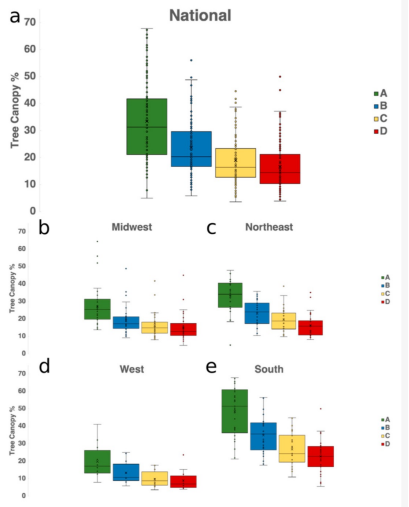
Redlining and Landscape Conditions

Temperatures & HOLC Grades



Tree Canopy & HOLC Grades



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Redlining & Temperature Differences

Ranking	State	City	D-A Rating Difference (°F)
1	OR	Portland	12.8
2	CO	Denver	12.0
3	MN	Minneapolis	10.8
4	GA	Columbus	10.3
5	FL	Jacksonville	9.9
6	CT	East Harford	9.7
7	TN	Chattanooga	9.6
8	IN	Indianapolis	9.5
9	VA	Roanoke	9.5
10	PA	Philadelphia	9.4
11	KY	Louisville	9.4
12	MD	Baltimore	9.3

Hoffman, Shandas, & Pendelton, 2020

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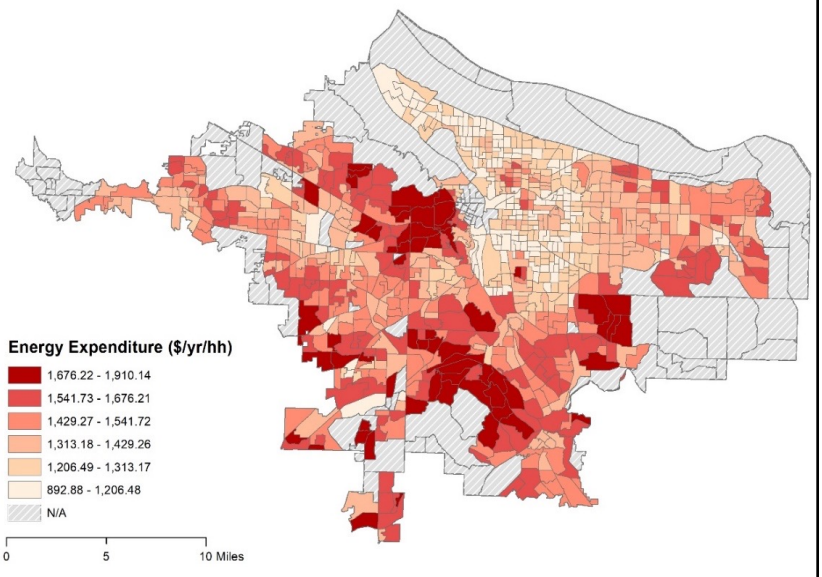
Cooling the City



Antonopoulos et al., 2020

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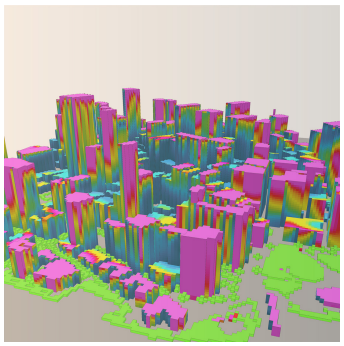
Predicting Changes in Temperatures

- Complex Fluid Dynamics Modeling (ENVI-Met™)
  - Microclimate assessments
  - Thermodynamics
  - Atmospheric physics
- Interventions across diverse land use types
  - Large lots, urban districts, suburban, commercial, etc.
  - Density applications
  - Cool roofs, green walls, street trees, etc.



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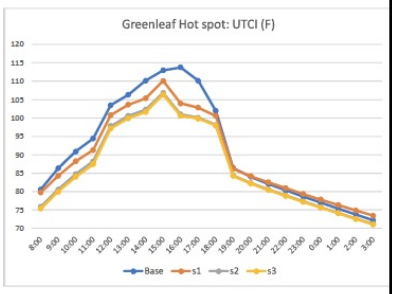
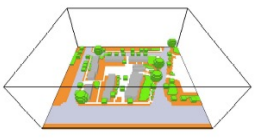
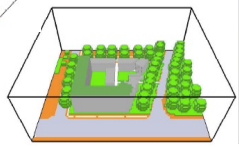
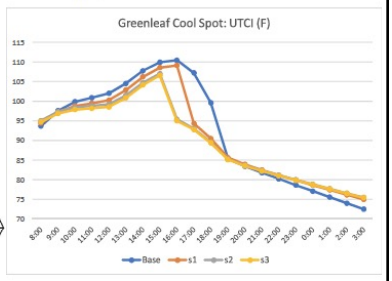
District of Columbia Public Housing









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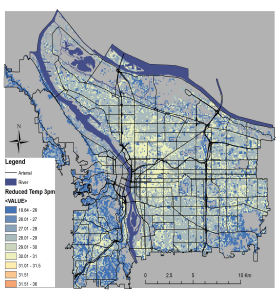
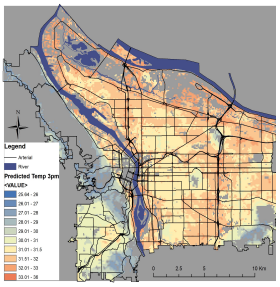
Cooling the City

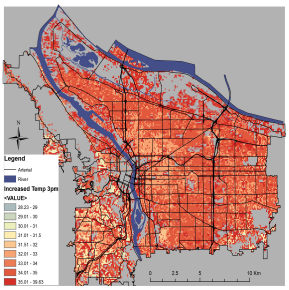
- Application of cooling interventions to all land use types
  - Combination of strategies: overall city temperatures cool by over 9^0 F(left)
  - Asphalt City: Increase of temperatures by 12^0F(right)



Combination of Cooling Strategies



Base Case
(current conditions)



Removal of Green Expansion of Asphalt

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Next Steps and Opportunities

- Assess scales of interventions – multiple buildings, intervention types, and development contexts
- Identify potential for centering multi-sectoral collaborations to test efficacy of 'in-situ' cooling interventions across multiple cities
- Identify policy options for advancing 'no net increase in neighborhood temperature'

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Contact:

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