The Southwest Urban Integrated Field Laboratory

Building Resilience to Extreme Heat

Phoenix extreme heat case study discussion

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Extreme Heat Drivers and Outcomes

Climate Drivers

- Climate variability & change
- Frequency/intensity of storms and heat waves
- Weather variables (beyond T_{max})

Social & Neighborhood Drivers

- Energy poverty and AC availability
- Housing quality
- Landcover and surface properties
- Local services & resources
- Unhoused population characteristics
- Outdoor workforce

Technology Drivers

- Grid reliability/stability and power outages
- Infrastructure vulnerability
- Equipment failure

Outcomes

- Population health -- heat-related mortality & morbidity
- Energy and water demand
- Household economic trade-offs
- Climate migration
- Seasonal/regional migration
- Regional economic environment and tax base
- Operational limitations for outdoor workforce
- Extreme heat damage to infrastructure (roads/rail…)

…and many more

Exploring Urban Cooling Strategies

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Solutions/strategies explored:

- Building materials
- Neighborhood morphology
- Green and blue infrastructure

Methods:

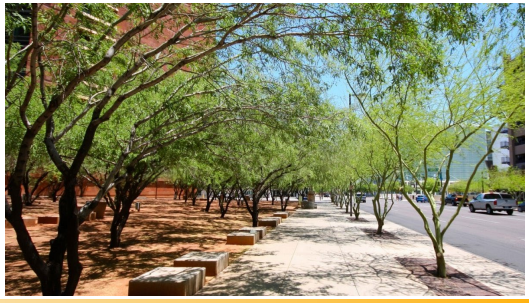
- Remote sensing
- Vehicle-based measurements
- Fixed stations
- Modeling across scales

Research Questions:

- What is the local and downwind cooling effect?
- What are the unanticipated co-benefits and disbenefits?





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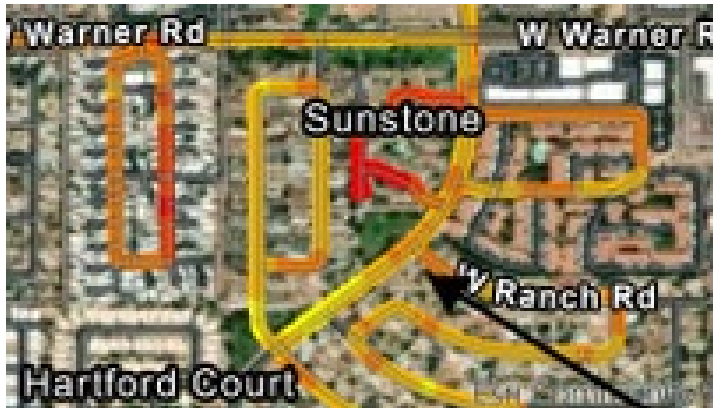
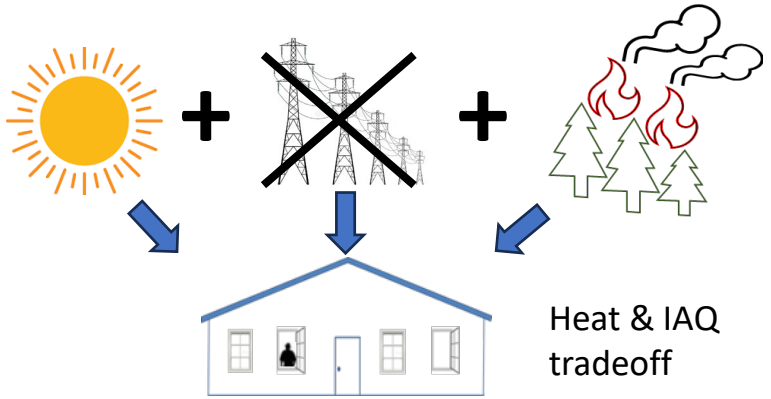
Knowledge gaps and needs

- Improved thermal environment data
  - Weather station tradeoffs: quality vs. spatial coverage
  - Satellite-based temperatures have limited utility
- High resolution models and model input data
  - Air temperatures vary at parcel and neighborhood scales (+/- 1 to 2 ˚C)
  - Microscale digital twin models are most useful if detailed input data are available and outdoor and indoor conditions are modeled.
- More exploration of complex system interactions
  - Compound and cascading events (e.g., heat + power outage + wildfires)





Challenge: communication of nuanced findings

Cool (more reflective) paving

- Reduces surface temperatures, stored thermal energy, and near surface air temperatures (time scale: hours)

- Increases total radiation on the body of a person… *walking on the surface… during the middle of the day* (time scale: seconds)

The Problem With 'Cool Pavements': They Make People Hot

A tool to help solve the problem of urban heat islands could have an unwelcome side effect, new research in L.A. finds.

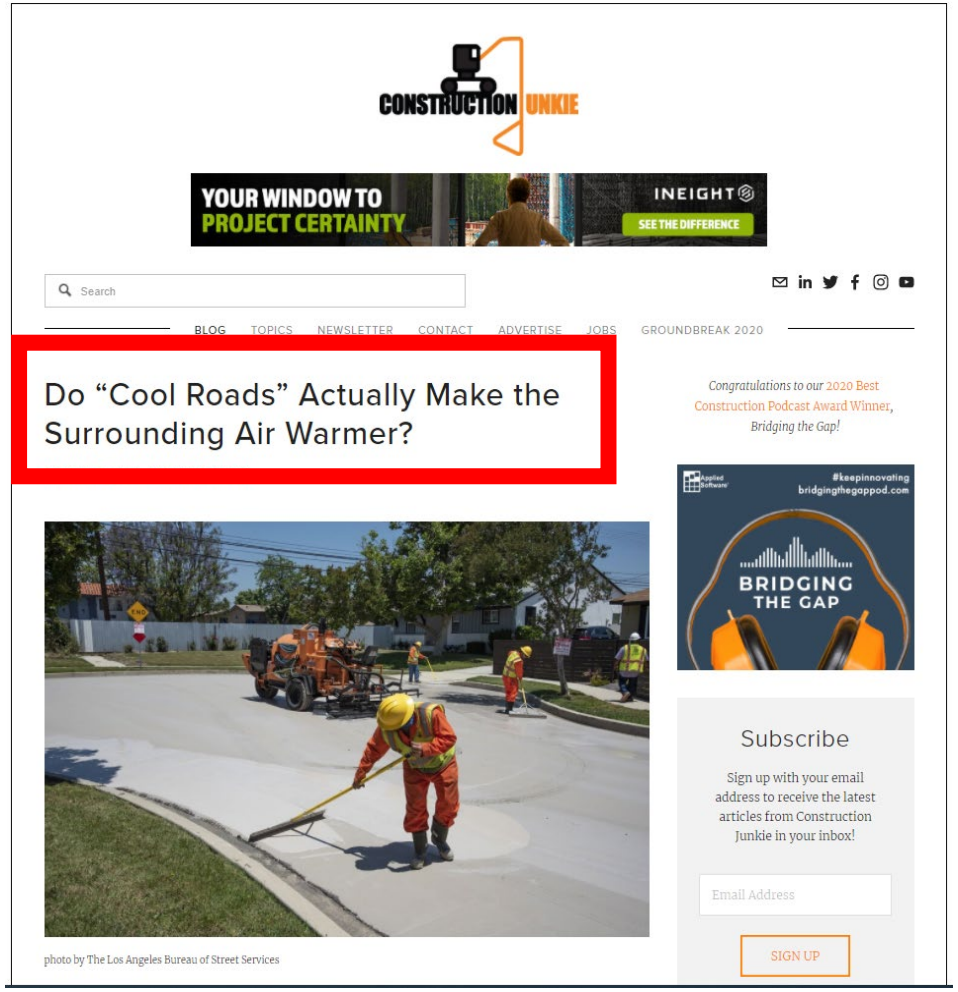
October 3, 2019, 11:07 AM MST

Workers apply CoolSeal to a street in Pacoima in June. *Los Angeles Bureau of Street Services*

In this article

About two months ago, Ariane Middel walked the empty streets of Sun Valley, a suburban neighborhood in Los Angeles' San Fernando Valley. The roads there had recently been coated with an asphalt mixture called CoolSeal, which lowers air temperatures by reflecting the energy from sunlight, rather than storing it and converting it into heat.

For hours, Middel and a team of researchers dragged an elaborate heat sensor, mounted to a garden cart, down the streets and sidewalks to grab meteorological data. A climate scientist at Arizona State University in Tempe –where air temperatures soar into triple digits–Middel didn't feel all that hot. But after crunching the data, she discovered the reflected sunlight



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Do "Cool Roads" Actually Make the Surrounding Air Warmer?

Congratulations to our 2020 Best Construction Podcast Award Winner, Bridging the Gap!

photo by The Los Angeles Bureau of Street Services

Southern California city cancels cool paving project

The atmospheric science community can help by…

1. improving capabilities at **microscale** for modeling and observations of **complete** thermal environments

2. working across disciplines to better understand **interactions and feedback** mechanisms in urban systems

3. being cautious in **communicating complex findings** to the media and public

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