Extreme Heat, Health, and Housing in Urban Maricopa County Arizona:

a story of exchanging knowledge to build community resilience

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youthmappers

Community Resilience

“Resilience is the capacity for communities, institutions, and individuals to respond and adapt to shocks and long-term stresses which can occur broadly to society, economic systems, and the built environment.”

Share.
Discover.
Solve.

Knowledge Exchange for Resilience Scholars

Erik Johnston

Joffa Applegate

Sarah Bassett

Kristin Borns

Diana Bowman

Katja Brundiers

Shauna BurnSilver

Melanie Gall

Margaret Hinrichs

Shade Shutters

Michael Simeone

Serena Sowers

Jowan Thornton

Jennifer Vanos

Knowledge Exchange for Resilience Fellows

Knowledge Exchange for Resilience Council

Knowledge Exchange for Resilience Staff

The Resilience Equation

$$\mathcal{F}_{\text{Risk (Shock)}} = \frac{\text{Exposure} \times \text{Vulnerability}}{\text{Adaptive Capacity} \times \text{Social Cohesion}}$$

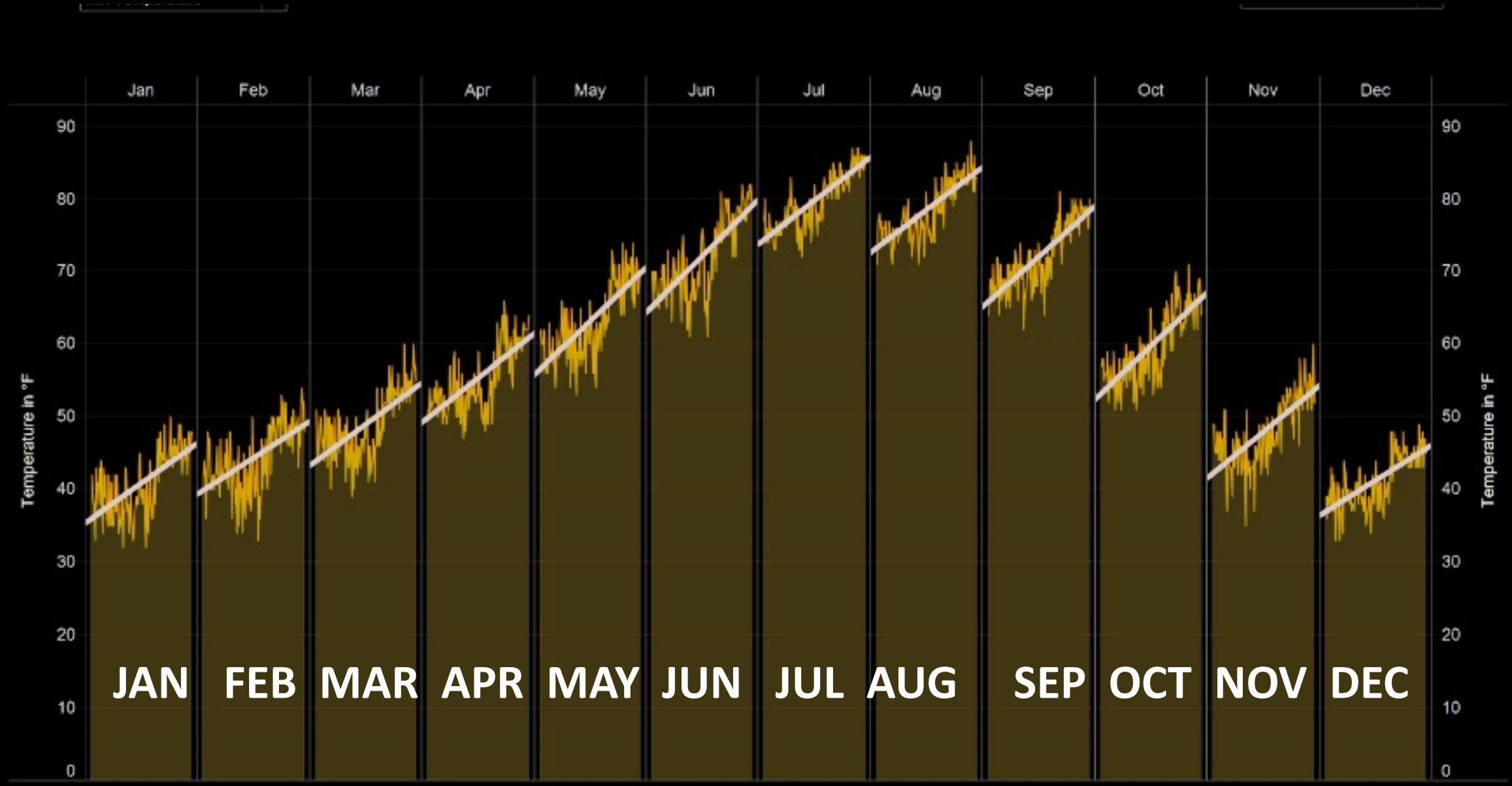
Approach

- **IDENTIFY VULNERABILITIES,** assets and current response mechanisms proactively;
- collect, liberate, analyze, visualize, create and communicate knowledge from **VAST DIVERSE DATA;**
- **MOBILIZE SOLUTIONS** within a multi-sector network of collaborators capable of investing and responding;
- promote allocation of human and financial resources for **SYSTEM IMPACT & TRANSFORMATION.**

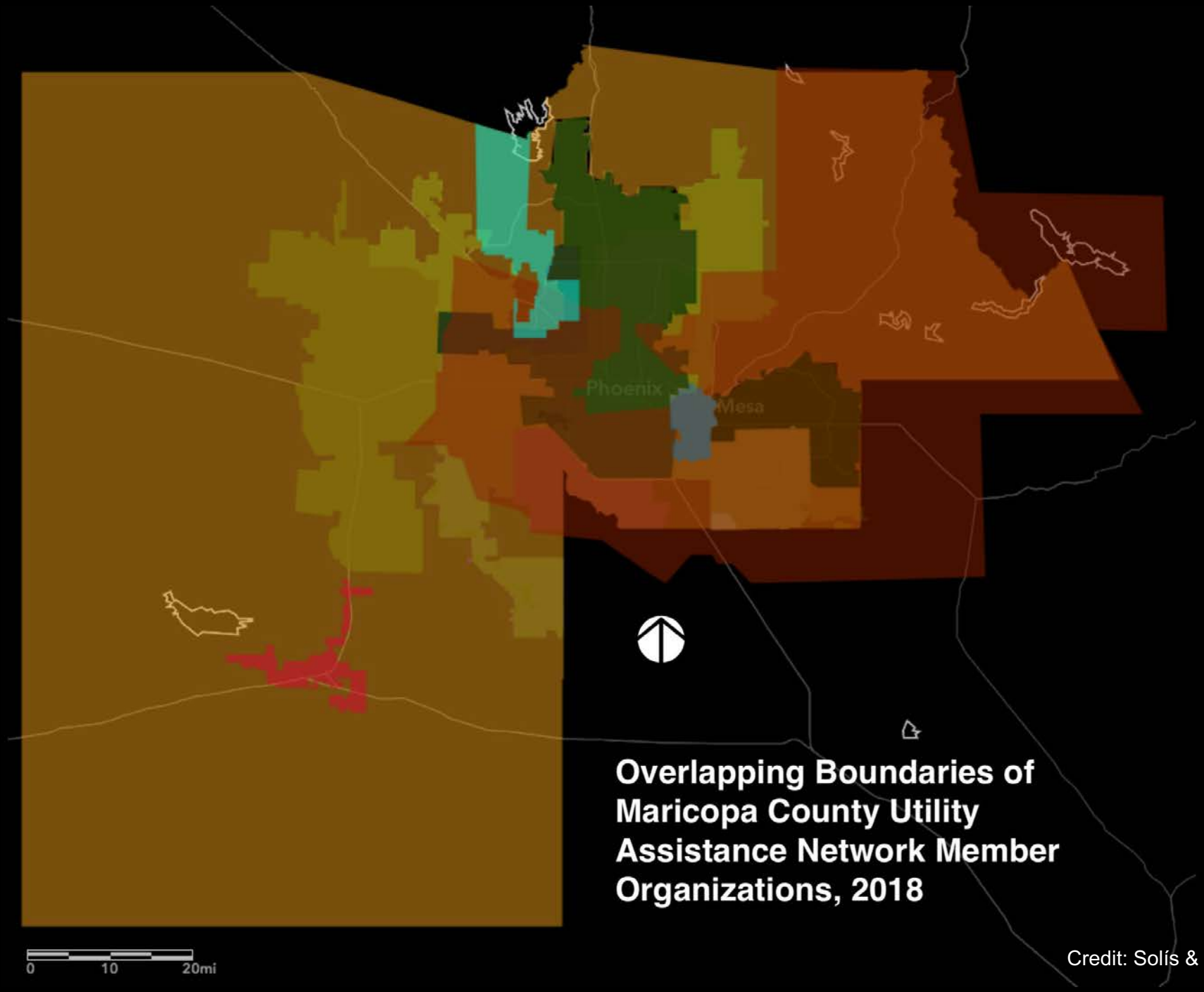
Approach

- **IDENTIFY VULNERABILITIES,** assets and current response mechanisms proactively;

Phoenix Monthly Minimum Temperature 1900-2020, by month

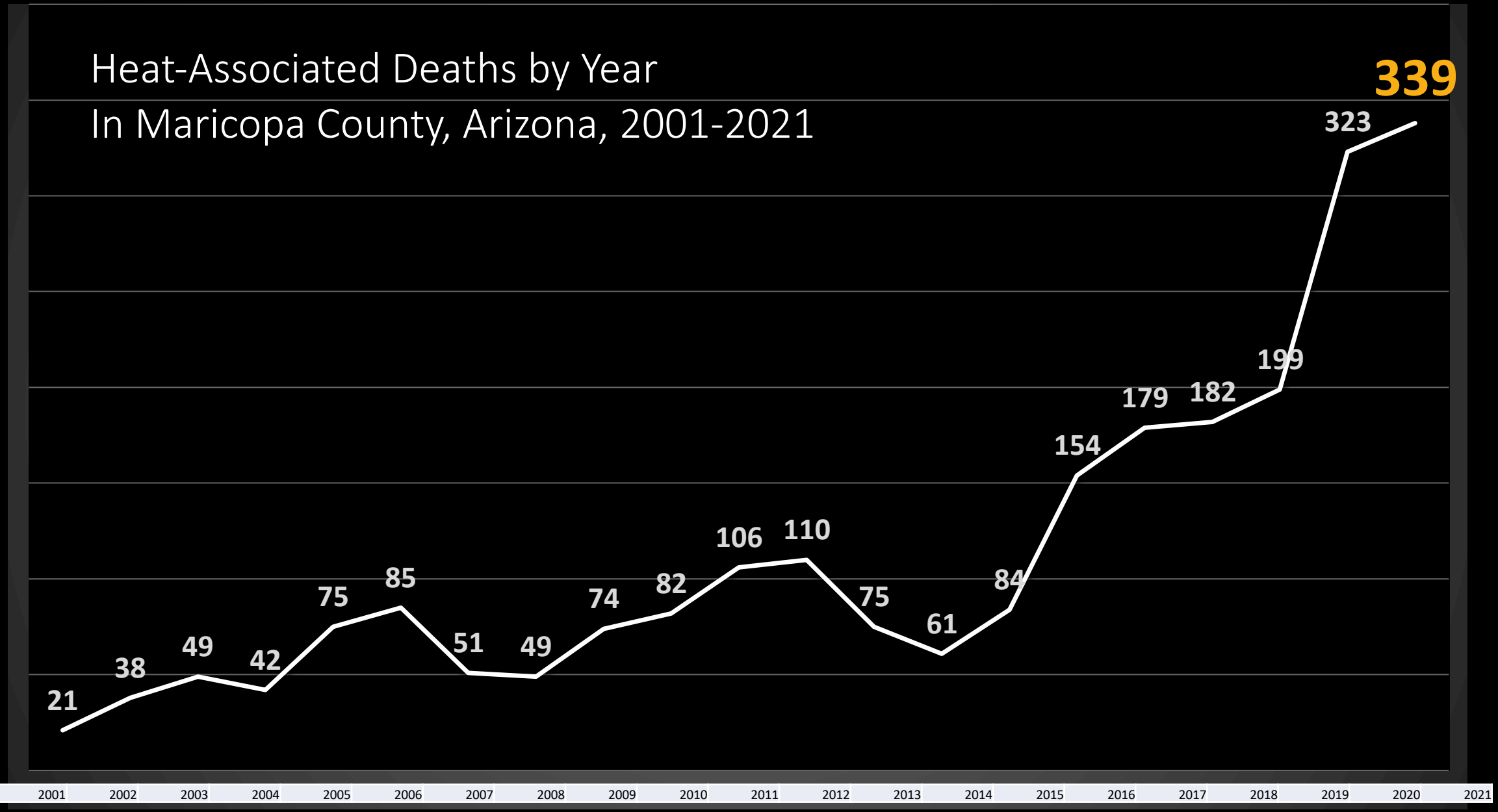


Credit: Dr. Sarbeswar Praharaj, ASU Knowledge Exchange for Resilience; Source: Office of the Arizona State Climatologist



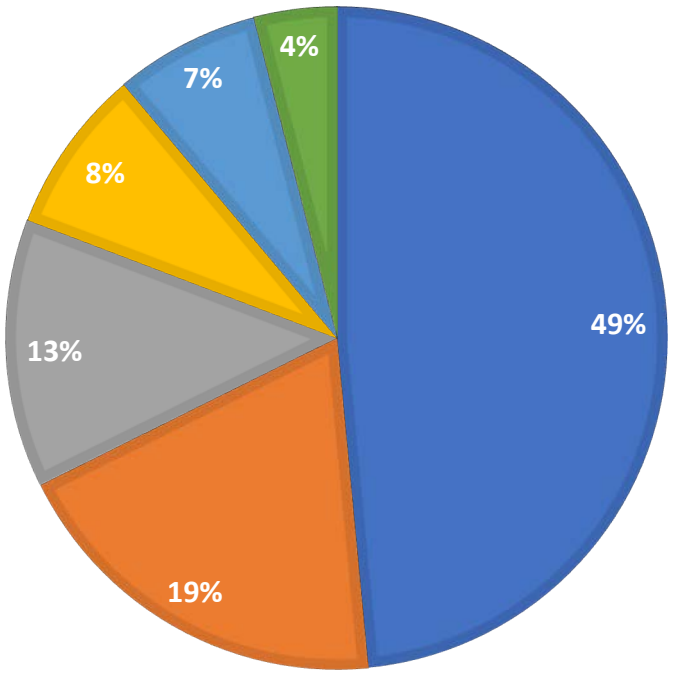
Overlapping Boundaries of Maricopa County Utility Assistance Network Member Organizations, 2018

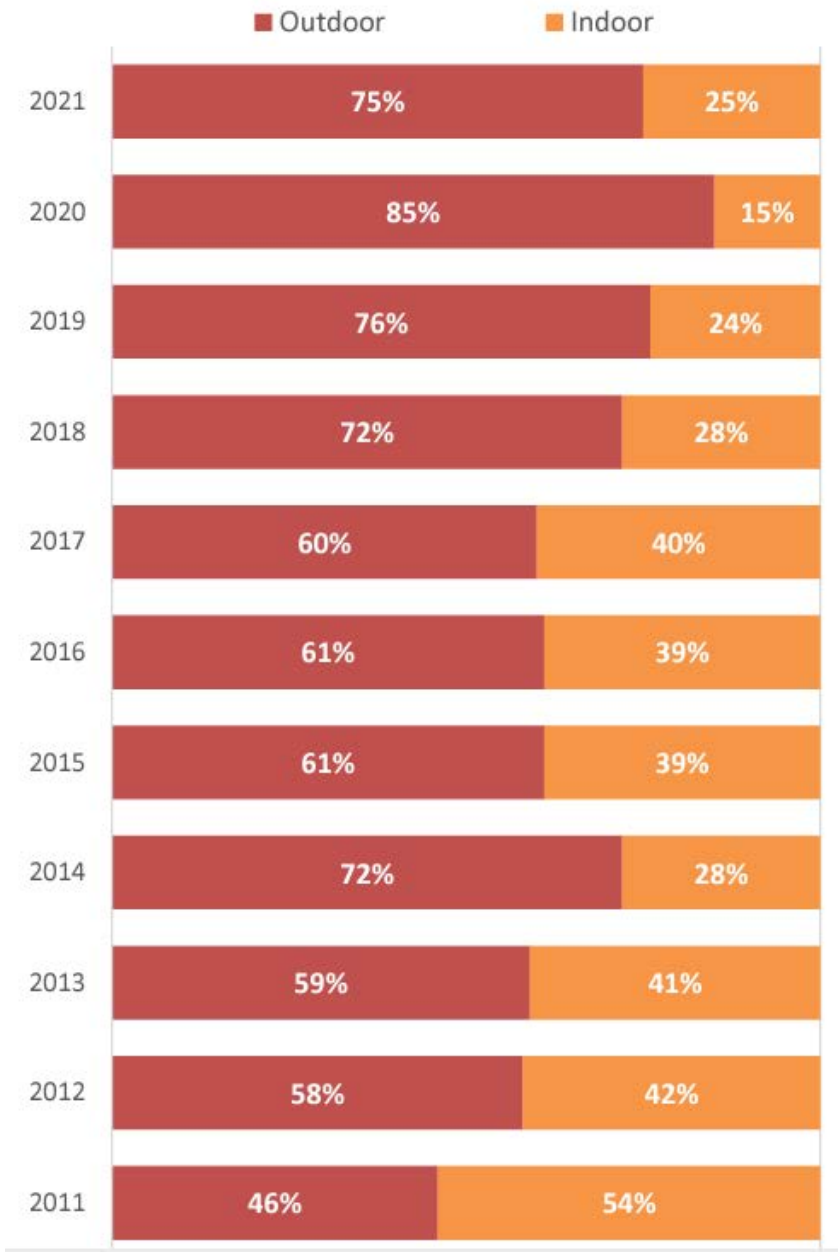
Credit: Solís & Asanad, KER



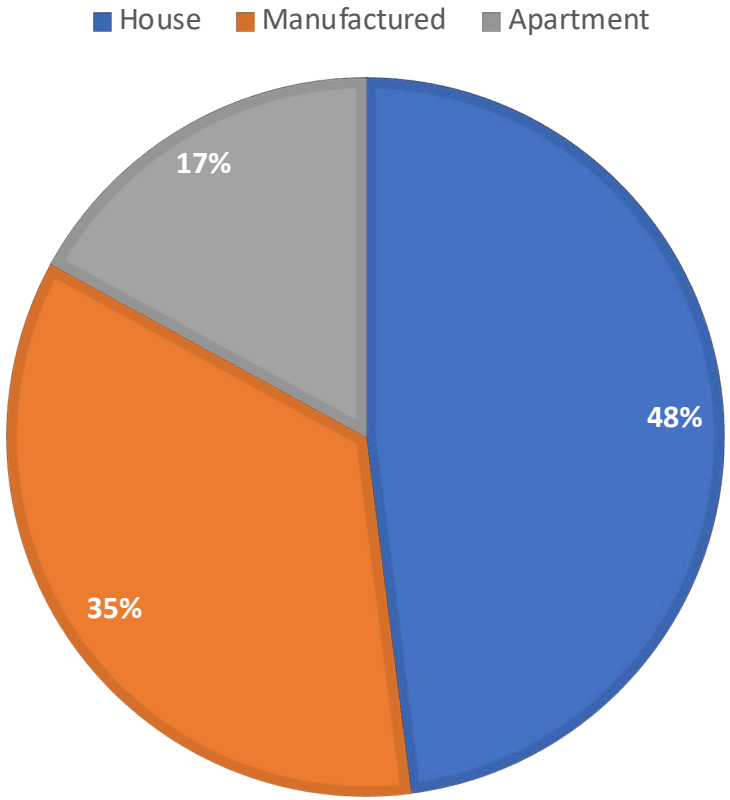
Source: Maricopa County Department of Public Health, various years..

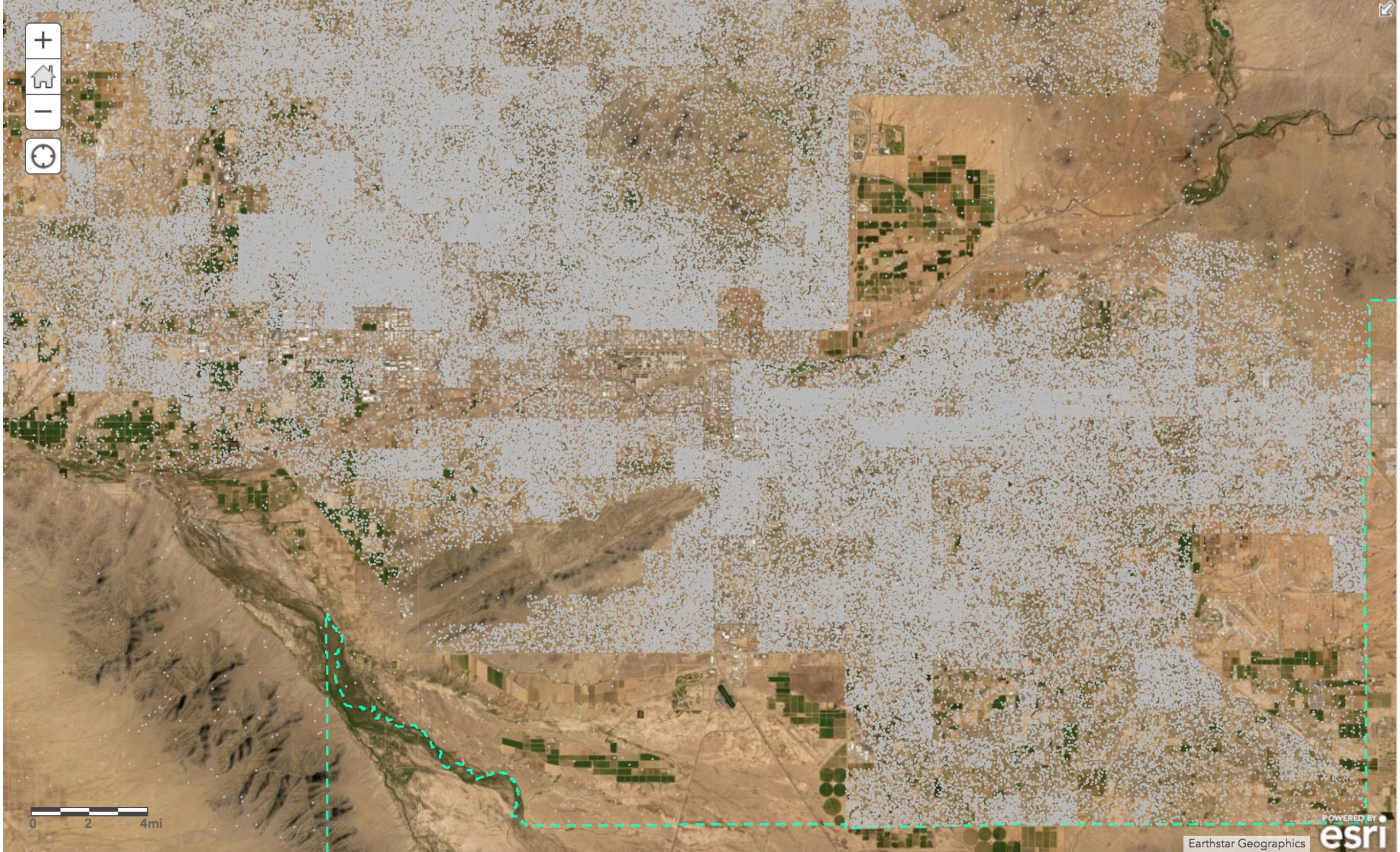
OUTDOOR DEATHS





INDOOR DEATHS

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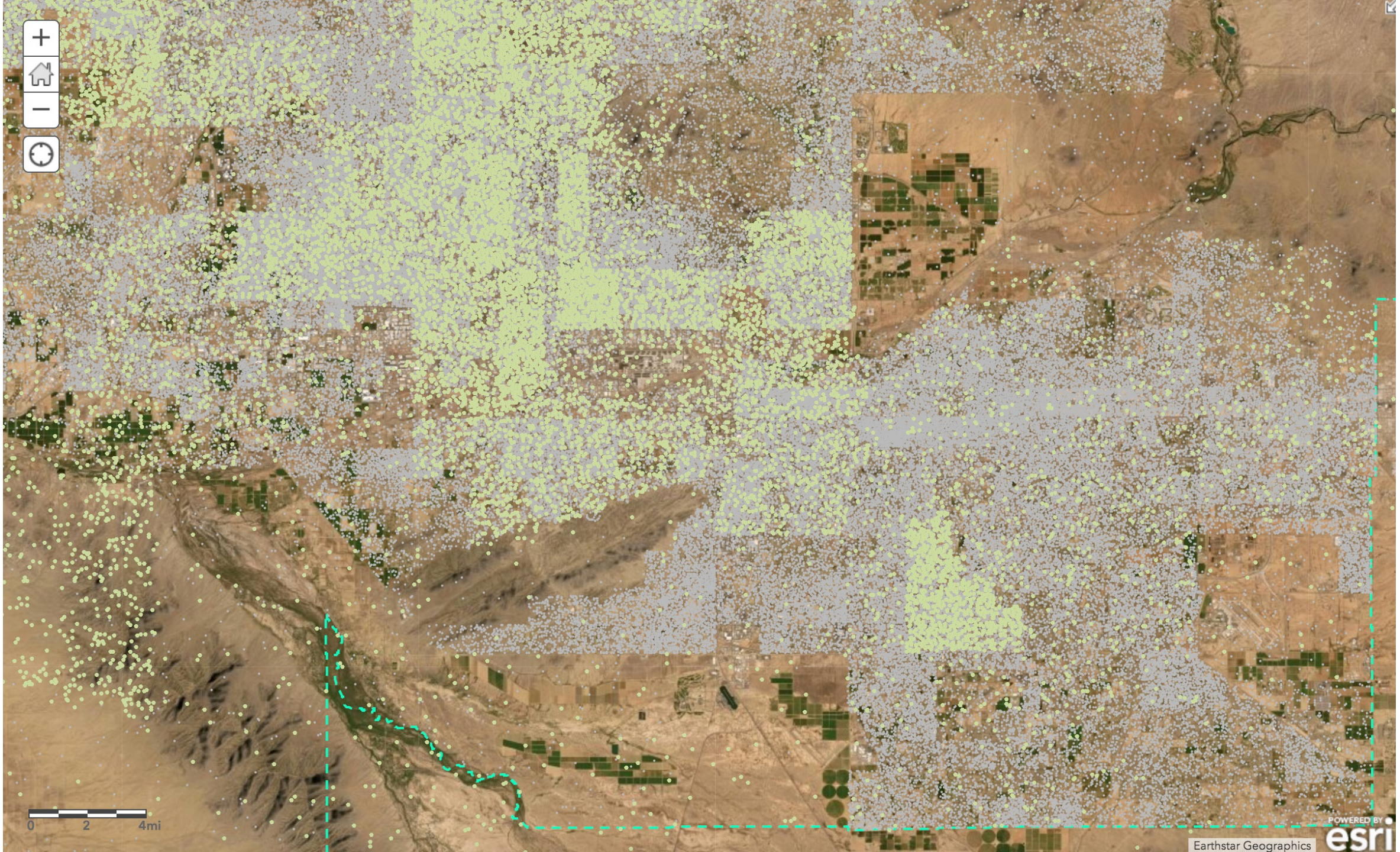
Earthstar Geographics
POWERED BY esri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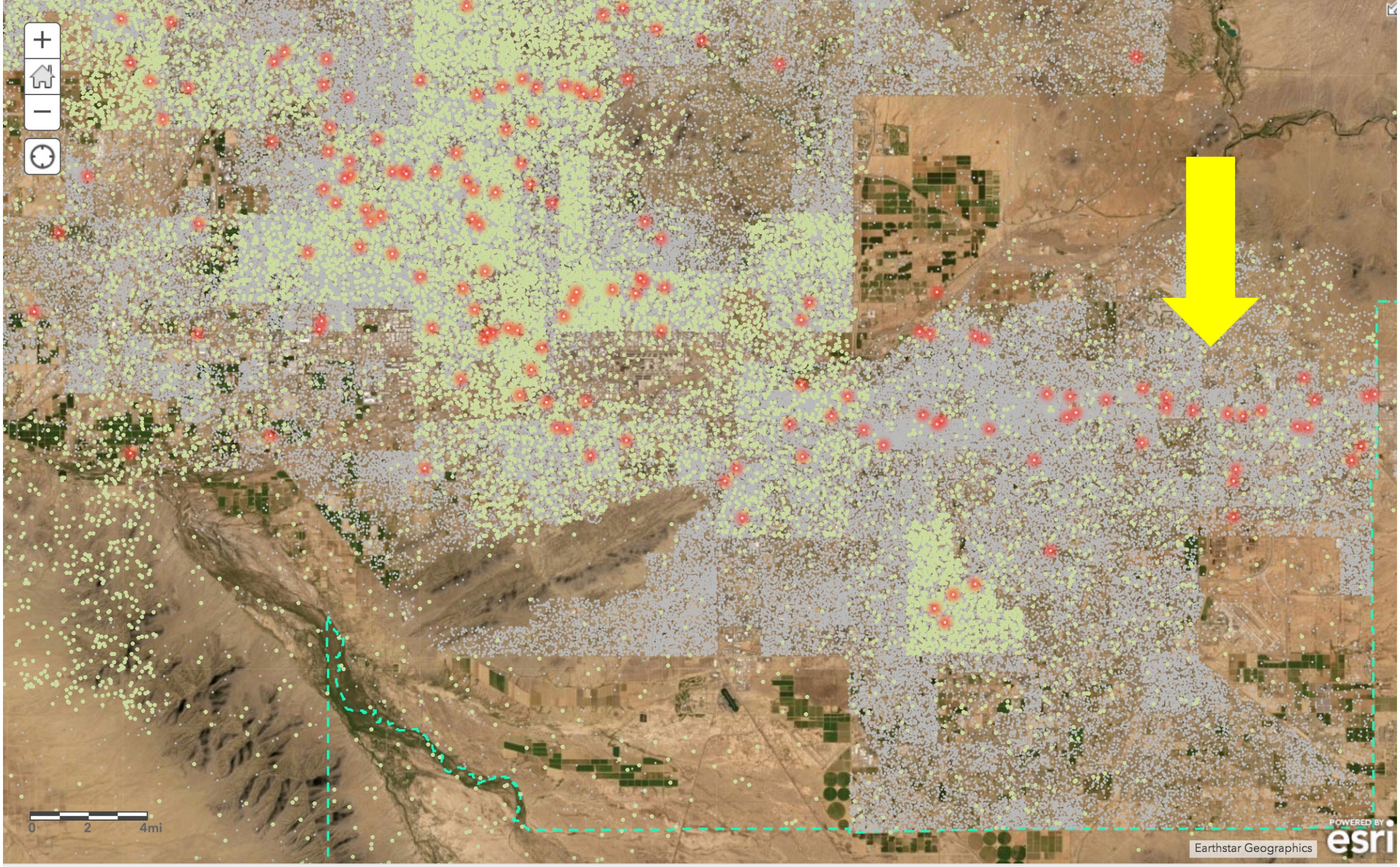
Earthstar Geographics
POWERED BY esri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Earthstar Geographics
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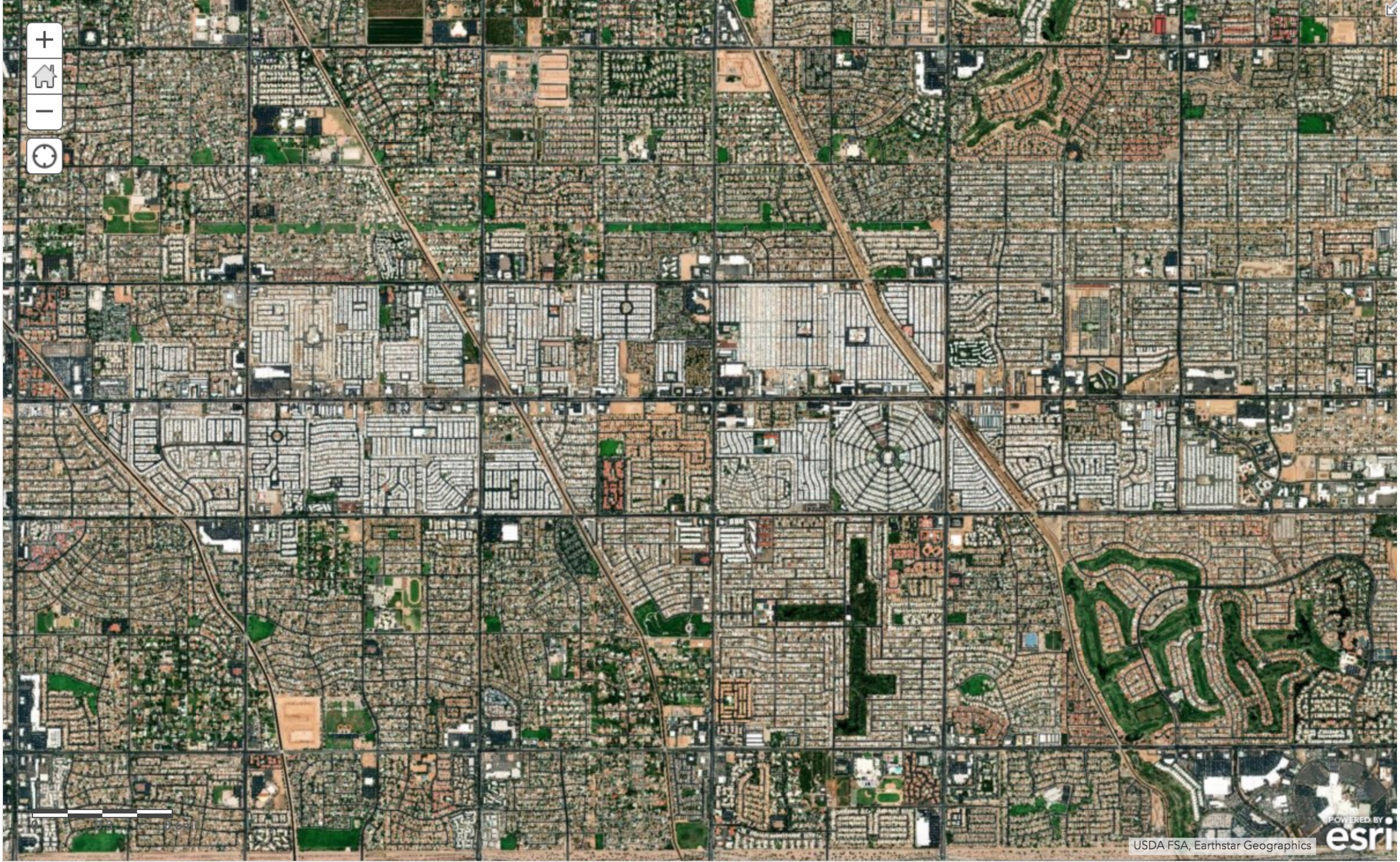
USDA FSA, Earthstar Geographics
POWERED BY esri


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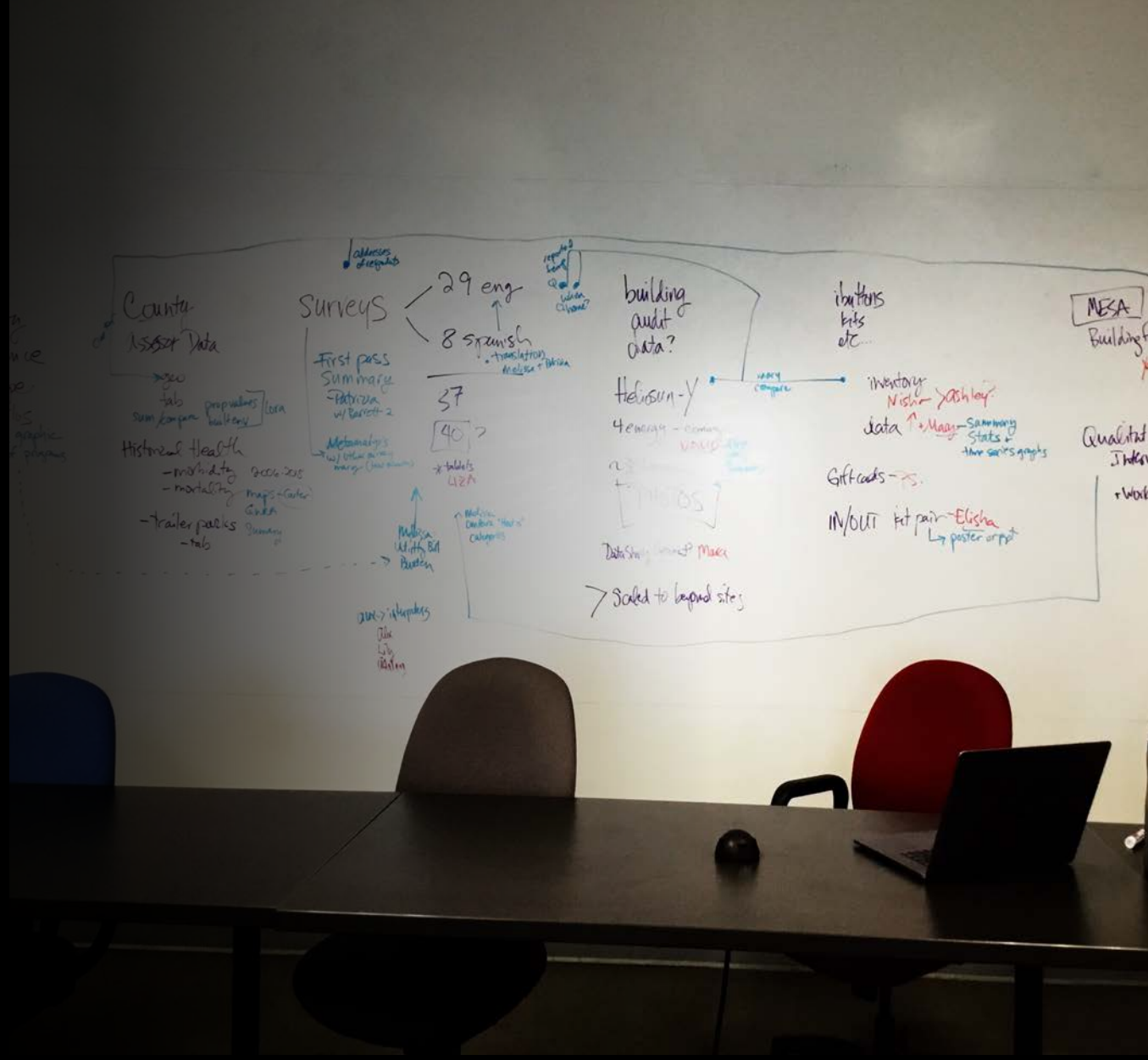
300
600
USDA FSA, Maxar, CNES/Airbus DS
POWERED BY esri

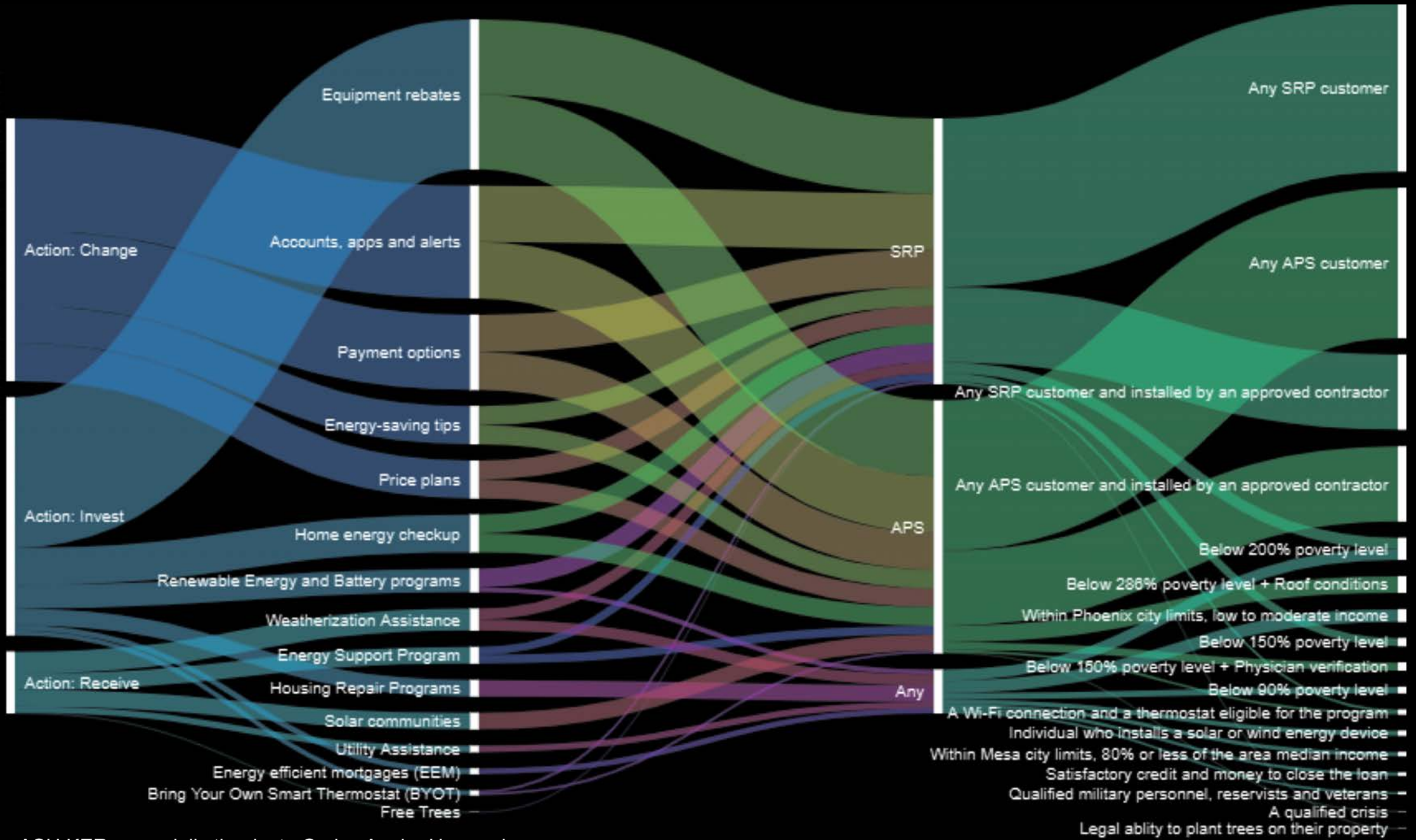
Approach

- **IDENTIFY VULNERABILITIES,** assets and current response mechanisms proactively;
- collect, liberate, analyze, visualize, create and communicate knowledge from **VAST DIVERSE DATA;**

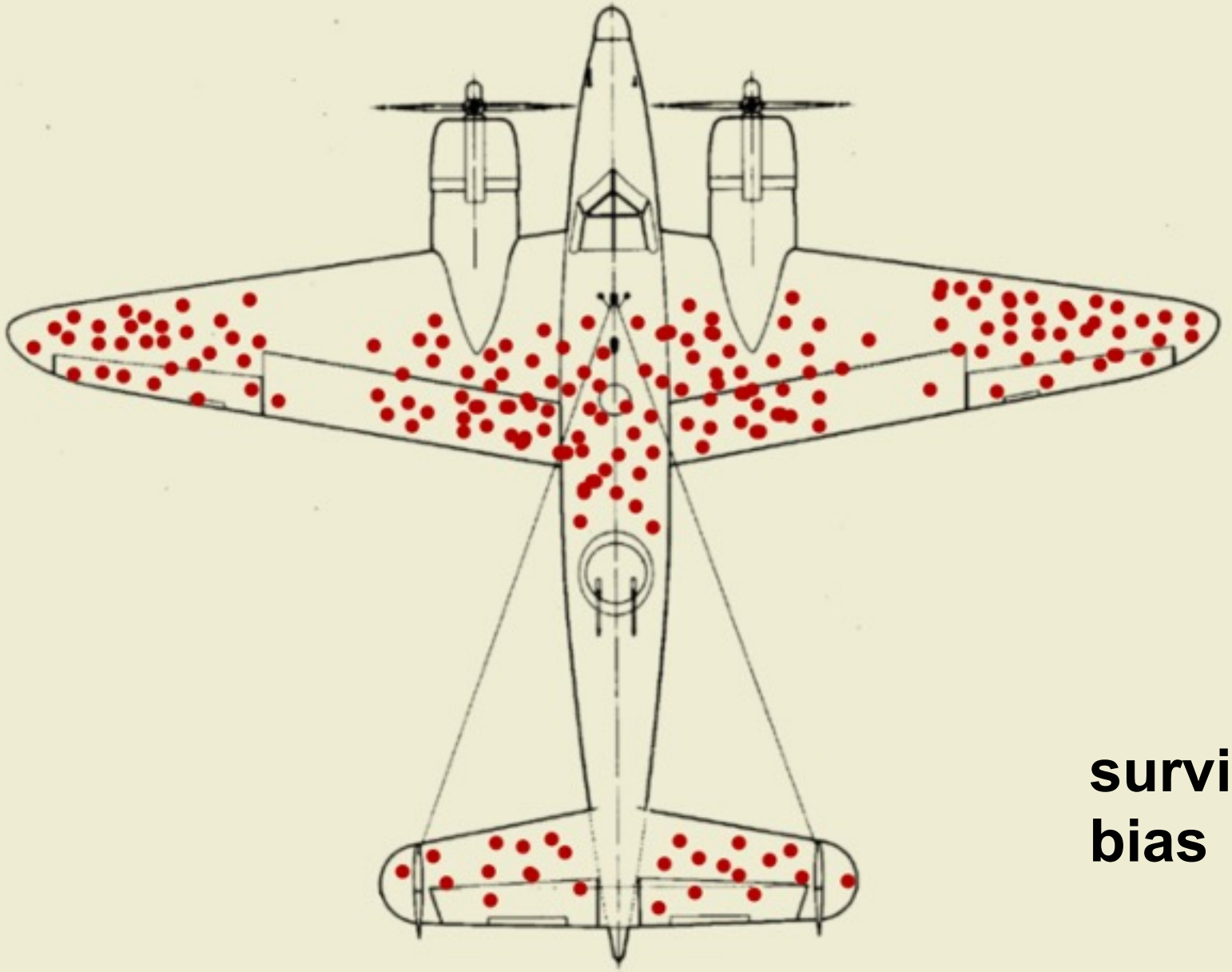
2019 - 2022

- 82 Organizations
- 7 ASU Units
- 211 Resident Surveys
- 32 Narrative Interviews
- 50 Thermal Kits
- 85 Days Heat Monitoring
- Exposure Cluster Analysis
- 19 Building Audits
- GWRA & Spatial Analytics
- Systems Mapping Exercises
- 3D Park Design Modeling
- Engineering Assessments
- Cost-Benefit Study
- Legal & Policy Review
- Documentary



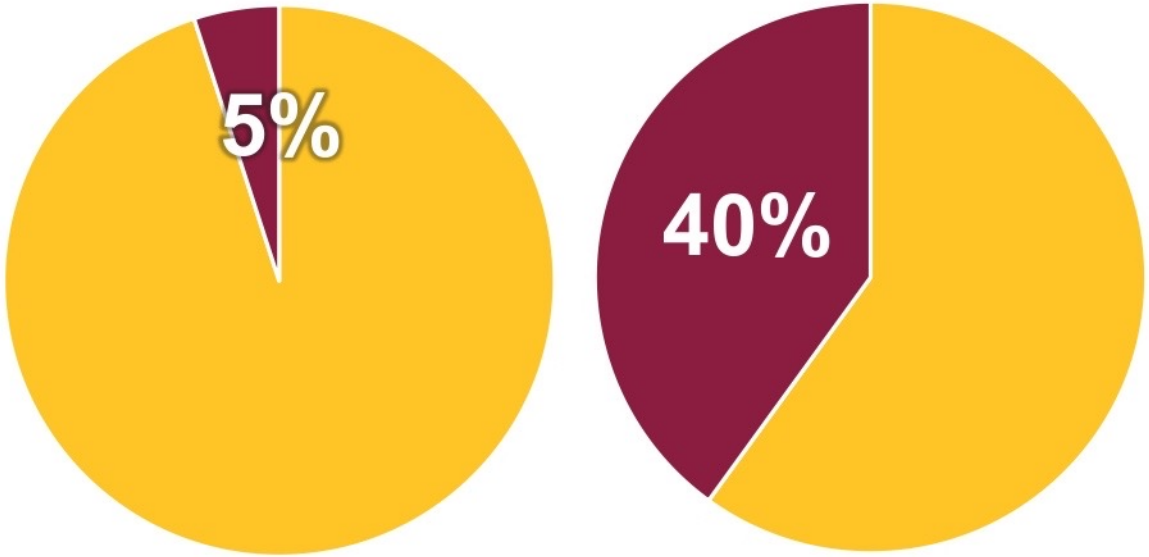


Credits: ASU KER, especially thanks to Carlos Aguiar Hernandez



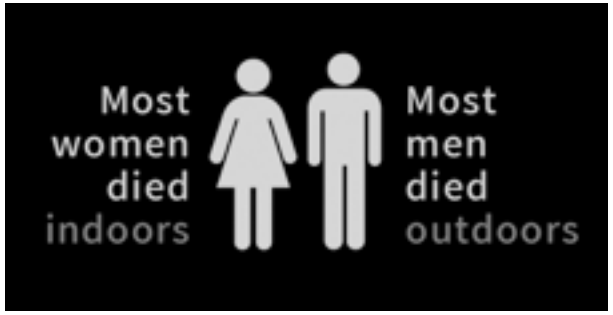
survivorship bias

Percent Mobile Homes



Total Housing Stock in Maricopa County

Indoor Heat Deaths



Despite that 5% of housing is mobil homes, trailer residents make up about 40% of indoor heat related deaths

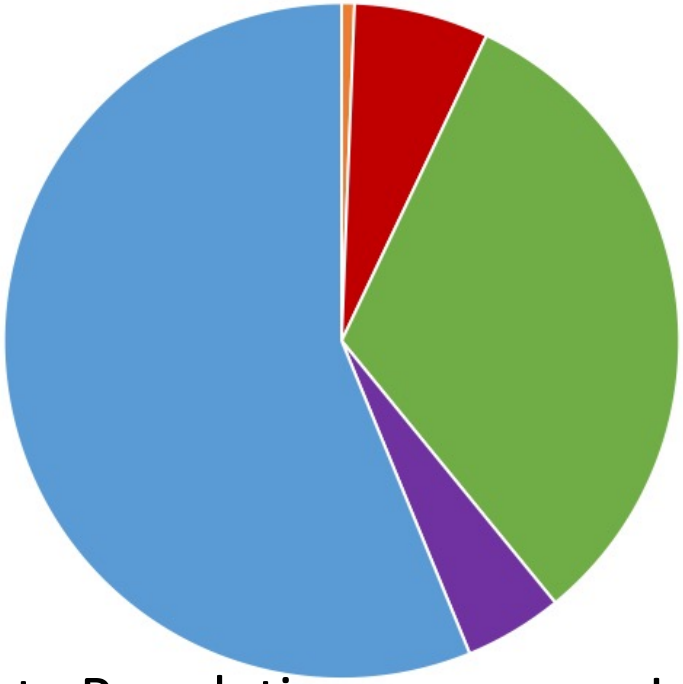
Age & Income

Nearly 30% of mobile home residents here have a household income of less than $25,000 per year.

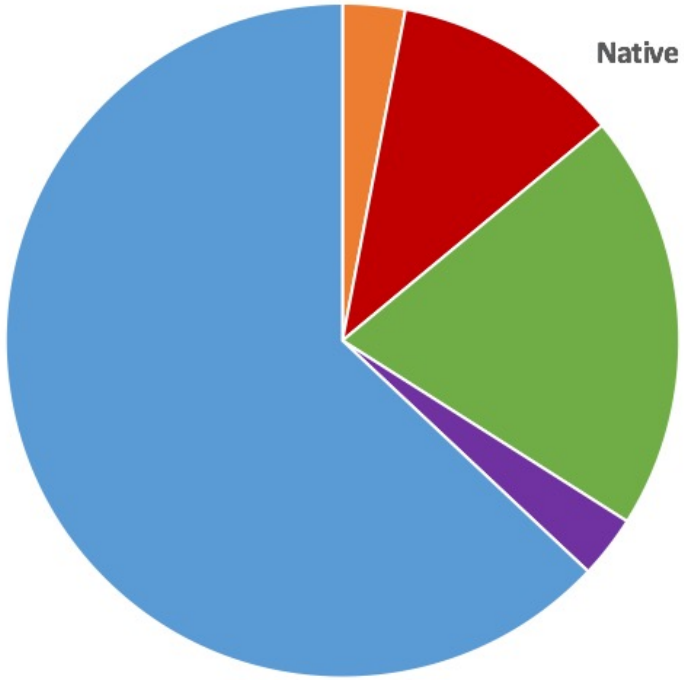
23%

of Indoor Heat Deaths are adults aged 65+ living in Mobile Homes

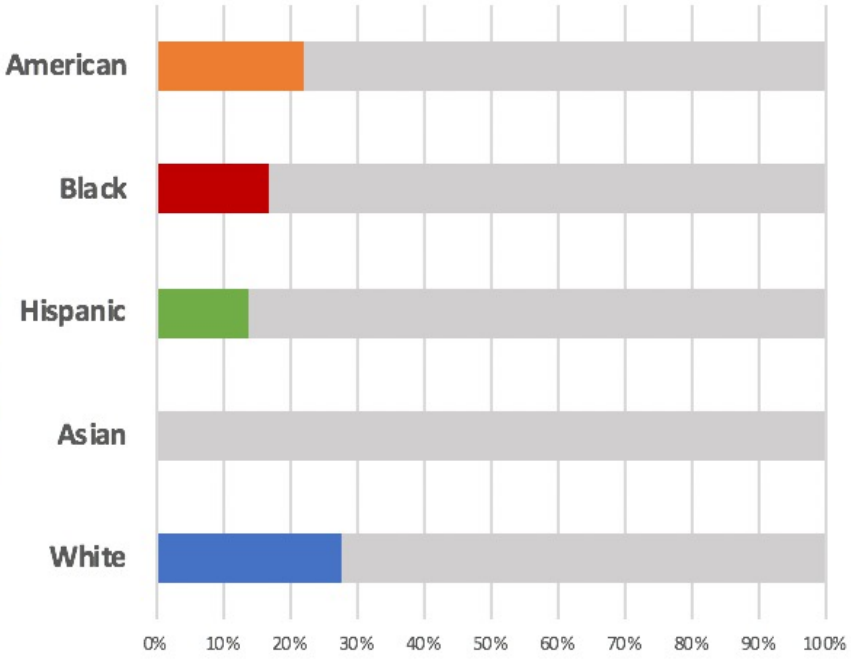
While 0.6 and 6.3 percent of Maricopa County residents are Native American and Black, respectively, they make up 3 and 11 percent of indoor heat associated deaths



County Population

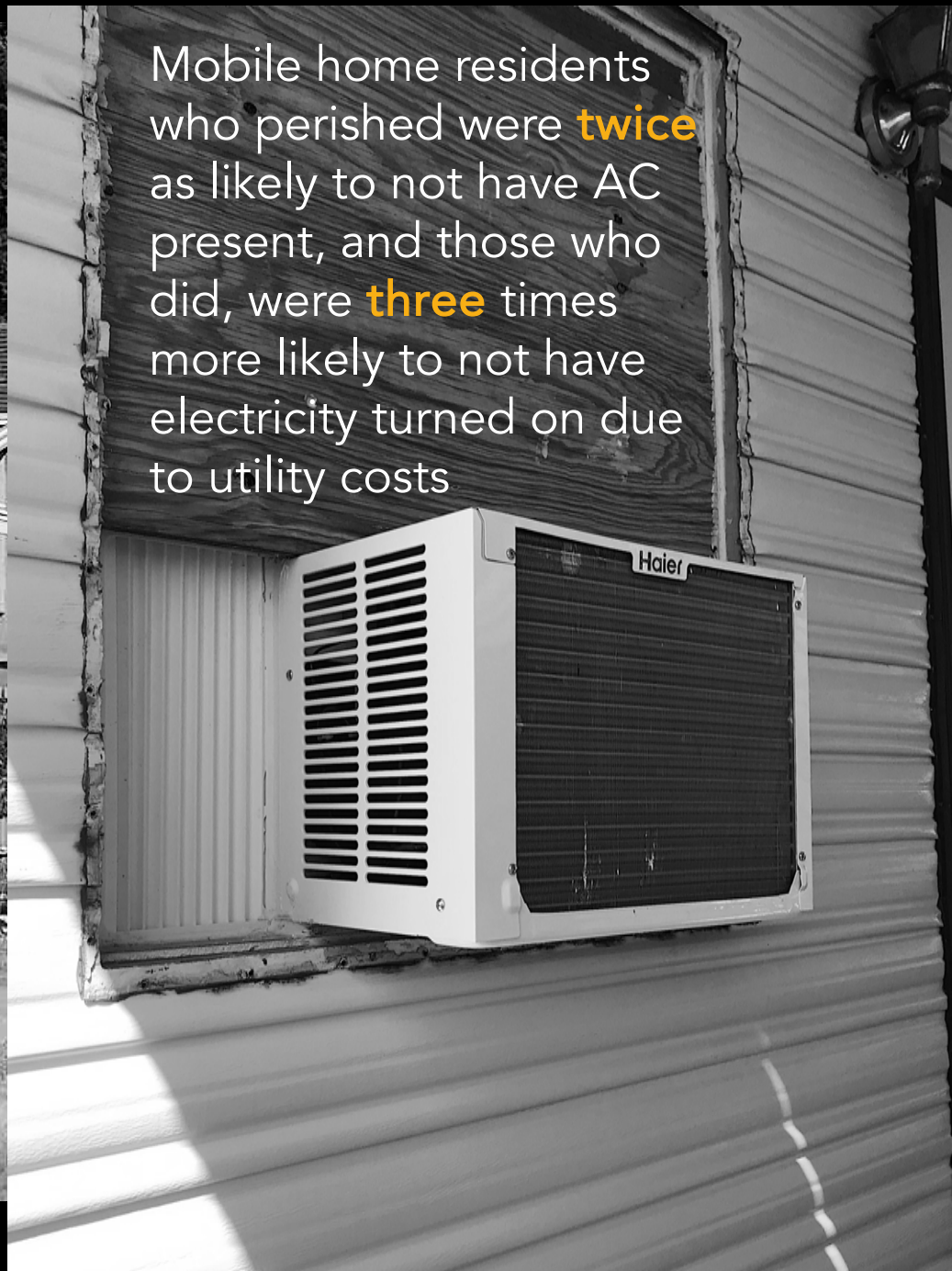


Indoor Deaths

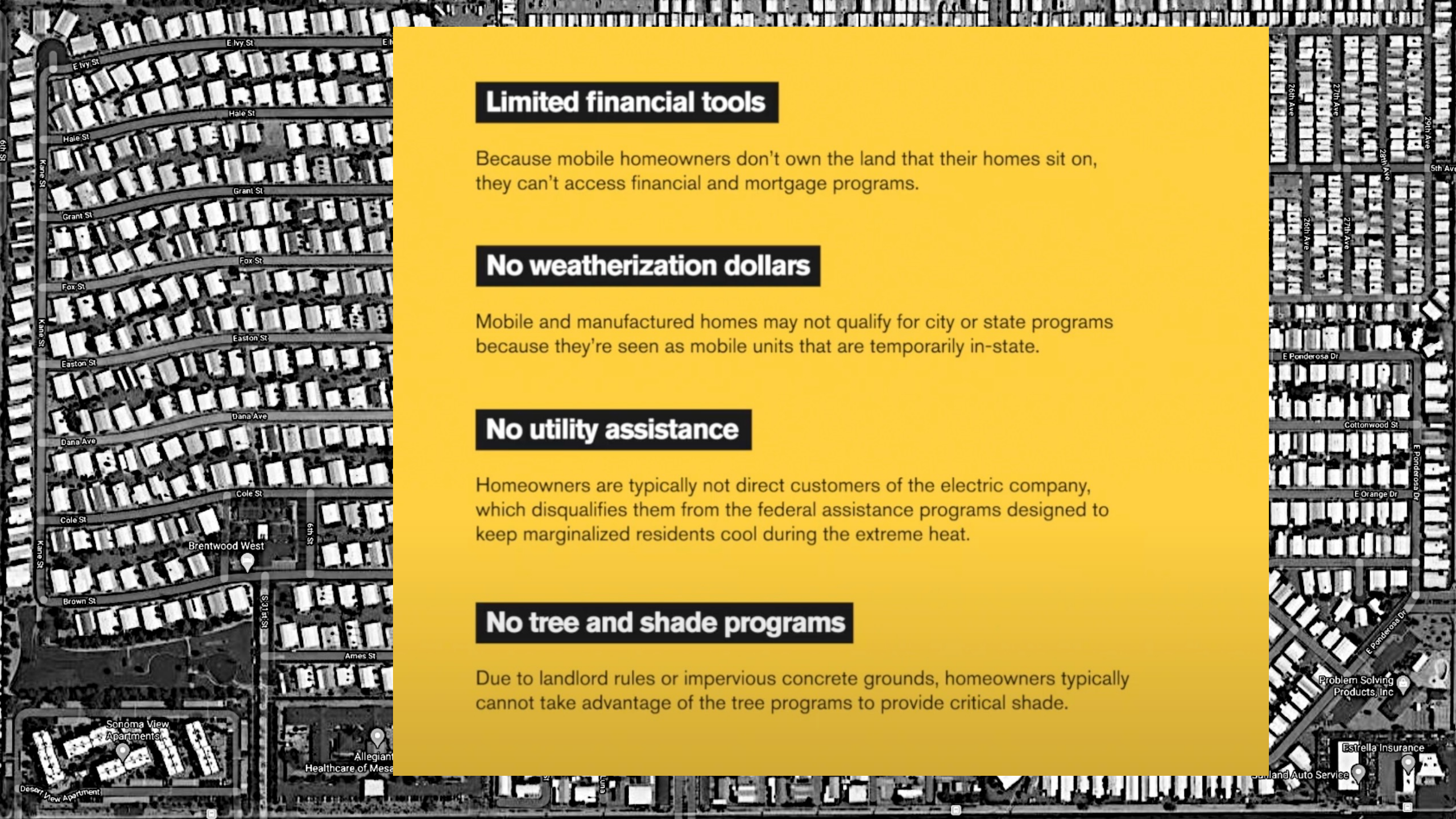


Rate of Indoor Deaths in Trailers/Mobile Homes

Credit: Patricia Solís, PhD, KER SGSUP; ACS Community Analyst, Maricopa County Public Health Department



Mobile home residents who perished were **twice** as likely to not have AC present, and those who did, were **three** times more likely to not have electricity turned on due to utility costs



Limited financial tools

Because mobile homeowners don't own the land that their homes sit on, they can't access financial and mortgage programs.

No weatherization dollars

Mobile and manufactured homes may not qualify for city or state programs because they're seen as mobile units that are temporarily in-state.

No utility assistance

Homeowners are typically not direct customers of the electric company, which disqualifies them from the federal assistance programs designed to keep marginalized residents cool during the extreme heat.

No tree and shade programs

Due to landlord rules or impervious concrete grounds, homeowners typically cannot take advantage of the tree programs to provide critical shade.

ATTRIBUTE TAGGING IDENTIFICATION

MAPATHON & GROUNDTRUTH PILOT

AI BUILDING FOOTPRINT DATA FEATURE EXTRACTION

MAPSWIPE MISSING DATA CAMPAIGN

OVERLAY TAX PARCEL RECORDS

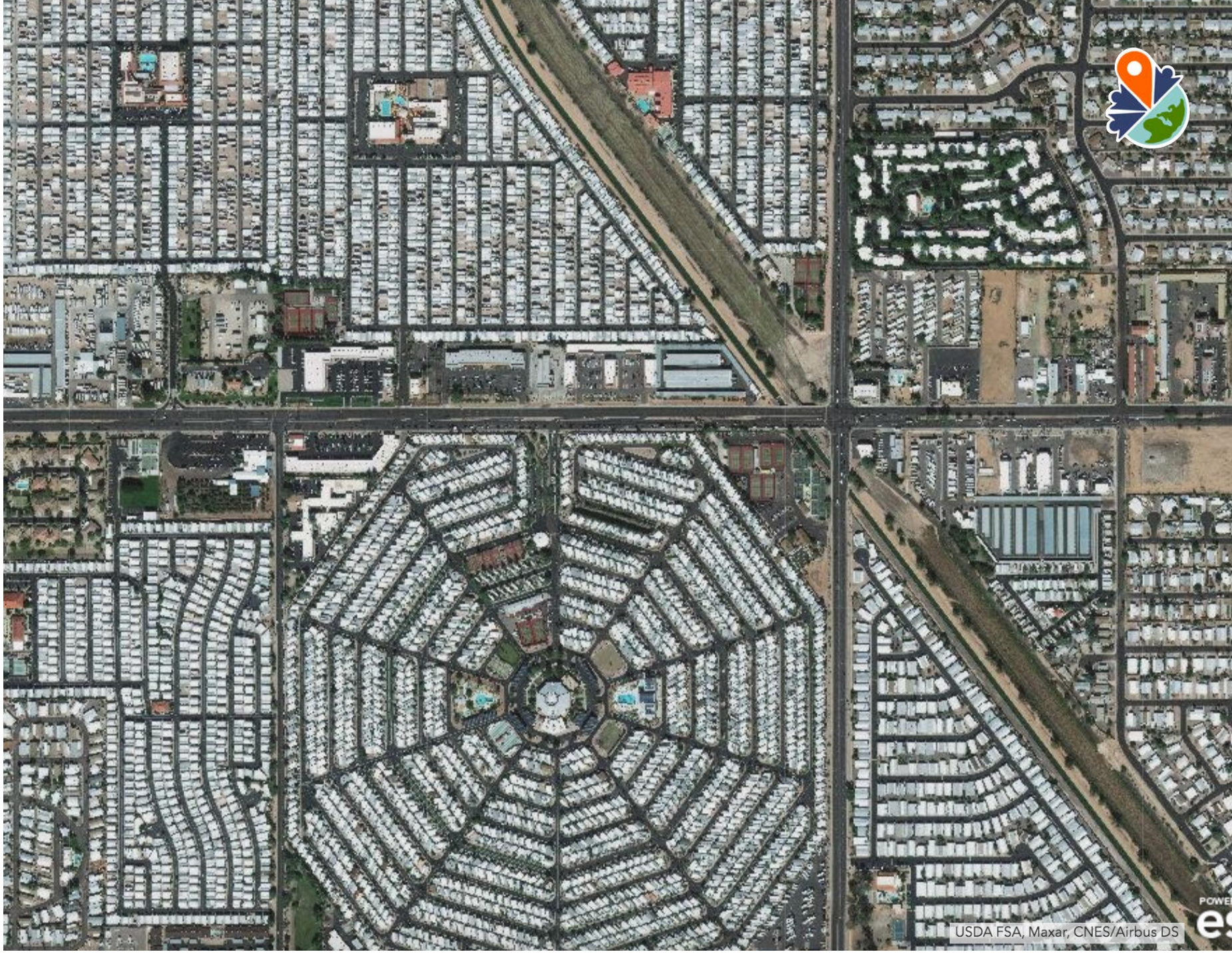
STATEWIDE GEODATABASE VALIDATION

SOLUTIONS COST CALCULATIONS BY JURISDICTION


youth
mappers
PEACE CORPS
SUMMIT

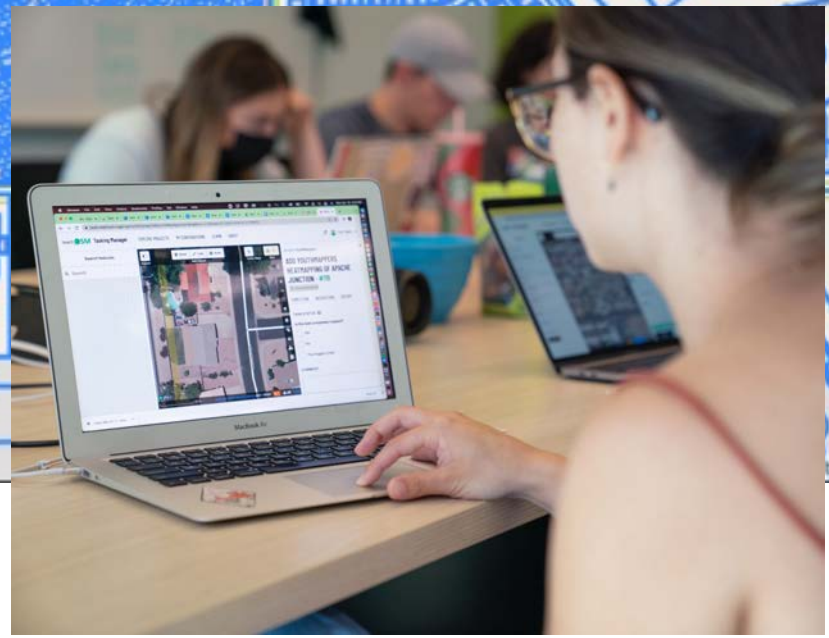
ATTRIBUTE TAGGING IDENTIFICATION

MAPATHON & GROUNDTRUTH PILOT




Knowledge Exchange for Resilience
Arizona State University
North Greenfield Road
K Street
T Street
East Maricopa Floodway
Roosevelt Water
The Orchard
Fry's Marketplace
US 80 Historic
US 80 Historic
South Greenfield Road
South Quinn Circle
Kurt Lane
South 48th Street
Village Boulevard
Candice Lane
Damian Drive
Dustin Lane
Ironwood
Kelly Lane
Resort Avenue
Via Hacienda
Wendy Lane
Ryan Lane
Lemon Lane
Citrus Boulevard
Via la Paz
Via Paloma Road
Via Bonita Road
Calle Rosas Drive
Tangerine
East Flores Drive
Hacienda de Valencia
Venture Out
Aero
Navajo
Douglas
Jenny
Aztec
Bonanza
Debonair
Boeing
Navion
Cherokee
Invincible
Helio
Merlin
Grumman
Ercoupe
East Albany Street
East Akron Street
Alder Ave
Alpine Av
1st Avenue
South 6th Street
South 5th Street
South 4th Street
3rd Street
2nd Street
South 4th Avenue
South 54th Street
East Aspe
East
0
300
600ft
Map data © OpenStreetMap contributors, Map layer by Esri
esri

2,000+ building features using HOT Tasking Manager, clarification for mobile homes attribute convention on OpenStreetMap



taginfo

English

KEYS · TAGS · RELATIONS · PROJECTS · REPORTS · ABOUT

building=static_caravan

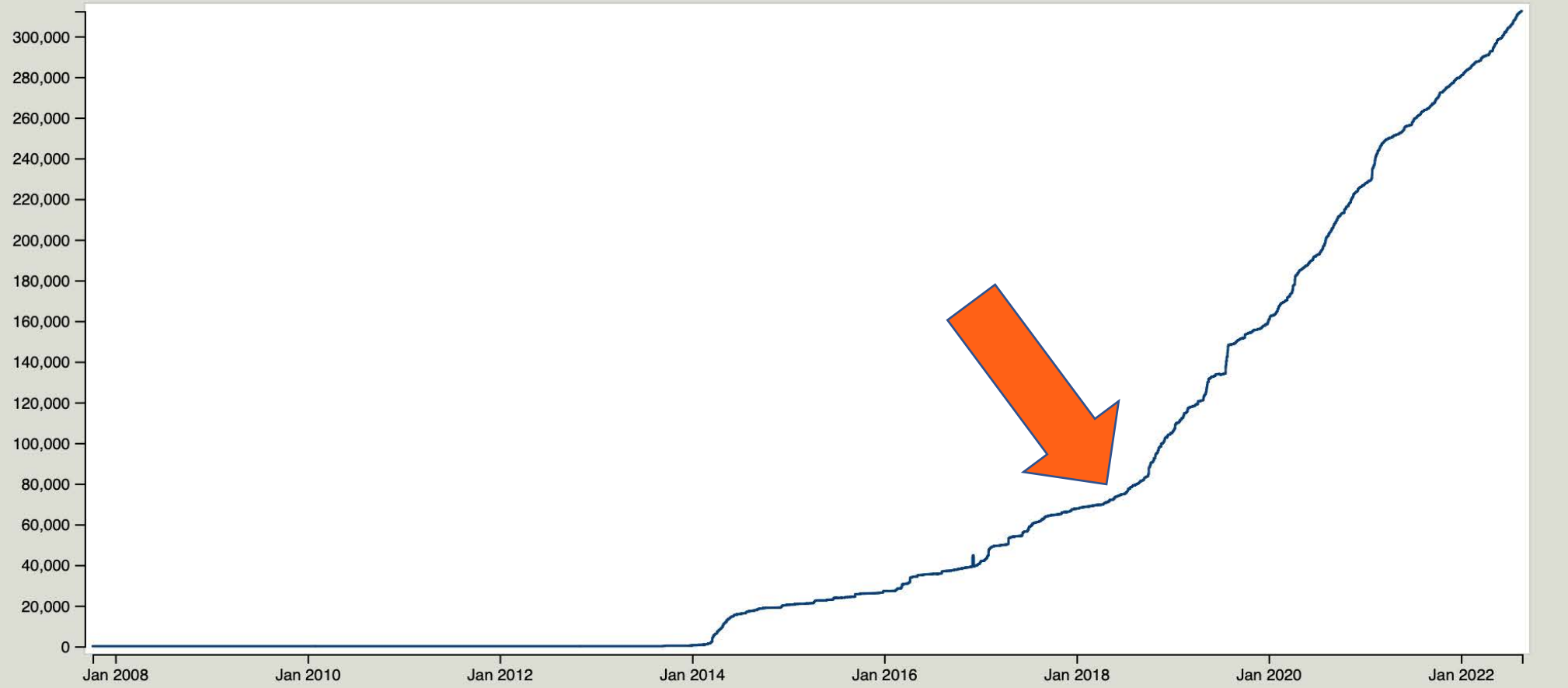
A mobile home (caravan) (semi)permanently left on a single site.

Comparison list (0 items)

XAPI JOSM

Overview | Combinations | Chronology | Map | Wiki | Projects | Characters

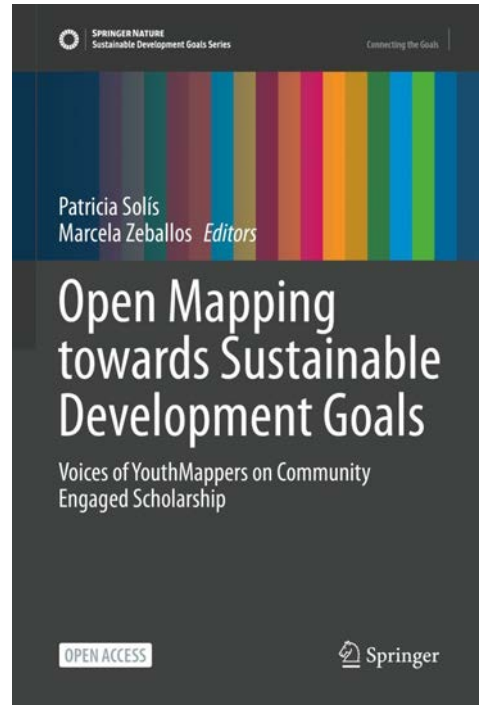
Chronology



Mapping for Resilience: Extreme Heat Deaths and Mobile Homes in Arizona

21

Elisha Charley, Katsiaryna Varfalameyeva, Abdulrahman Alsanad, and Patricia Solís



Abstract

YouthMappers help discover hidden vulnerabilities to extreme heat in the face of a changing climate by mapping health outcomes compared to energy assistance. What emerged is a pattern of disproportionate deaths by housing type, necessitating innovations in tagging unique mobile home attributes in OpenStreetMap (OSM). The resulting community engagement generated solutions that stakeholders and residents of mobile homes can implement for greater resilience, and a model for connecting SDG 13 (Sustainable Development Goals) for climate action to SDG 3 good health and well-being by looking at the homes where people live.

Keywords

Climate Impacts · Heat · Housing · OpenStreetMap Attributes · Arizona · Health

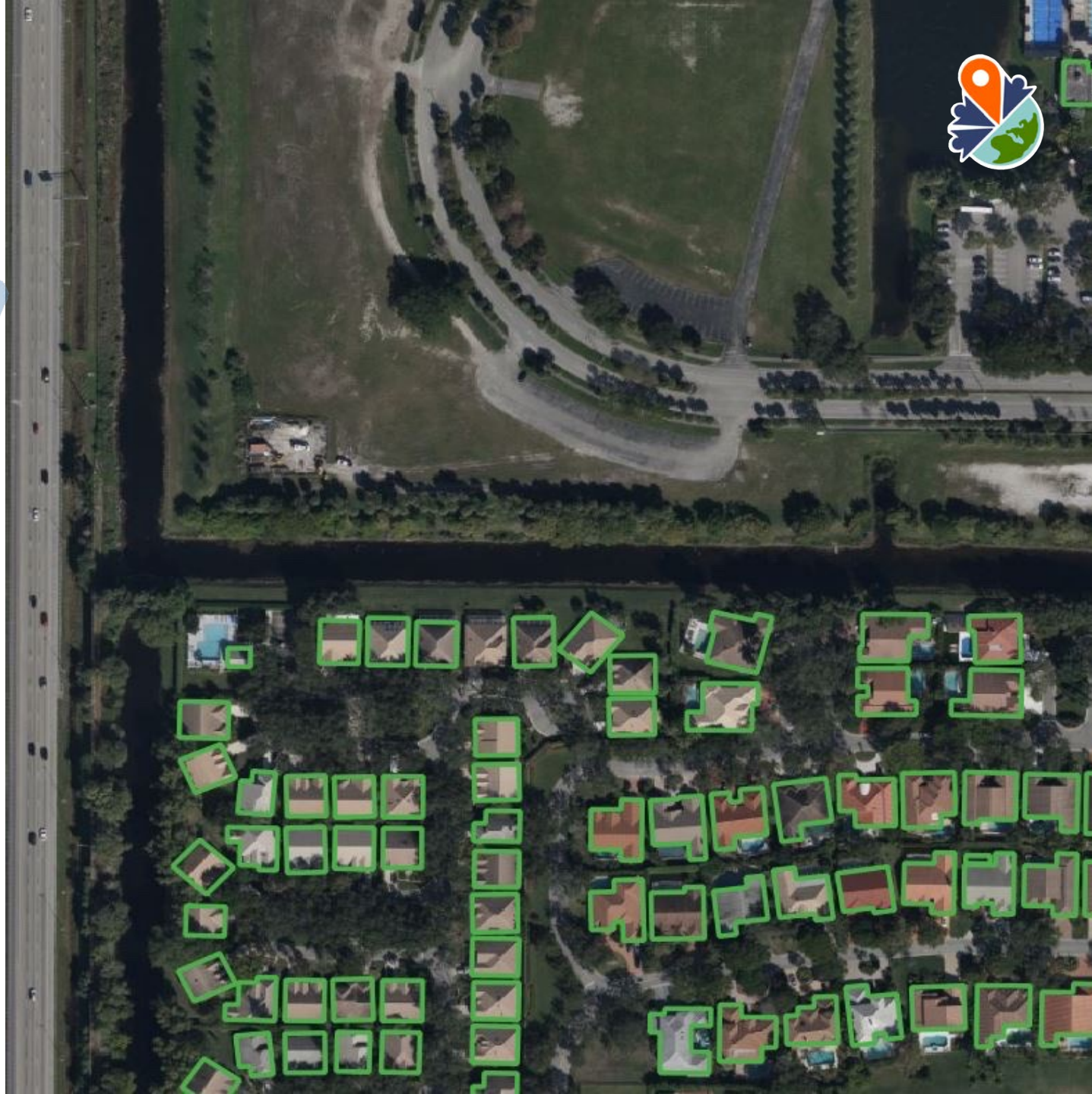
youthmappers

USAID
FROM THE AMERICAN PEOPLE

ATTRIBUTE
TAGGING
IDENTIFICATION

MAPATHON &
GROUNDTRUTH
PILOT

AI BUILDING
FOOTPRINT DATA
FEATURE
EXTRACTION

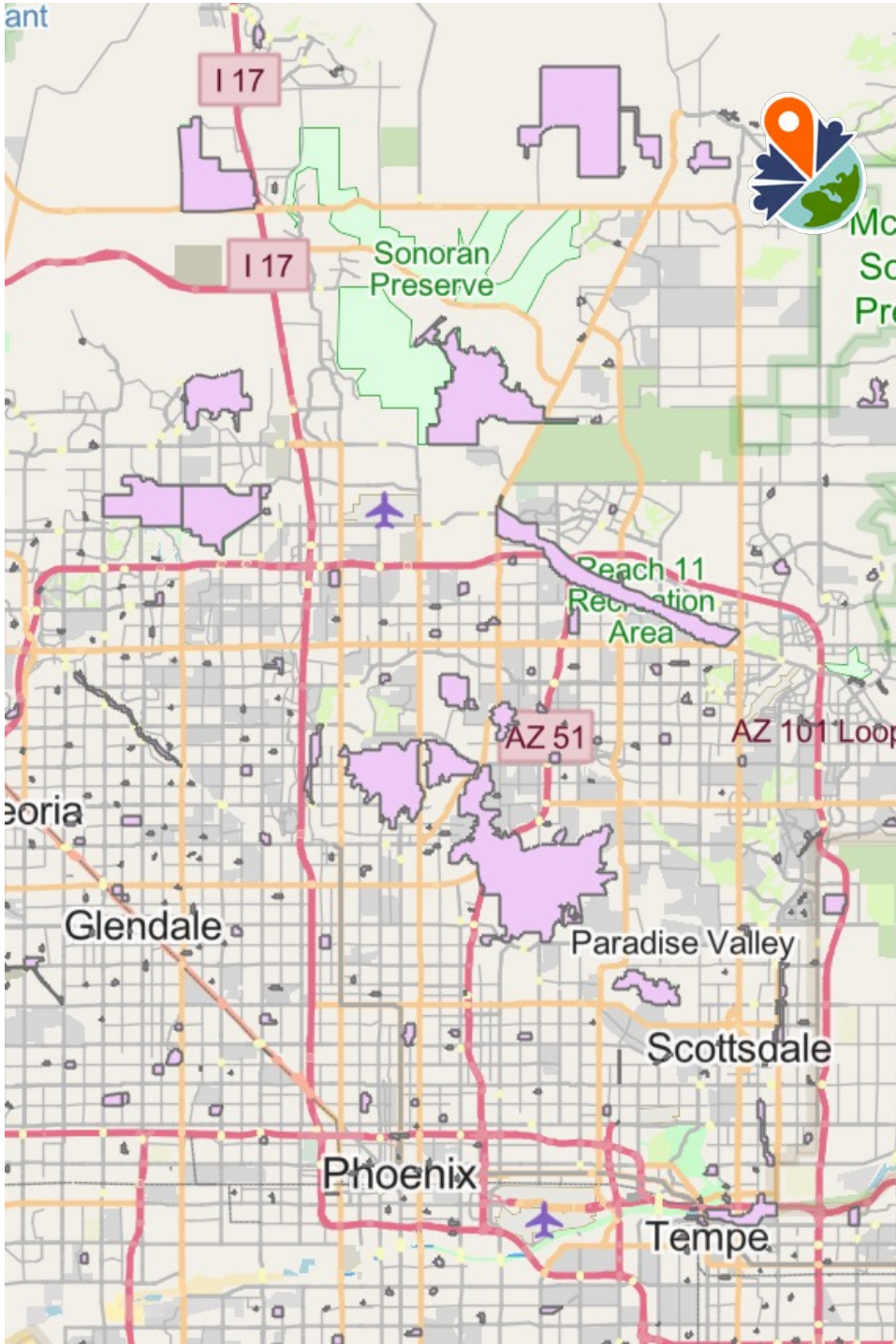


ATTRIBUTE TAGGING IDENTIFICATION

MAPATHON & GROUNDTRUTH PILOT

AI BUILDING FOOTPRINT DATA FEATURE EXTRACTION

OVERLAY TAX PARCEL RECORDS



ATTRIBUTE TAGGING IDENTIFICATION

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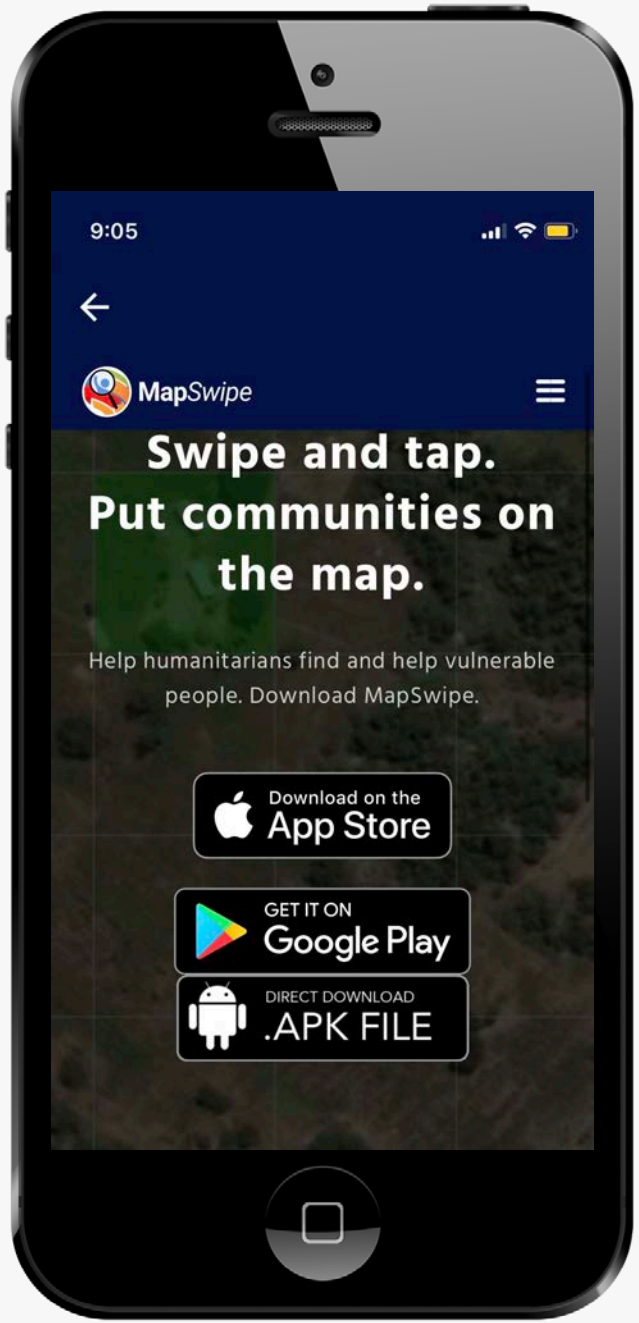
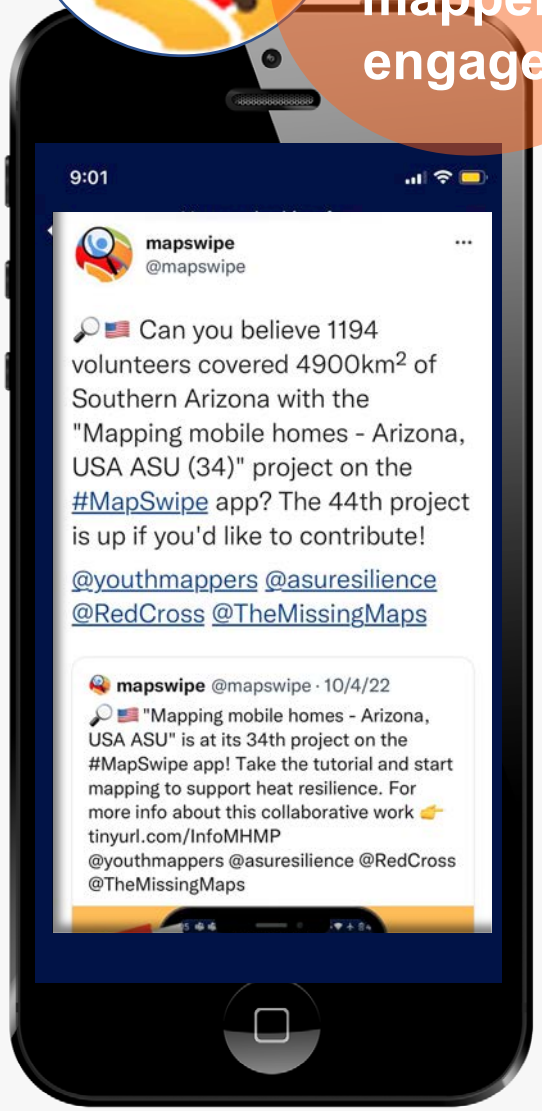
MAPSWIPE MISSING DATA CAMPAIGN

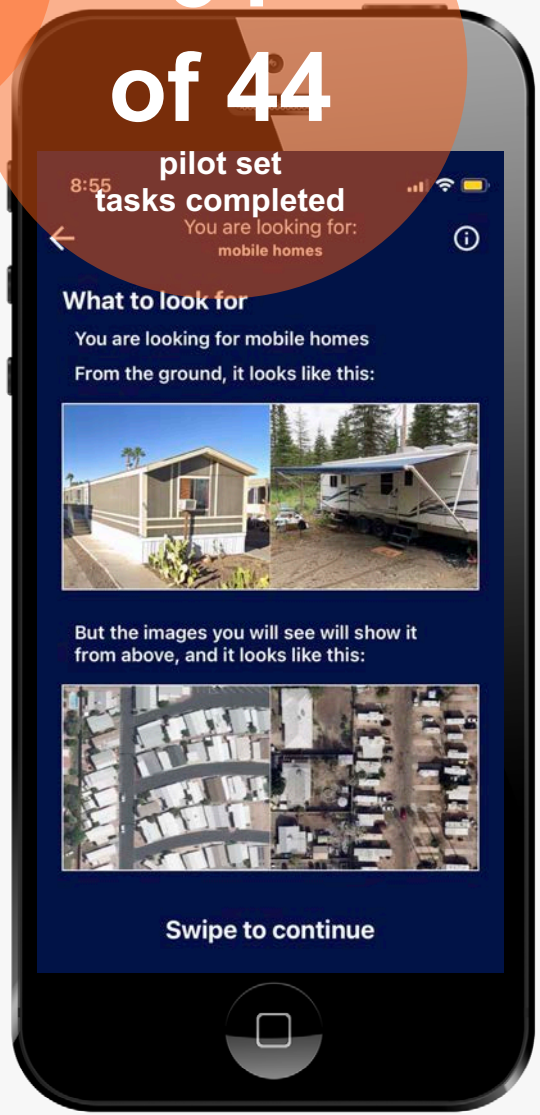
OVERLAY TAX PARCEL RECORDS

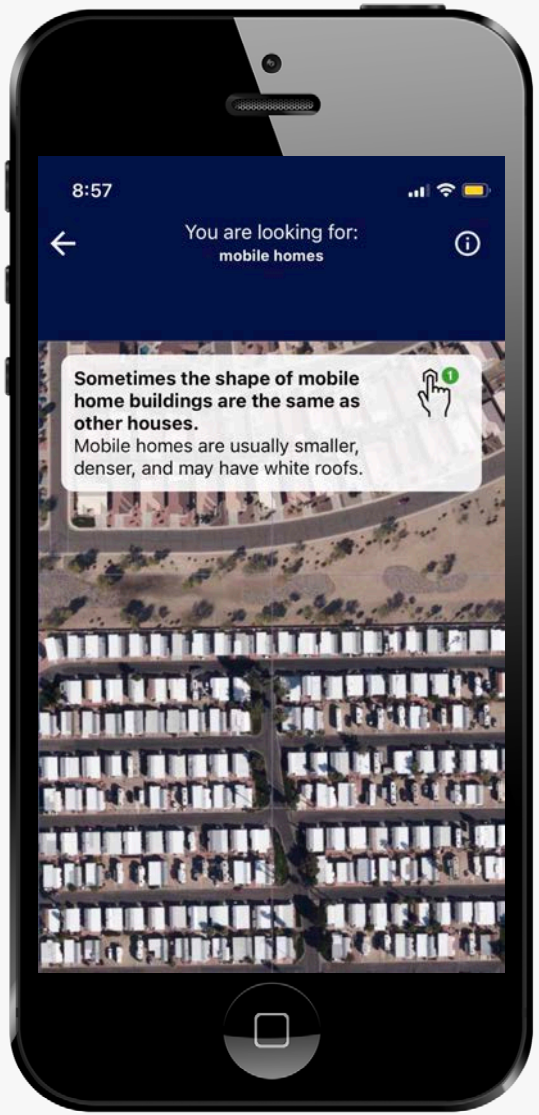


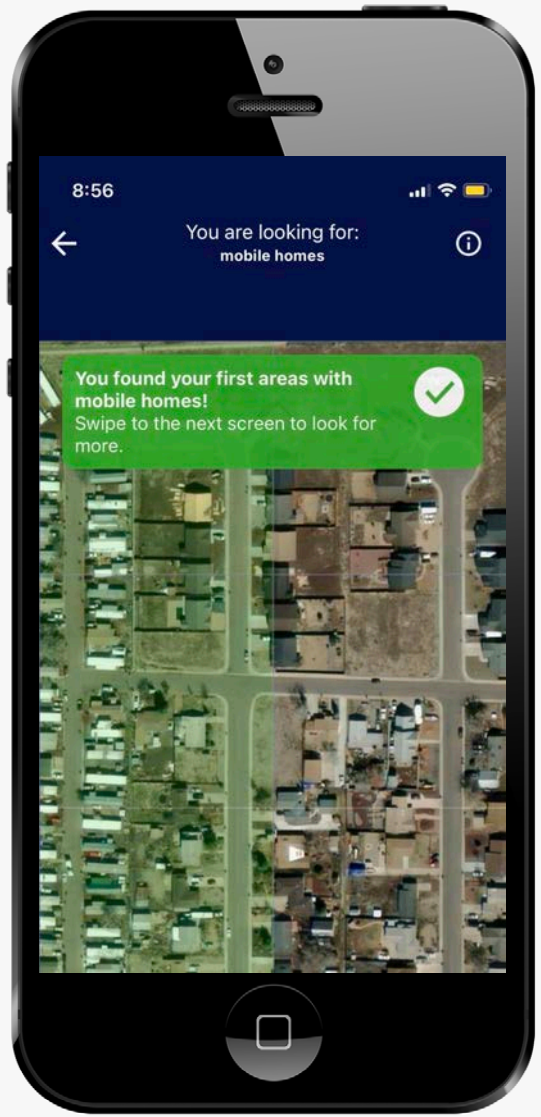
1,194
mappers engaged

34 of 44
pilot set tasks completed









ATTRIBUTE TAGGING IDENTIFICATION

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AI BUILDING FOOTPRINT DATA FEATURE EXTRACTION

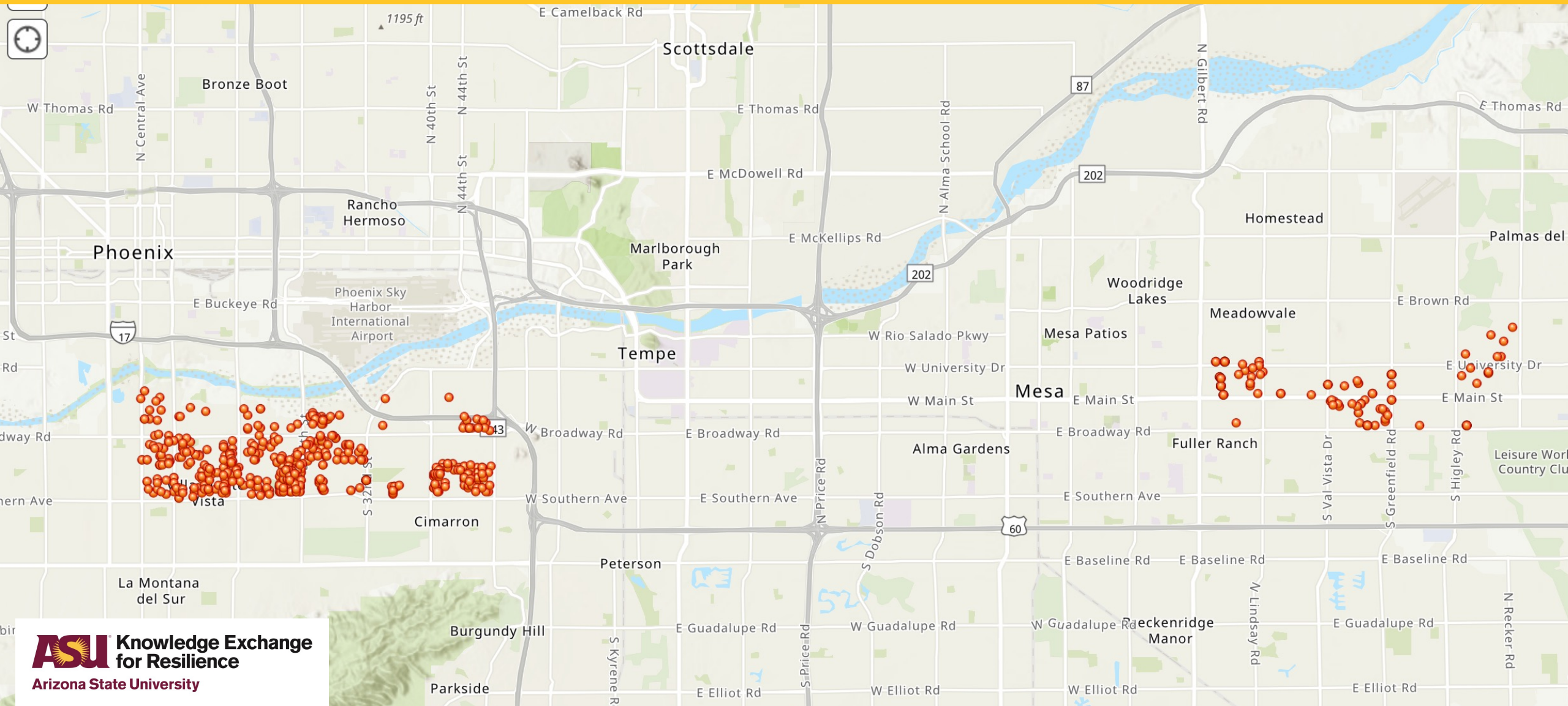
MAPSWIPE MISSING DATA CAMPAIGN

OVERLAY TAX PARCEL RECORDS

STATEWIDE GEODATABASE VALIDATION

SOLUTIONS COST CALCULATIONS BY JURISDICTION

703 students in 2 study areas yielded **9 volunteers** enlisting 61 households



Knowledge Exchange for Resilience
Arizona State University

Exposure in trailer parks and mobile units is high

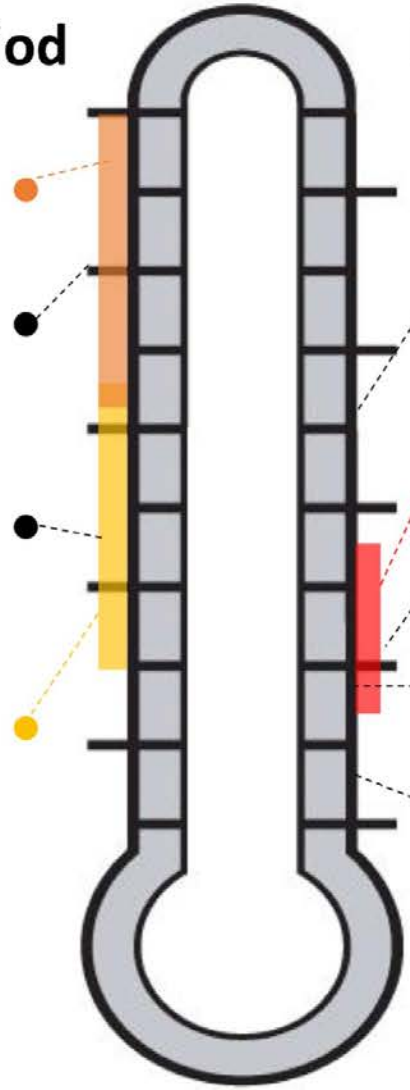
Land Surface Temperature at Research Site and in Phoenix during Study Period

112.0°F - 150.7°F Range of Land Surface Temperature at Study Site

131.3°F Average Land Surface Temperature at Study Site

96.6°F Average Official Temperature at Phoenix Sky Harbor Airport

78.8°F - 114.8°F Range of Official Temperature at Phoenix Sky Harbor Airport



Mobile Home Residents Recorded Indoor Thermal Exposure

111.2°F Maximum Indoor Temperature Recorded for any Participant

73.0°F - 94.7°F Range of Average Indoor Temperature Recorded across Participants

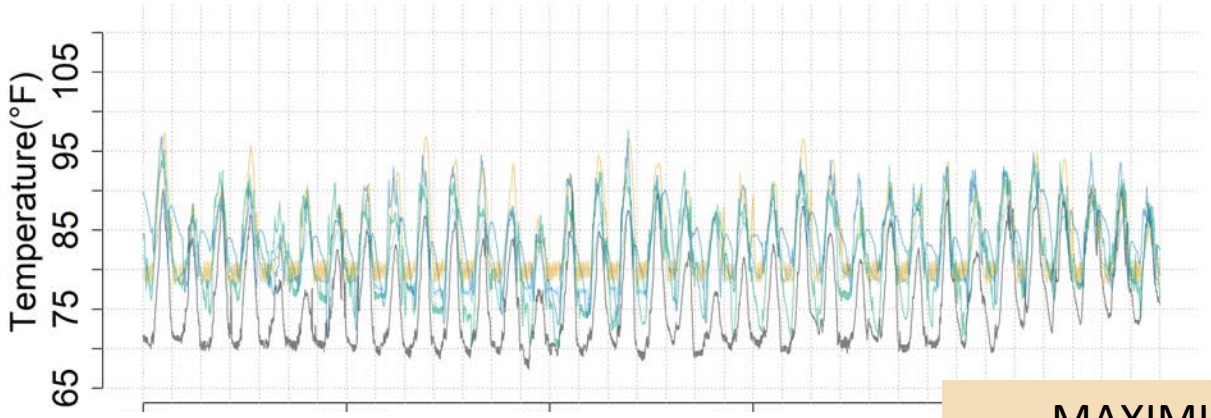
81.9°F Median among Participants of Average Recorded Indoor Temperature

76.4°F Average Preferred Indoor Temperature

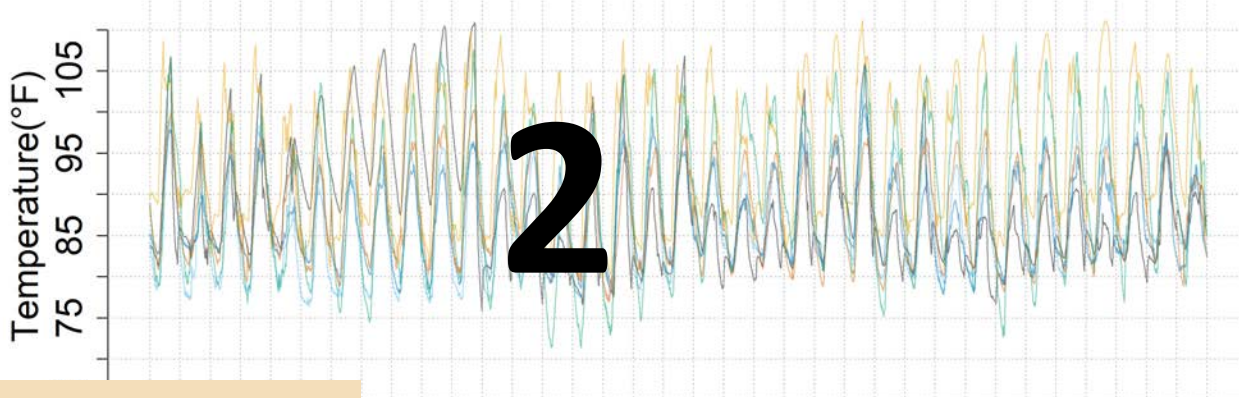
64.9°F Minimum Indoor Temperature Recorded for any Participant

Credit: Patricia Solís, PhD, ASU KER, SGSUP

94°F



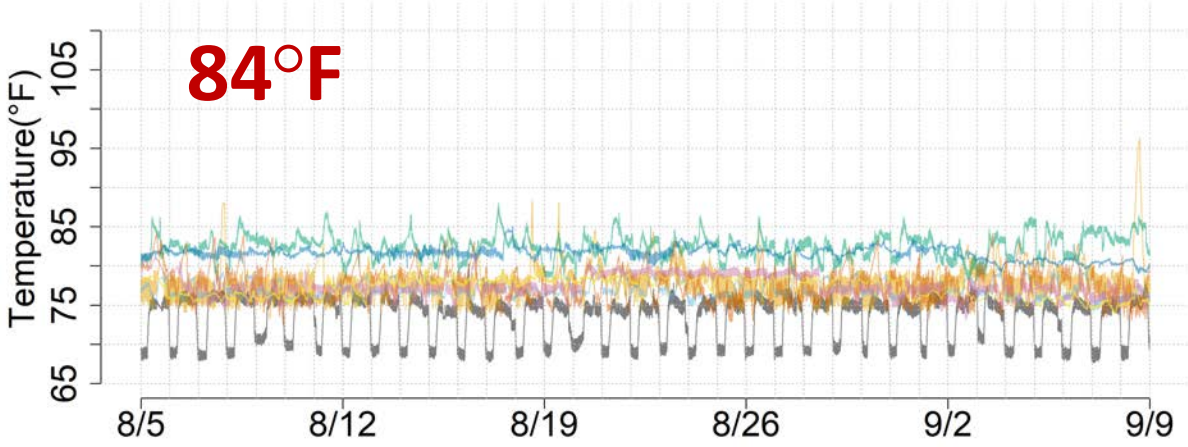
Cluster 1 (n = 6) 105°F



MAXIMUM RECORDED TEMPERATURE INDOORS

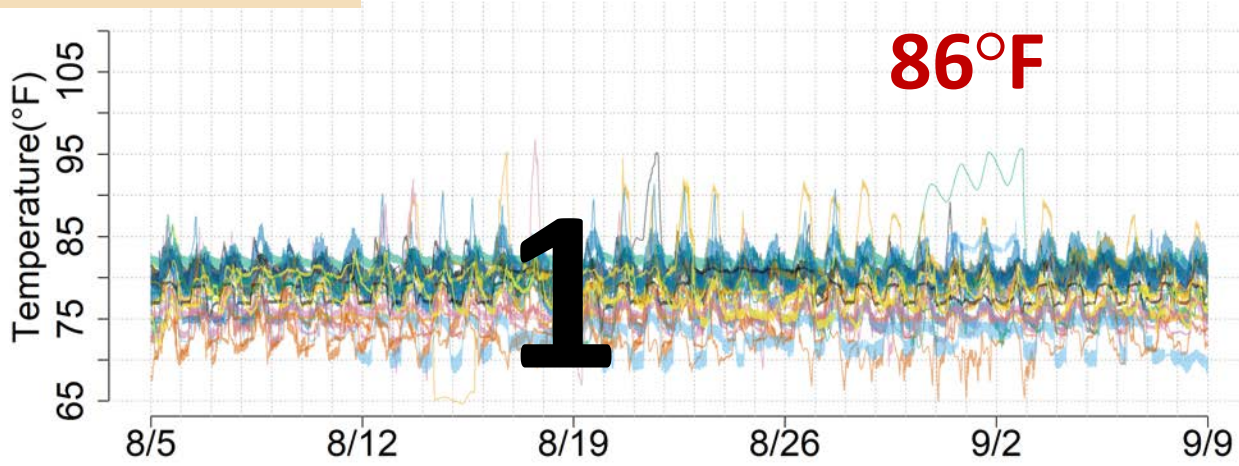
Cluster 4 (n = 8)

84°F



Cluster 2 (n = 25)

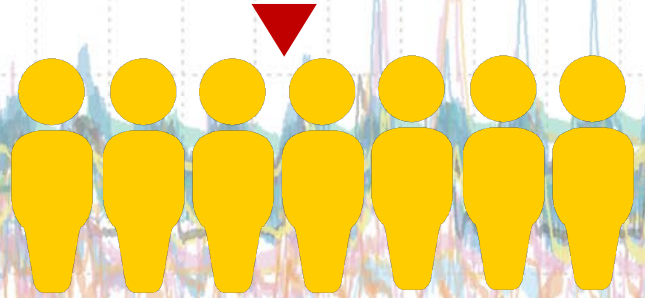
86°F



PERSONA 1 (SLIM-HIGH CLUSTER)

- Majority of respondents were in South Phoenix (87%)
- 57% of reported household income fell between $25,000-$49,000
- Answered highest REPORTED average indoor thermostat temperature of the clusters : 78.2°F

household income



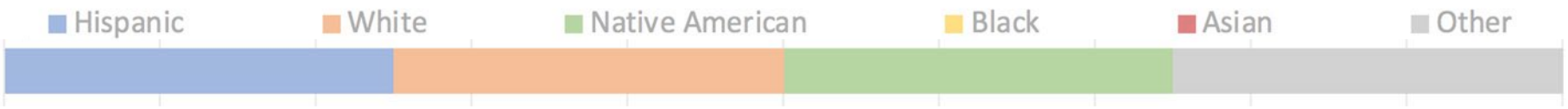
median household size 3.5

73% female

44

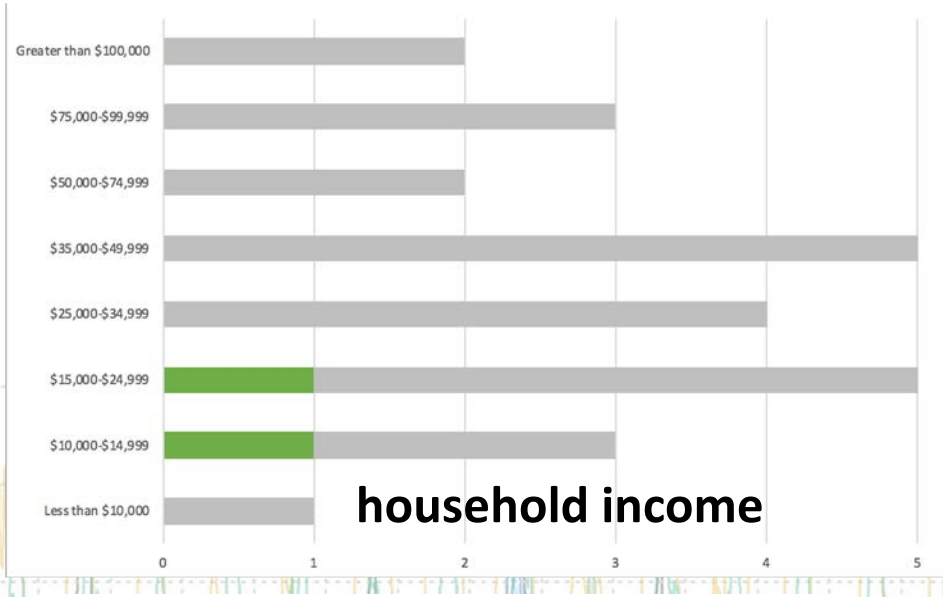
median age

80% central AC

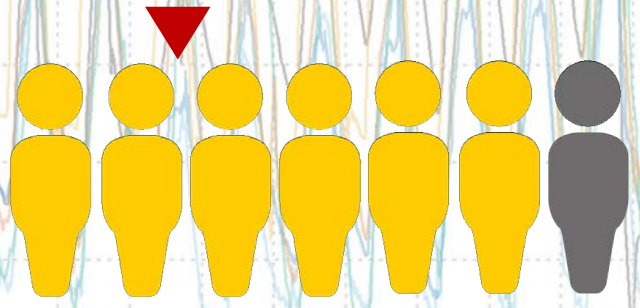


PERSONA 2 (WIDE-HIGH CLUSTER)

- All respondents were in Mesa
- 100% of respondents did not use central air conditioning
- Reported total household income was under $25,000
- Had the highest RECORDED average indoor temperature of the four clusters at 88.9°F and highest RECORDED maximum indoor temperature at 105.8°F



household income

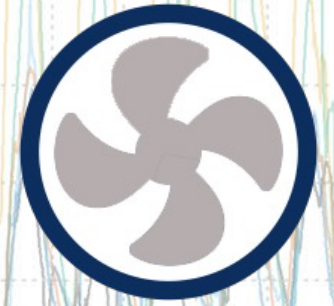


median household size 2.5

50% female

53

median age



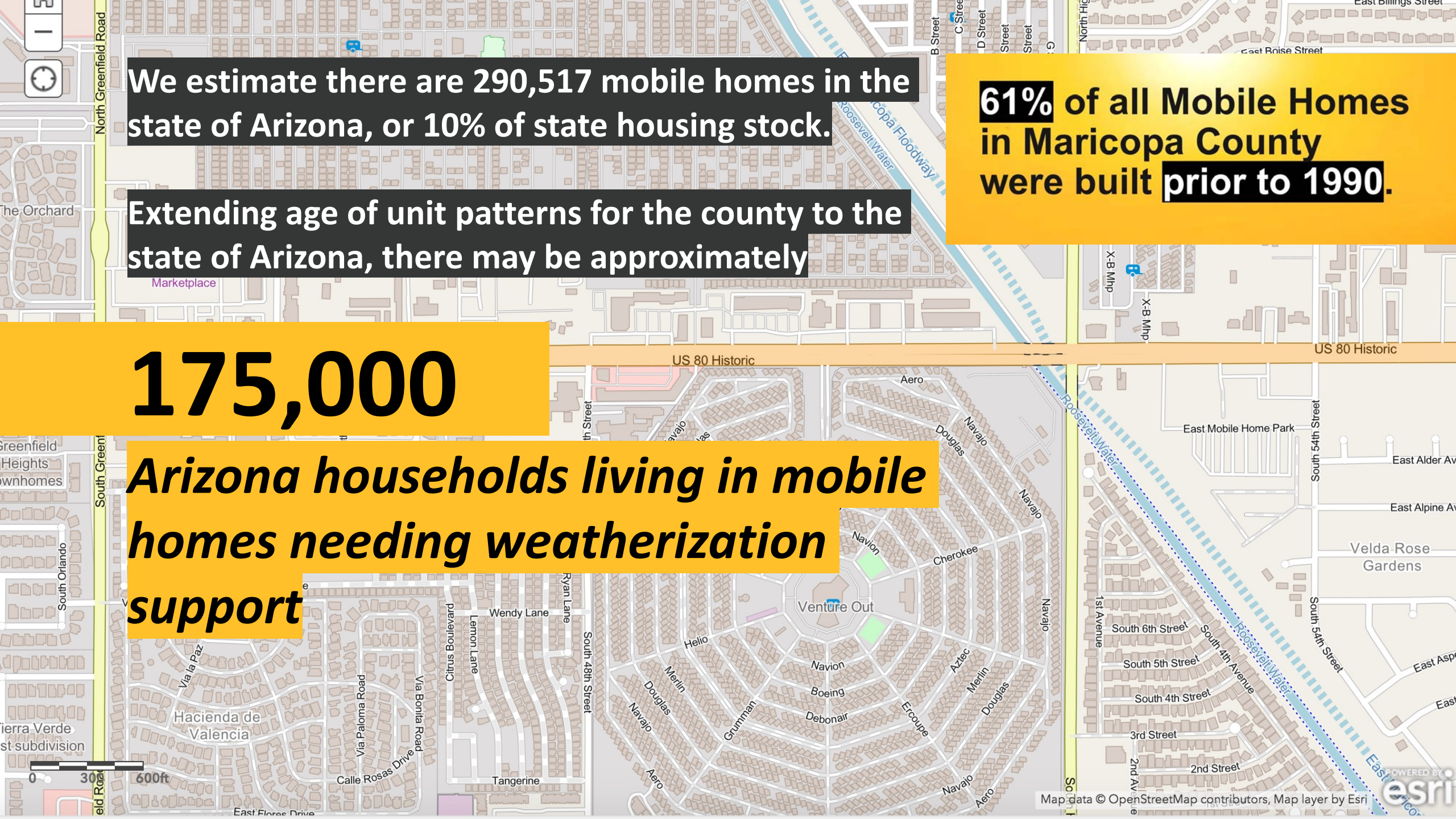
0% central AC

	Mobile Home Households	Single-family Households	All Maricopa County
Median Household INCOME	**$ 46,544**	**$ 71,369**	$ 65,252
Median Housing VALUE	**$ 33,565**	**$ 261,793**	$ 276,800
Median Monthly RENT	**$ 1,026**	**$ 1,288**	$ 1,119

- **Mobile Home Households vs Single-family Households:**
  - **Have 65% the household income**
  - **Live in housing valued at 13%**
  - **Pay 80% the monthly rent amount**

- Twice as likely to forego basic household necessities like medicine or food, in order to pay their energy bill.

- 11% have trouble paying their energy bill (compared to 5% of other housing types).


We estimate there are 290,517 mobile homes in the state of Arizona, or 10% of state housing stock.
61% of all Mobile Homes in Maricopa County were built prior to 1990.
Extending age of unit patterns for the county to the state of Arizona, there may be approximately
175,000
Arizona households living in mobile homes needing weatherization support
North Greenfield Road
Roosevelt Water Copa Floodway
B Street
C Street
D Street
East Boise Street
East Billings Street
The Orchard
Marketplace
X-B Mhp
US 80 Historic
Aero
Navajo
Douglas
East Mobile Home Park
South 54th Street
East Alder Av
East Alpine Av
Velda Rose Gardens
Navion
Cherokee
Venture Out
Wendy Lane
Ryan Lane
South 48th Street
Helio
Merlin
Boeing
Grumman
Debonair
Ercoupe
Aztec
Hacienda de Valencia
Via la Paz
Via Paloma Road
Via Bonita Road
Citrus Boulevard
Lemon Lane
Calle Rosas Drive
Tangerine
East Flores Drive
1st Avenue
South 6th Street
South 4th Avenue
South 5th Street
South 4th Street
3rd Street
2nd Street
South Orlando
South Greenfield
Greenfield Heights
Sierra Verde
0
300
600ft
Map data © OpenStreetMap contributors, Map layer by Esri
esri

Approach

- **IDENTIFY VULNERABILITIES,** assets and current response mechanisms proactively;
- collect, liberate, analyze, visualize, create and communicate knowledge from **VAST DIVERSE DATA;**
- **MOBILIZE SOLUTIONS** within a multi-sector network of collaborators capable of investing and responding;

Technical Solutions

Natural Solutions

Policy-Related Solutions

Social & Community Programs

Innovative Financial Products & Opportunities

ASU Knowledge Exchange for Resilience
Arizona State University

Theoretical Framework

GEOGRAPHICAL REVIEW

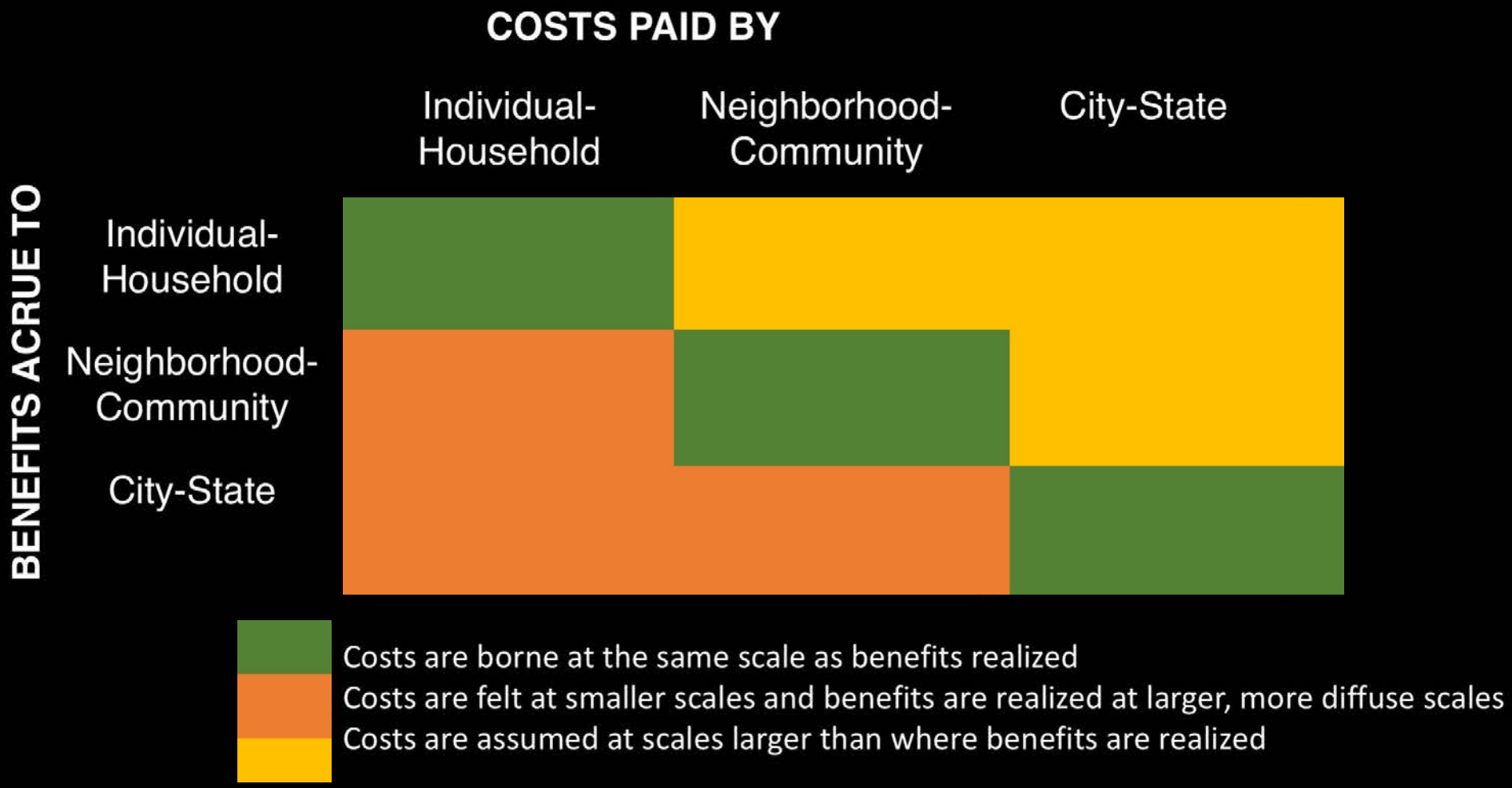
Original Article | Full Access

The Decision-Making/Accountability Spatial Incongruence Problem for Research Linking Environmental Science and Policy†

Patricia Solís, Jennifer K. Vanos, Robert E. Forbis Jr.

First published: 15 November 2016 | https://doi.org/10.1111/gere.12240 | Citations: 18

Testing Framework



Credits: Solís

Meta-analysis

Design Criteria for Heat Solutions in Mobile Homes

	Price	Ease of Installation	Maintenance	Usability	Effectiveness	Resilience	Sustainability	Durability	Aesthetic	**Total (∑n)**	**Weighting Factor *(W)***
Price	1.0	0.5	0.33	0.25	0.2	0.25	0.33	0.5	1.0	4.37	**0.040**
Ease of Installation	2.0	1.0	0.67	0.5	0.4	0.5	0.67	1.0	2.0	8.73	**0.081**
Maintenance	3.0	0.6	1.0	0.75	0.6	0.75	1.0	1.5	3.0	12.20	**0.113**
Usability	4.0	2.0	1.33	1.0	0.8	1.0	1.33	2.0	4.0	17.47	**0.161**
Effectiveness	5.0	2.5	1.67	1.25	1.0	1.25	1.67	2.5	5.0	21.83	**0.202**
Resilience	4.0	2.0	1.33	1.0	0.8	1.0	1.33	2.0	4.0	17.47	**0.161**
Sustainability	3.0	1.5	1.0	0.75	0.6	0.75	1.0	1.5	3.0	13.10	**0.121**
Durability	2.0	1.0	0.67	0.5	0.4	0.5	0.67	1.0	2.0	8.73	**0.081**
Aesthetic	1.0	0.5	0.33	0.25	0.2	0.25	0.33	0.5	1.0	4.37	**0.040**
Total (Σ)										**108.27**	**1.000**

Specific Built Heat Solutions in Mobile Homes, Scored {Z} and Weighted {W} per Criteria																	
Criteria	***W***	❶Replacing Windows / Doors		❷Shade Awnings		❸Solar Powered Homes		❹Reflective Coatings		❺Trees		❻Skirting		❼Misters		❽Solar Canopies	
		Z	Z*W	Z	Z*W	Z	Z*W	Z	Z*W	Z	Z*W	Z	Z*W	Z	Z*W	Z	Z*W
Price	**0.040**	2	0.08	3	0.12	1	0.04	1	0.04	3	0.12	3	0.12	2	0.08	1	0.04
Ease of Installation	**0.081**	2	0.162	2	0.162	1	0.081	1	0.081	4	0.324	4	0.324	2	0.162	1	0.081
Maintenance	**0.113**	5	0.565	5	0.565	2	0.226	4	0.452	4	0.452	5	0.565	3	0.339	2	0.226
Usability	**0.161**	5	0.805	5	0.805	3	0.483	5	0.805	5	0.805	5	0.805	4	0.644	3	0.483
Effectiveness	**0.202**	4	0.808	4	0.808	5	1.01	3	0.606	5	1.01	4	0.808	4	0.808	5	1.01
Resilience	**0.161**	4	0.644	4	0.644	5	0.805	3	0.483	5	0.805	4	0.644	4	0.644	4	0.644
Sustainability	**0.121**	4	0.484	4	0.484	5	0.605	3	0.363	5	0.605	4	0.484	3	0.363	5	0.605
Durability	**0.081**	5	0.405	5	0.405	5	0.405	4	0.324	4	0.324	4	0.324	3	0.243	5	0.405
Aesthetic	**0.040**	5	0.2	5	0.2	3	0.12	3	0.12	5	0.2	4	0.16	3	0.12	4	0.16
TOTAL	**1.000**		**4.153**		**4.193**		**3.775**		**3.274**		**4.645**		**4.234**		**3.403**		**3.654**

Household Scale

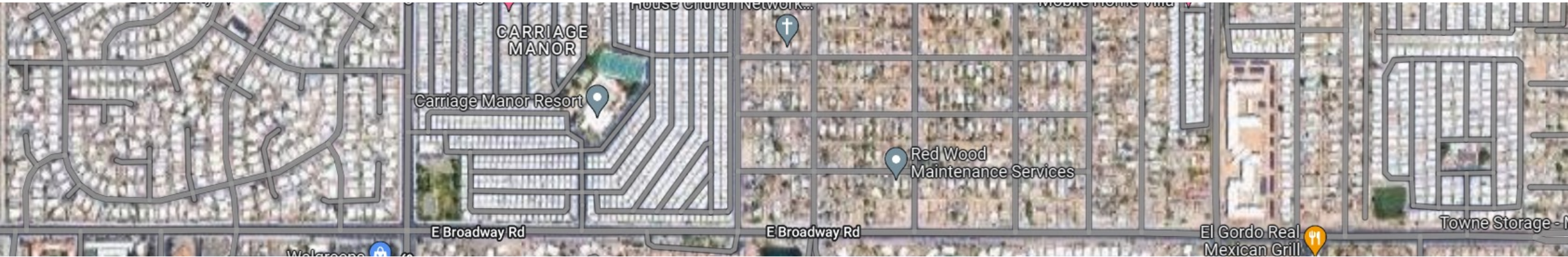
- Air sealing the home
- New AC units
- Skirting
- Shade Awnings
- Window coverings
- Roofing tech
- LED lights
- Reflective White Coating
- Personal heat warning systems

Park Level

- Trees & Green walls
- Outdoor Misters
- Shade sails
- Replacing pavement & asphalt with soil & plants
- Upgrade utility connections
- Solar canopies
- Cooling centers within park
- Early detection warning systems to notify that home gets too hot

City Level

- Upgrade utility connections
- Solar communities
- Cooling centers & resilience hubs within city
- Subsidized transportation to access cooling centers
- Wellness checks
- Zoning and incentives
- Improve the building envelope program
- Outreach & education programs
- Update utility assistance programs
- Utility conversion program



State and Region

- Stop bans on cooling technology
- Review economic programs and financial mechanisms like tax credits
- Energy efficiency standards and requirements
- Legislation to institute utility shutoff protection
- Support for affordable housing in greater supply
- Include mobile homes in federal hedge fund protection bills
- Better data collection, analysis, monitoring

Spatial Incongruence Matrix of Built Environment Solutions Subset				
Scale where Benefits Accrue ▶ ▼ ***Main Implementing Actor***	Mobile Home Unit	Trailer Park	Community or City Level	Part or All of County or State
Mobile Home Resident Household	❶❷❻ 12.580			
Trailer Park Owner	❶❷❻ 12.580	❶❷❺❻❼ 20.628		
Park Associations, Neighborhoods, Municipalities		❸❹❺❽ 15.348	❸❹❺❽ 15.348	
County-wide or State Level Agencies and Non-profit alliances			❸❹❺❽ 15.348	❸❹❺❽ 15.348

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OPINION

Self-isolating from COVID-19 in a mobile home? That could be deadly in Arizona

Mark Kear, Margaret Wilder, Patricia Solis, David Hondula and Mark Bernstein, opinion contributors Published 6:05 a.m. MT May 3, 2020

Opinion: What do you do when it is dangerously hot in your house and there is nowhere to go? This will be a life or death question for many this summer.

CONNECT TWEET LINKEDIN COMMENT EMAIL MORE

A record 264 heat-related deaths occurred in Arizona in 2017. Older folks - those most likely to live in hard-to-cool homes and who may need to shelter in place throughout the summer - are most at risk. *(Photo: Photo: David Kadlubowski/The Republic/azc)*

Los Angeles Times

POLITICS

Coronavirus could worsen death toll of summer heat waves, health officials warn

The Washington Post

Democracy Dies in Darkness

mate and Environment

Extreme heat is killing people in Arizona's mobile homes

By Karen Peterson
July 2, 2021 at 8:23 a.m. EDT

esidents of older, substandard mobile homes are at higher risk of death in summer's blazing mperatures

TUCSON — For the past 23 years, Jim Filipiak, 73, has lived in a 1976 singlewide mobile home. Mobile homes dominate the flat landscape of his Tucson neighborhood, a mostly treeless plot near the railroad tracks and Interstate 10. The retiree and Vietnam veteran has remodeled his home and kept up with maintenance, but there's little he can do to shield himself from what has become the norm in Arizona: searing, deadly summer heat.

Filipiak has two window air-conditioners, but they suck up electricity and drive up the bill, so he only runs the AC for the few hottest hours of the day to protect his two rescue dogs. Even if he could afford a more efficient central AC unit, the wiring in his home couldn't sustain it. Instead, Filipiak relies on an evaporative cooler, until summer rains and humidity in July and August render it useless. Then he relies on fans. In mid-June, when Tucson and Phoenix both broke records for triple-digit heat, the interior temperature of his home never dropped below 90 degrees, day or night.

Last summer's relentless, 100-degree heat and compounding drought killed a record 520 people in Arizona — twice the total deaths reported nationally from hurricanes, wildfires, tornadoes, severe storms and floods, and a significant increase from the past decade, when heat-related deaths in Arizona never went above 283. With this summer already dangerously hot, researchers are sounding the alarm about a heat-vulnerable community that has been historically disregarded because of where they live: substandard, aged mobile homes.

Heat death investigations from 2020 are still pending, but at least 13 people in Maricopa County alone died in their mobile homes, said Patricia Solis, a geographer and executive director of the Knowledge Exchange for Resilience at Arizona State University. (Mobile home-specific death totals are not available statewide.) Thousands more are vulnerable again this summer, as punishing temperatures are already smothering parts of the country.

Already the first victims of natural disasters, residents of these older mobile homes are a microcosm of the at-risk population for heat emergencies: the poor and those living on fixed incomes, the very young and the elderly, people with disabilities, people who live alone and people of color. Filipiak's neighborhood includes a Native American community.

"We are beginning to see this to be a real health concern, certainly a moral one," said Margaret Wilder, with the School of Latin American Studies and the School of Geography, Development & the Environment at the University of Arizona. "It should be of concern to any policymaker."

Wilder and Solis are members of the team of researchers, already well-versed in heat- and climate-related studies, who are collaborating on a project led by Mark Kear, assistant professor in the School of Geography, Development & the Environment at the University of Arizona. It began in 2019; their report will be published this fall.

"We are all exposed to global warming; the temperatures outside are up for all of us, but not all of us are equally vulnerable," Kear said.

The New York Times

Aug. 13, 2019

As Phoenix Heats Up, the Night Comes Alive

That will be true for many more cities as the world gets hotter.

Photographs by George Etheredge | Written by Marguerite Holloway

Evening can mean the start of a new day for some residents. "I switch everything around. I do everything at night," said Tee McKee, as she folded clothes in the community laundry room at the Shady Grove Mobile Home and RV Park in Mesa. "I try to put in insulation and old curtains to keep the cool in and the heat out." But, she said, metal RVs roast in the sun and radiate heat long into the night.

Last year, heat caused or contributed to the deaths of 182 people in Maricopa County, which includes Phoenix. Preliminary figures suggest the toll this year will be similar, if not higher, according to the health department. Thirty-six percent of those who died in 2018 were 65 or older and at least 23 percent were homeless. Recent research found that mobile home residents are also especially vulnerable. In 2012 and 2014, nearly half the indoor heat deaths occurred in mobile homes, said Patricia Solis, a geographer at Arizona State University.

Dr. Solis is one of dozens of heat experts in the region — part of what Mark Hartman, Phoenix's chief sustainability officer, described as "the epicenter of research related to heat." They are trying to determine, among many things, how best to mitigate heat through urban planning and how to help vulnerable populations, including people who cannot afford air-conditioning. Ultimately, Phoenix could become a model for what it means to be "heat ready."

Some of the research takes place after sunset, as on a July night when Ariane Middel, a professor of urban climate at Arizona State University, and two colleagues pulled Marty, an assemblage of meteorological sensors, through downtown Tempe to examine the microclimate.

Other cities with temperate climates may start to experience heat like Phoenix's in the coming decades, said Dr. Middel. "We are almost a living laboratory. We can test strategies and see different ways to keep adapting and mitigating."

"By the time it gets hot in other places," she said, "they can take what we have learned here."

NATIONAL GEOGRAPHIC

SCIENCE | CORONAVIRUS COVERAGE

As summer arrives, how wi most vulnerable escape de heat and COVID-19?

A dangerous and uncharted trifecta of the pandemic, hig unemployment, and extreme heat is looming, and cities make plans.

BY STEPHEN LEAHY

A fountain provides relief from the summer heat in Queens, New York City, in July 2019. New York—and the rest of the United States—faces an unusually hot summer, and city officials are honing plans for how to relieve those most vulnerable to the heat in the face of CO... Read More
PHOTOGRAPH BY GABRIELLA ANGOTTI-JONES, THE NEW YORK TIMES/REDUX

PUBLISHED JUNE 16, 2020

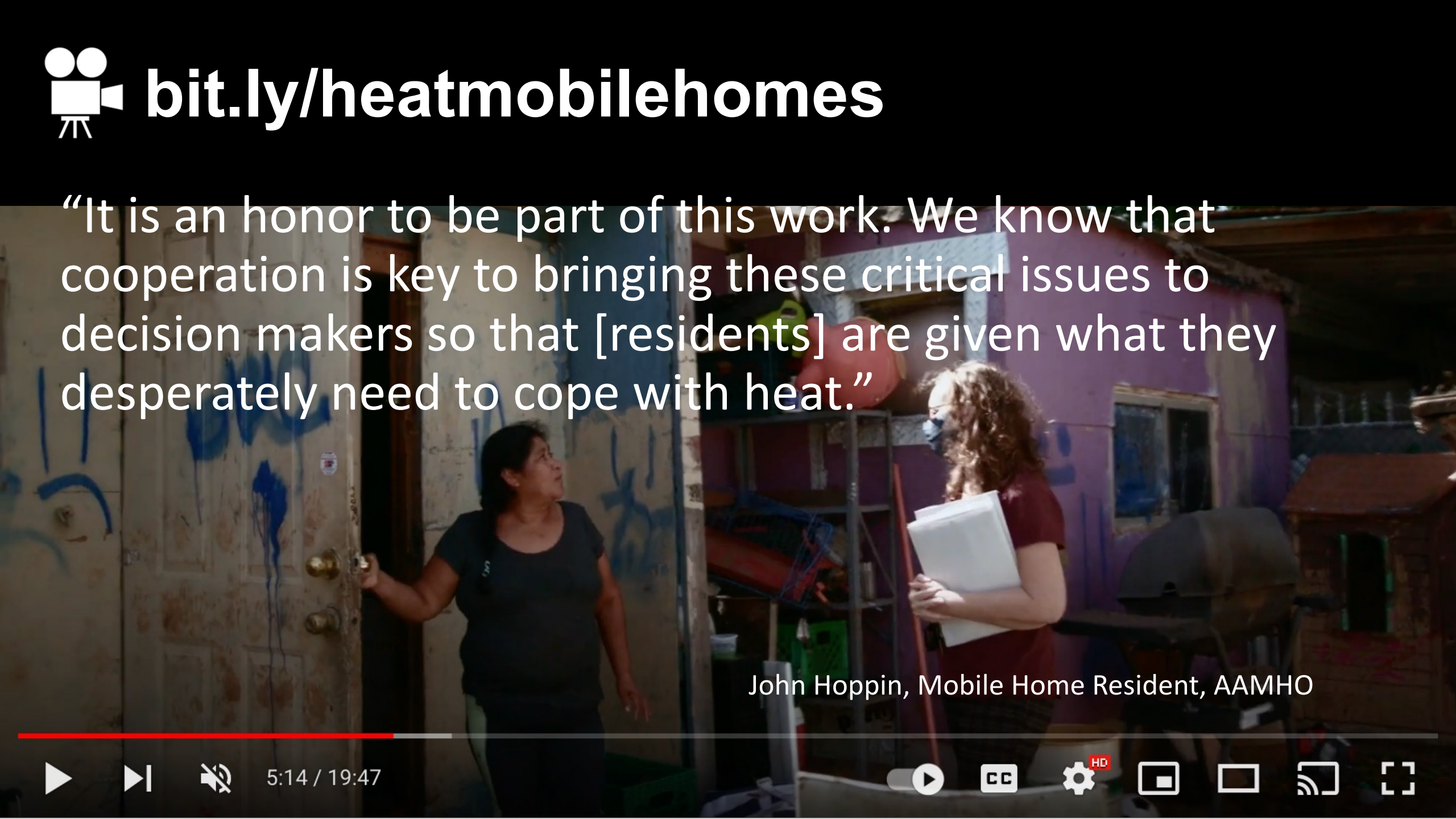
Imagine your mother is se of COVID-19. She says it's Would you advise her to r an air-conditioned public

The United States is facin unemployment, and summ average in much of the co authorities, says Patricia Exchange for Resilience a focused on building comm

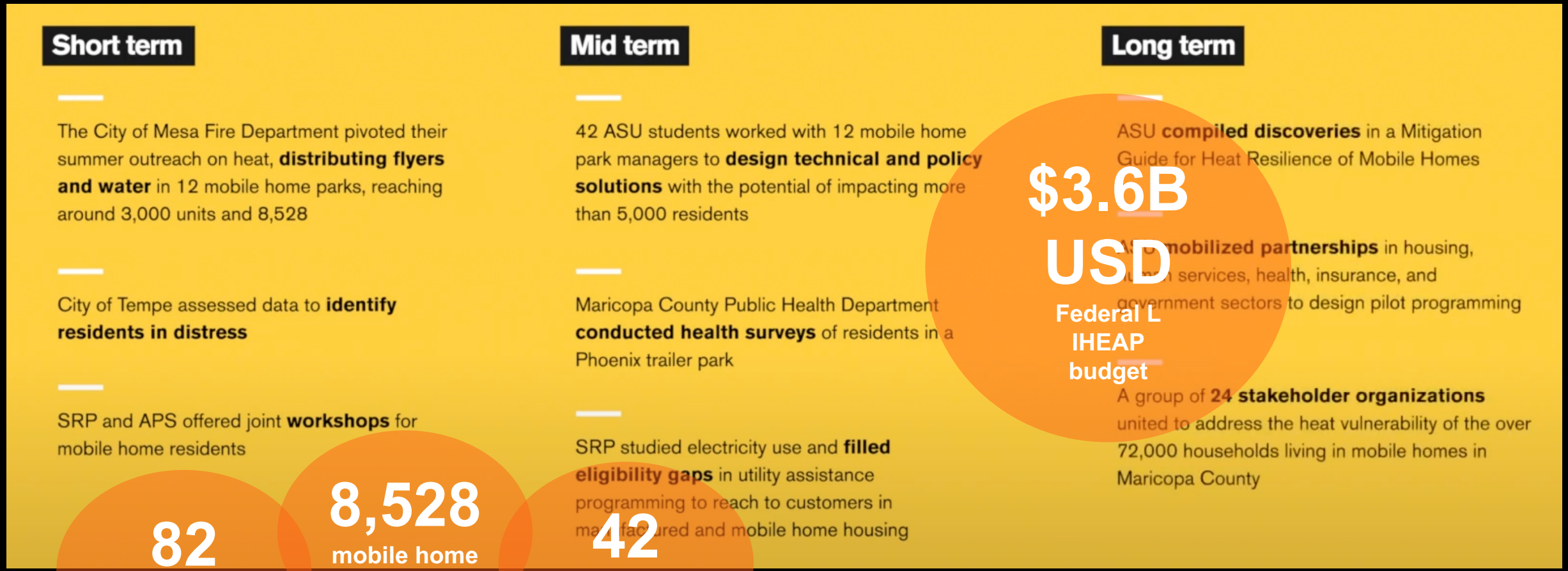
"We haven't figured out h

Even though heat is the se the U.S., the Federal Eme funding for heat emergen their own, Solis adds.

bit.ly/heatmobilehomes



Mobilizing a multi-scale solutions set



Approach

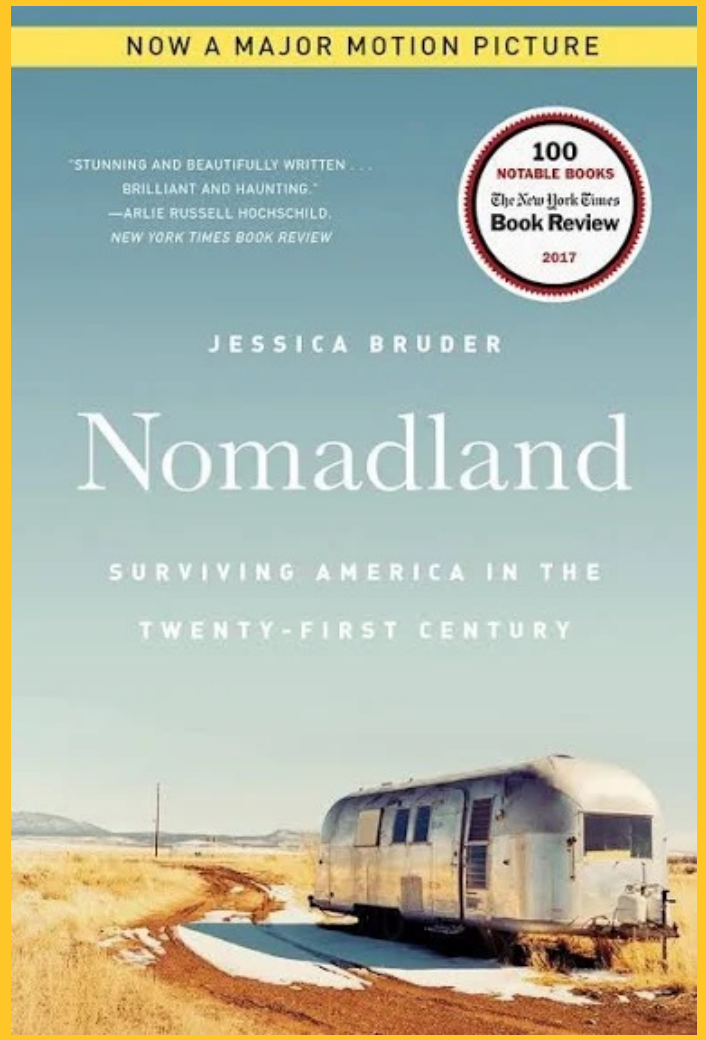
- **IDENTIFY VULNERABILITIES,** assets and current response mechanisms proactively;
- collect, liberate, analyze, visualize, create and communicate knowledge from **VAST DIVERSE DATA;**
- **MOBILIZE SOLUTIONS** within a multi-sector network of collaborators capable of investing and responding;
- promote allocation of human and financial resources for **SYSTEM IMPACT & TRANSFORMATION.**

- Ineligibility or opted-out for current support programs
- Landlord rental policies that prohibit cooling technology (e.g. front AC, shade sails)
- Mixed ownership means complex set of stakeholders who must be engaged
- Varied utilities infrastructure
- Difficult to get data we need

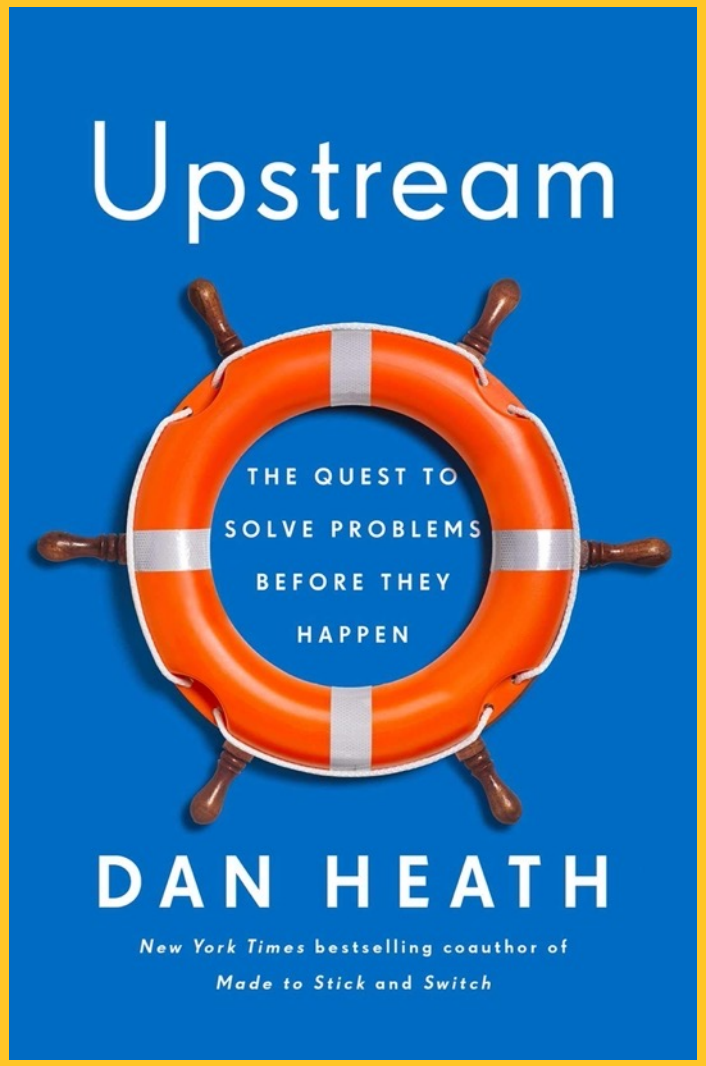
Where do we go from here?

- Olson (1965), “logic of collective action”
  - concludes that diffuse interests are too difficult to organize
  - too weak to influence outcomes
- Trumball (2012), “legitimacy coalition”
  - temporary unlikely alliances among decision-makers
  - identify and promote certain collective, discrete actions that would otherwise be too difficult or lack influence
- Solís, Vanos & Forbis (2016), seeking a spatial congruence to better link “decision-accountability”

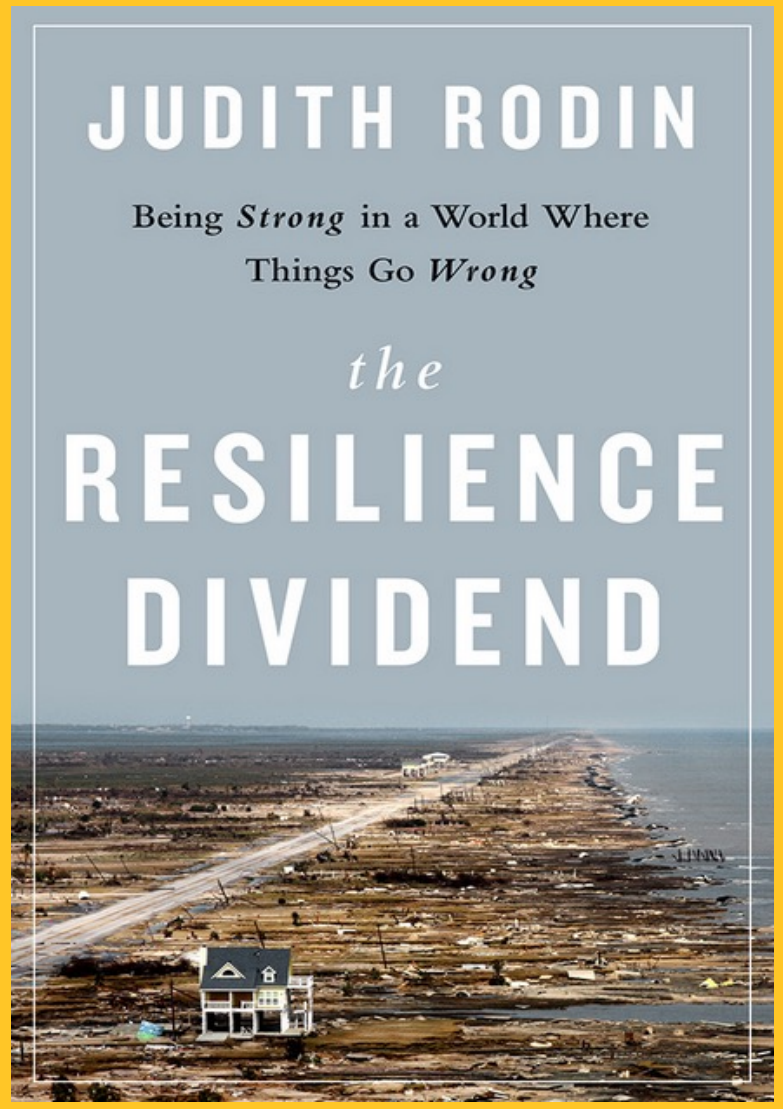
Community Asset Approach



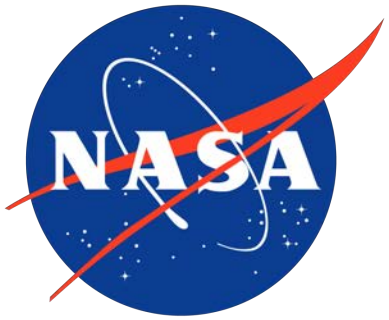
Systems Change



Co-benefits


JUDITH RODIN
Being *Strong* in a World Where Things Go *Wrong*
the
RESILIENCE DIVIDEND


ASU
Knowledge Exchange for Resilience
Arizona State University



"What is the cost of doing nothing?"

ARIZONA DEPARTMENT
OF HEALTH SERVICES

Arizona
Department
of Housing

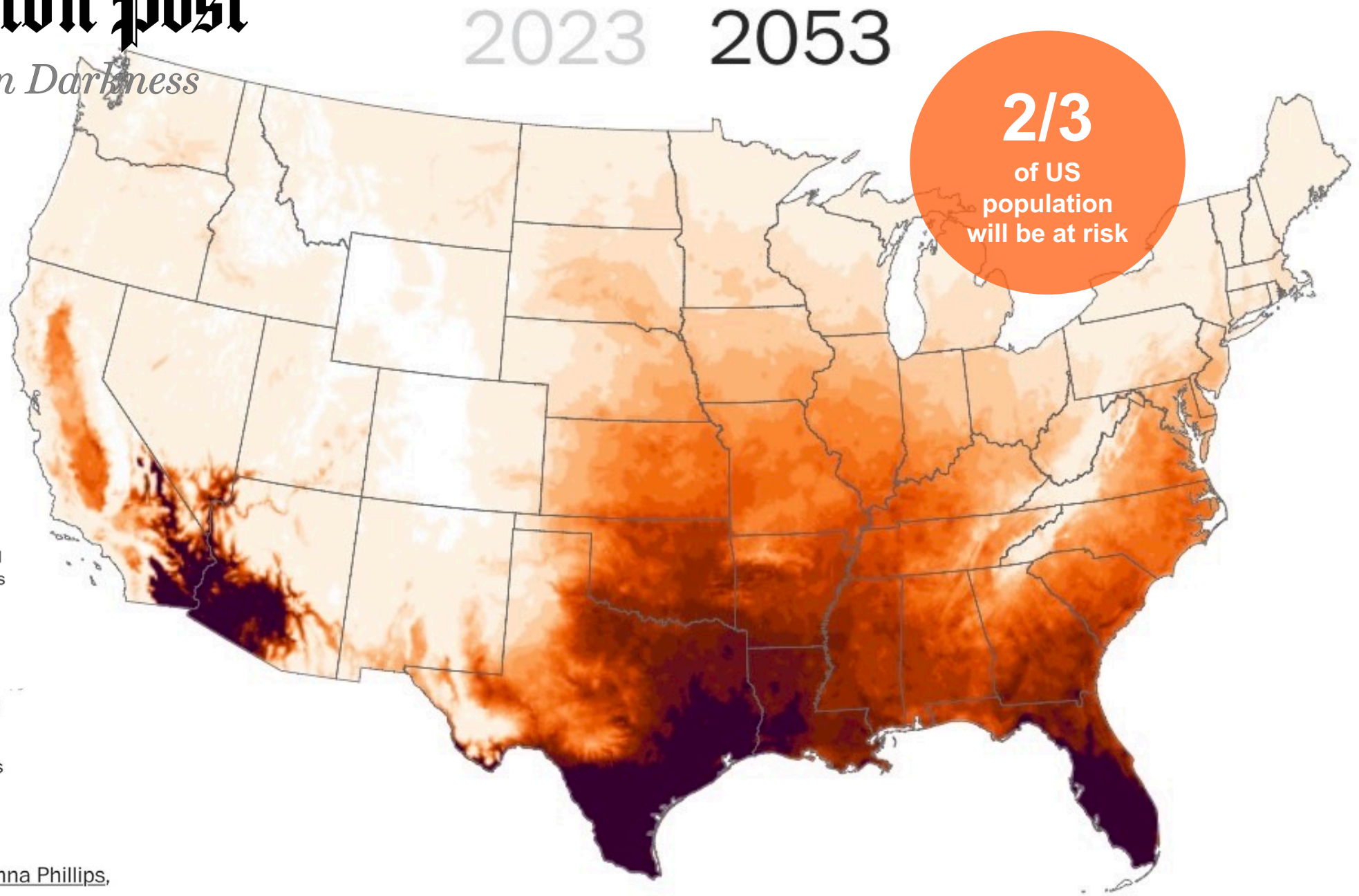
FEMA

ARIZONA
RESIDENTIAL UTILITY CONSUMER OFFICE

The Washington Post
Democracy Dies in Darkness

More dangerous heat waves are on the way: See the impact by Zip code.

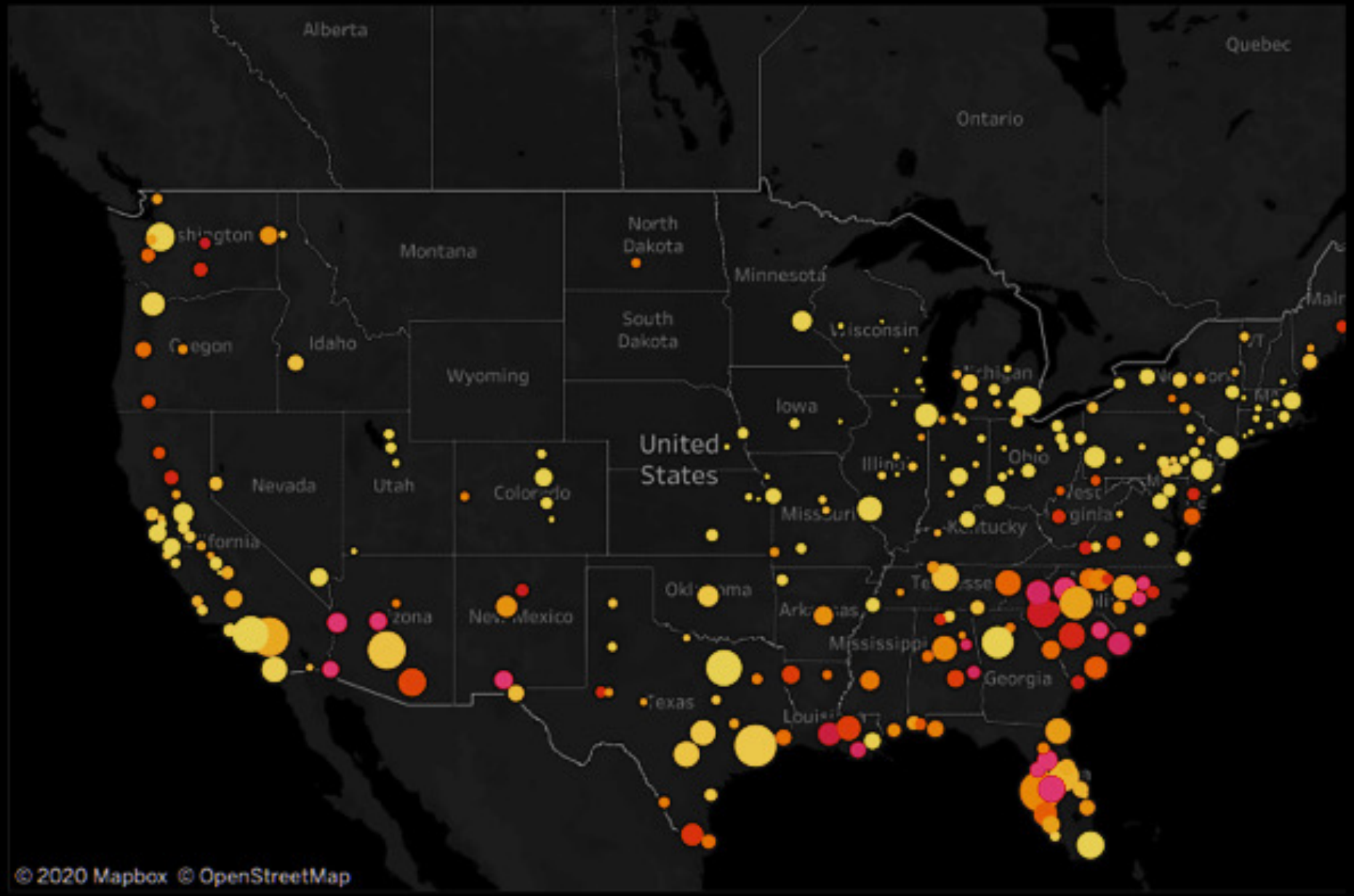
By mid-century, nearly two-thirds of Americans will experience perilous heat waves, with some regions in the South expected to endure more than 70 consecutive days over 100 degrees



By John Muyskens, Andrew Ba Tran, Anna Phillips, Simon Ducroquet and Naema Ahmed

Mobile Homes Concentrated in South & Southwest

Share of Mobile Home Households by Metro, Sized for Number of Mobile Home Households



Tweet

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@MichaelEMann

"resilience" and "innovation" are the "thoughts and prayers" of climate inactivism.
#NewClimateWar

Community Resilience

"…it generally implies that cities accept disruptions and change as inevitable… [but resilience] must go beyond an apolitical focus on infrastructure and potential shocks to one that explicitly engages with the multiple dimensions of equity"

Meerow et al, 2018
Birch & Brand, 2019
Hardy et al, 2017

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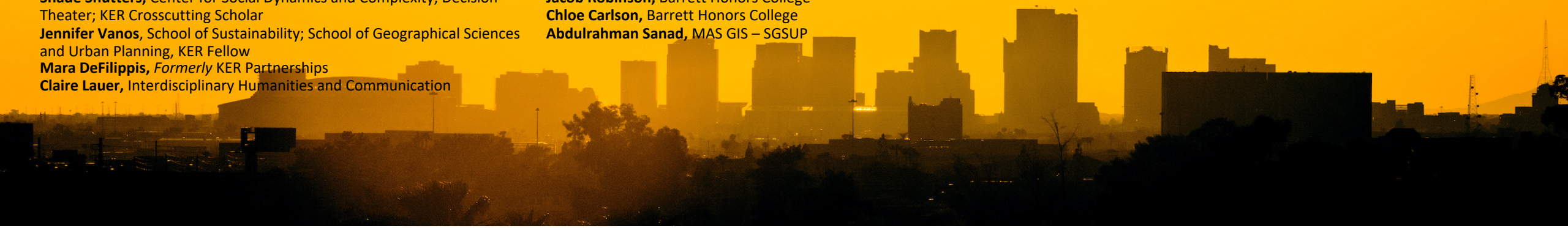

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