

---

# Advancing the Theory and Practice of Urban Heat Resilience

**Ladd Keith**, University of Arizona

**David Hondula**, Arizona State University

**Hunter Jones**, U.S. NOAA

**Sara Meerow**, Arizona State University

**V. Kelly Turner**, University of California, Los Angeles

---

# Workshop Goals

*Lay the groundwork for the next decade of actionable science on urban heat resilience.*

- Articulate the current state of urban heat resilience research and practice and areas of need within expertise areas
- Identify the most critical research gaps and needed synergies between focus areas
- Foster an interdisciplinary community of urban heat resilience research and practice
- Develop a practice-driven research agenda on urban heat resilience

# Focus Areas

Key areas of knowledge and practice critical to advancing urban heat resilience.

- Planning
- Built environment
- Health
- Energy
- Climate services
- Heat mapping

Opportunities for engagement both *within* and *across* focus areas.

# Focus Areas

Key areas of knowledge and practice critical to advancing urban heat resilience.

- Planning
- Built environment
- Health
- Energy
- Climate services
- Heat mapping



*Equity*

Opportunities for engagement both *within* and *across* focus areas.

**Arlie Adkins**, University of Arizona  
**Marissa Aho**, City of Houston  
**Michael Allen**, Old Dominion University  
**Julie Arrighi**, Red Cross Red Crescent  
Climate Centre  
**Philip Berke**, University of North  
Carolina-Chapel Hill  
**John Bolduc**, City of Cambridge  
**Kizzy Charles-Guzman**, New York City  
**Susan Clark**, University at Buffalo  
**Kristina Dahl**, Union of Concerned  
Scientists  
**Edith de Guzman**, TreePeople  
**Juan Declet**, Union of Concerned  
Scientists  
**Ann Dillemoth**, American Planning  
Association  
**Lisa Dilling**, University of Colorado  
Boulder  
**Kristie Ebi**, University of Washington

**C.J. Gabbe**, Santa Clara University  
**Beth Gibbons**, American Society of  
Adaptation Professionals  
**Eric Gimon**, Energy Innovation  
**Ben Hickson**, Pima Association of  
Governments  
**Nicole Hill**, The Nature Conservancy  
**Jeremy Hoffman**, Science Museum of  
Virginia  
**Kathy Jacobs**, University of Arizona  
**Braden Kay**, City of Tempe  
**Vijay Limaye**, Natural Resources Defense  
Council  
**Daphne Lundi**, New York City  
**Ellen Mecray**, U.S. NOAA  
**Pablo Méndez Lázaro**, Universidad de  
Puerto Rico  
**Adelle Montebianco**, Middle Tennessee  
State University  
**Richard Moss**, Joint Global Change  
Research Institute

**Doug Parsons**, American Adapts Media  
**Charles Redman**, Arizona State  
University  
**Shubhayu Saha**, U.S. CDC  
**Taj Schottland**, Trust for Public Land  
**Vivek Shandas**, Portland State  
University  
**Kurt Shickman**, Global Cool Cities  
Alliance  
**Joy Shumake-Guillemot**, WHO-WMO  
**Colby Tucker**, U.S. EPA  
**Kristin VanderModel**, Desert Research  
Institute  
**Margaret Wilder**, University of Arizona  
**Olga Wilhelmi**, U.S. NCAR  
**Tracey Woods**, American Association of  
Blacks in Energy  
**George Xian**, U.S. USGS  
**Bo Yang**, University of Arizona

# Urban Heat Resilience

Sara Meerow

Arizona State University

Urban resilience about a city's ability to cope with shocks and stresses

Growing focus of research and practice

Different definitions of urban resilience

Boundary concept

*Urban resilience refers to the ability of an urban system—and all its constituent socio-ecological and socio-technical networks across temporal and spatial scales—to maintain or rapidly return to desired functions in the face of a disturbance, to adapt to change, and to quickly transform systems that limit current or future adaptive capacity.*

-Meerow et al. (2016)

# Urban Heat Resilience

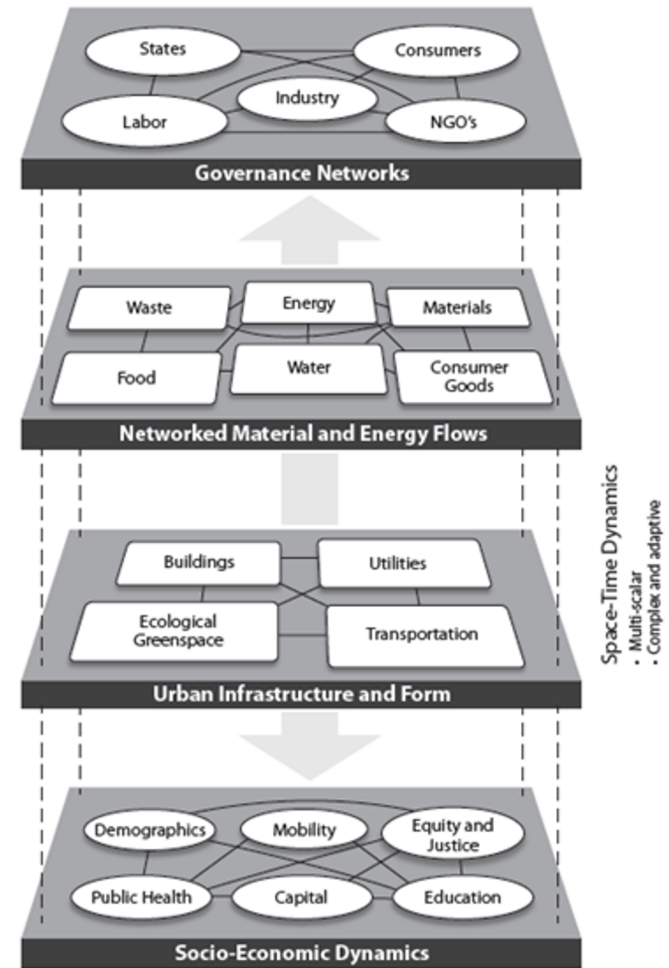
Urban resilience about a city's ability to cope with shocks and stresses

Growing focus of research and practice

Different definitions of urban resilience

Boundary concept

Applied to urban social, ecological, and technical systems & governance



# Urban Heat Resilience

Urban resilience about a city's ability to cope with shocks and stresses

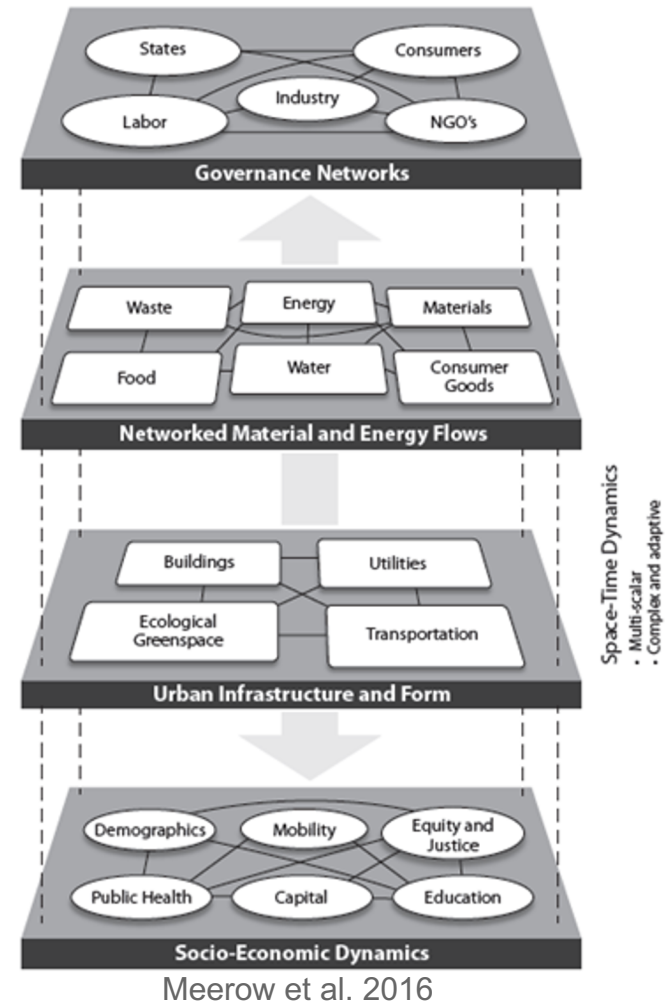
Growing focus of research and practice

Different definitions of urban resilience

Boundary concept

Applied to urban social, ecological, and technical systems & governance

'Specified' vs 'general' urban resilience





# 2050 visions for a 'heat resilient' city

**'Vision zero for heat':** No heat-related deaths or severe illnesses

**Equity:** No disparities in thermal environment or health impacts

**Community:** Informed, engaged, connected, adequately resourced

**Built environment:** Vegetation, shade, low emission and waste heat building cooling, no utility interruptions

**Governance:** Heat given equal status to other hazards, proactive and coordinated planning, 'nimble' agencies,

# What is currently understood about urban heat resilience?

**V. Kelly Turner**

University of California, Los Angeles

- Social causes of heat vulnerability and uneven health outcomes (n=15)
- The built environment causes and solutions to urban heat island (n=12)
- Climate change will cause more extreme heat events (n=3)

On balance...

Biophysical > Social



For both...

General > Specific



Which causes...

Solutions > Implementation

# What are the gaps in knowledge and practice regarding urban heat resilience that you think most urgently need to be addressed?

**David Hondula**  
Arizona State University

## Knowledge

- Economic and health impacts of (in)action
- Efficacy of interventions
- Heat experiences of most vulnerable, including “complexities of affordability”
- Risk perception among public and decision-makers, tied to communication strategies
- Multi-scale urban climate conditions, contemporary and future
- Indoor thermal environments
- Effects of chronic exposures



## Practice

- Policy, funding, and market mechanisms
- Accessibility of solutions for low-income people and smaller municipalities (size & budgets)
- Measuring and modeling
  - Thermal comfort
  - At multiple scales
- Training of planners, responders, managers at local and state levels
- Data discovery and access



# Areas of research/practice that are critical to work with to advance urban heat resilience?

Hunter Jones  
U.S. NOAA

“Heat resilience is uniquely multidisciplinary -- it is hard to imagine a practice area that wouldn't be beneficial to include”

Local government,  
construction,  
outdoor workers,  
energy providers,  
communications, health,  
sociology, economics,  
political economy,  
parks department,  
planning and policy...

**Understanding heat illness causal elements at the individual case level** – from “Why do outdoor workers die?” to “Why did this outdoor worker die and what could have prevented it?” Frames precise target for intervention.

**Understanding risk perception and individual behavior** – who sees themselves as at risk, who doesn't, and why – and how does this drive or fail to drive self-protective behaviors?

**Better, high-resolution data** – Health data at the individual level, and climate data at the urban scale. Break down barriers in health data sharing and access; do better than statistical downscaling for cities.

**Co-developed tools specific to UHI mitigation** – practitioners managing sea level rise and storm events have rich toolset to work with – how can we learn from them and better equip UHI managers.

**Policy triggers for UHI assessment** – when new infrastructure is being implemented how can we trigger UHI assessment and mitigation?

**Better evidence and evaluation of outcomes** – Which interventions work best under what conditions, and how do we know we got it right?

Buzzword  
Alert

# Anticipated outputs and ongoing engagement

- Workshop findings briefing
- Peer-reviewed paper
- Community of research and practice for collaboration opportunities