# Plan Integration for Resilience Scorecard<sup>™</sup> (PIRS<sup>™</sup>) for Heat



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# **7** Principles of Urban Heat Resilience Planning

- 1. Setting clear urban heat planning goals and associated metrics for success
- 2. Building a comprehensive "fact base" of information on heat risks
- **3.** Developing a diverse portfolio of heat mitigation and management strategies
- 4. Managing uncertainty
- 5. Coordination across planning efforts
- 6. Inclusive participation in planning processes
- 7. Effective implementation, monitoring, and evaluation



## **The Network of Plans**

- Collection of community plans that shape the built environment (Berke et al., 2006)
- Heat addressed in different plan types (Meerow & Keith, 2022; Turner et al., 2022)
- These plans are rarely coordinated (Berke et al., 2019; Woodruff et al., 2022)



Keith & Meerow. 2022. PAS Report 600: Planning for Urban Heat Resilience. APA. tinyurl.com/urbanheatresilience

## Plan Integration for Resilience Scorecard<sup>™</sup> (PIRS<sup>™</sup>)

Designated the plan integration tool of choice by American Planning Association (APA) & U.S. FEMA, originally developed for flood hazards (Malecha et al., 2019)

- Identify inconsistencies across network of plans
- Systematically evaluate current hazard planning strategies
- Compare combined effect of those strategies spatially against hazard and vulnerability



Plan Integration for Resilience Scorecard GUIDEBOOK

Spatially evaluating networks of plans to reduce hazard vulnerability

Malecha et al. 2019. Plan Integration for Resilience Scorecard Guidebook (Version 2.0.). Texas A&M University. mitigationguide.org

#### **Plan Integration for Resilience Scorecard™ (PIRS™) for Heat**

**Project Team:** Ladd Keith, UArizona (PI); Sara Meerow, ASU (Co-PI), Joseph DeAngelis, APA (Co-PI), Philip Berke, UNC Chapel Hill (Advisor)

**Funding:** U.S. NOAA/NIHHIS Extreme Heat Risk Initiative

#### **Research objectives**

- Adapt the original PIRS<sup>™</sup> methodology for urban heat mitigation
- Pilot PIRS<sup>™</sup> for Heat with six partner cities of Baltimore, Boston, Ft. Lauderdale, Houston, and Seattle
- PIRS<sup>™</sup> for Heat Guidebook



Plan Integration for Resilience Scorecard™ (PIRS™) for Heat

Spatially evaluating networks of plans to mitigate heat



#### Policy tasks: Assemble the network of plans

Plan Name	Year Adopted	Scale	Plan Category	Number of policies
Imagine Boston 2030	2017	City	Comprehensive	60
Resilient Boston	2017	City	Resilience	8
Climate Action Plan 2019 Update	2019	City	Climate	22
2021 Natural Hazard Mitigation Plan Update	2021	City	Hazard	16

#### Policy tasks: Generate lists of applicable policies

- Policies here are specific land use planning-related actions that achieve goals (e.g., regulations, programs, designs)
- Two graduate student coders for improved intercoder reliability
- To be included in the analysis, the policy must pass the Three-Point Test

#### Policy tasks: Three-point test

To be included in the analysis, a policy must:

1. Potentially reduce or increase vulnerability to heat *"Invest in an active transportation corridor,* 

*including safer crosswalks and more walkable and bikeable* **<u>green space</u>** *along Columbia Road.*"

– Imagine Boston, page 165

#### Policy tasks: Three-point test

To be included in the analysis, a policy must:

- 1. Potentially reduce or increase vulnerability to heat
- Contain at least one mappable, place-specific term (could be the whole city)

"Invest in an active transportation corridor, including safer crosswalks and more walkable and bikeable green space **along Columbia Road**."

– Imagine Boston, page 165

#### Policy tasks: Three-point test

To be included in the analysis, a policy must:

- 1. Potentially reduce or increase vulnerability to heat
- 2. Contain at least one mappable, place-specific term (could be the whole city)
- 3. Contain a recognizable policy tool, or a form of government intervention to achieve specific objectives and outcomes

"Invest in an active transportation corridor, including safer crosswalks and more walkable and bikeable green space along Columbia Road."

– Imagine Boston, page 165

#### Land Use Analysis and Permitting Process

- Land suitability
- Site review
- Design/construction
   guidelines/requirements

#### **Capital Improvements**

- Urban forestry
- Green stormwater
   infrastructure
- Parks
- Transit infrastructure
- Transportation infrastructure
- Weatherization
- Shade structures
- Green roofs
- Cool roofs
- Water features

# **Policy Tool Categories**

#### **Development Regulations**

- Permitted land use
- Density of land use
- Subdivision regulations
- Zoning overlays
- Setbacks or buffer zones
- Cluster development
- •

#### Land Acquisition

- Acquire land and property
- Open space or easement requirements/purchase
- Unknown
- Density Transfer Provisions
- Transfer/purchase of development rights

# Financial Incentives and Penalties

- Density bonuses
- Tax abatement
- Impact/special study/protection fees

#### **Public Facilities**

- Siting
- Sizing/capacity

# Post Disaster Reconstruction Decisions

- Development moratorium
- Post-disaster land use change
- Post-disaster capital improvements

#### Unknown

#### **Boston: Policy tool categories**

Policy Tool Category	Number of Policies
Capital Improvements	74
Land Use Analysis and Permitting Process	16
Development Regulations	14
Land Acquisition	2
Density Transfer Provisions	0
Financial Incentives and Penalties	0
Public Facilities	0
Post Disaster Reconstruction Decisions	0

# Heat mitigation categories

#### Land Use

- Urban development
   patterns
- Roadways and parking lots
- Ventilation corridors
- Land conservation

#### **Urban Design**

- Street and building orientation
- Building shape and massing
- Shade structures
- Cool pavements

#### **Urban Greening**

- Urban forestry
- Vegetated parks and open spaces
- Green stormwater infrastructure
- Green walls and roofs
- Water features

#### Waste Heat

- Building energy efficiency
- Cool roofs and walls
- Transportation



#### **Boston: Heat mitigation strategy categories**

Heat Mitigation Strategy Category	Number of Policies
Land use	35
Urban design	2
Urban greening	44
Waste heat	55

#### Policy scoring

Policies scored based on research team consensus:

- +1 (likely decreases urban heat)
- 0 (likely neutral effect)
- -1 (likely increases urban heat)
- Unknown (unknown, but likely impact on urban heat)

#### **Boston: Policy scores**

Score	# of Policies
+1	66
0	6
-1	1
Unknown	37

#### Mapping tasks

- Determine planning districts
  - Census tracts
- Map the policies
  - Coded geospatial indicators (place-specific term) for each policy

#### Creating the PIRS<sup>™</sup> for Heat scorecard map

- For each policy, assign the score to relevant census tracts
- Add up policy scores for each census tract
- Map net score for each census tract

## Analyzing physical and social vulnerability

- Assess against physical urban heat hazard
  - Utilized mean land surface temperature
- Assess against social vulnerability
  - Utilized CDC Social Vulnerability Index (available nation-wide and requested by community partners)

#### **PIRS<sup>™</sup> for Heat: Boston Scorecard Analysis**



Resilience through planning

Stories

# Plan Evaluation for Heat Resilience: 3 complementary approaches for analyzing how plan networks address heat

#### PIRS<sup>™</sup> for Heat

Assess land use policies in plans, their cumulative impact on heat, and spatial distribution



#### Plan Quality

Assess whether plans contain characteristics of high-quality plans & different types of heat strategies

Criteria	City of Tempe General Plan 2040	City of Tempe Climate Action Plan 2019	City of Tempe Climate Action Plan Update 2021	Maricopa County Multi- Jurisdictional Hazard Mitigation Plan
Goals	83%	67%	100%	83%
Fact Base	25%	58%	83%	67%
Strategy Identification	40%	40%	40%	60%
Monitoring and Implementation	64%	36%	45%	91%
Coordination	88%	75%	100%	100%
Public Participation	86%	86%	86%	86%
Uncertainty	29%	0%	14%	43%
Overall Plan Quality	59%	52%	67%	76%

#### Plan Crossreferencing

Assess which plans reference other community plans to identify more central & isolated plans



Meerow, Keith, Roy, Trego. 2024, Plan evaluation for heat resilience: Complementary methods to comprehensively assess heat planning in Tempe and Tucson, Arizona. *Environmental Research Letters*, DOI 10.1088/1748-9326/ad5d05

## **U.S. NIHHIS: Center for Heat Resilient Communities**

#### Mission

To protect public health from the dangers of both acute and chronic high-temperature conditions through equity-centered, datainformed, whole-of-government approaches to mitigate and manage heat in diverse communities and heat-exposure settings.

#### Center objectives

- Develop a comprehensive Heat Resilient Communities framework
- Enable and enhance local heat-action in at least 30 communities in the U.S. and beyond
- Recommend actionable strategies for NOAA, NIHHIS, and federal partners to prioritize and coordinate investments in communities.

#### **U.S. NIHHIS: Center for Heat Resilient Communities**

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# Thank you





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