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### MOTIVATION

#### Extreme weather events threaten sustainability, equity, and public health goals

- Many municipalities are prioritizing walking and biking to reduce auto-dependence and GHG emissions
- Heatwaves are occurring more frequently and lasting longer
- Outdoor thermal comfort plays a key role in determining walkability and quality of life
- People who are socially disadvantaged (lower-income and no vehicle access) tend to walk more
- Providing heat-resilient and pedestrian-friendly environments should be a planning priority

### RESEARCH OBJECTIVES

#### How does heat affect pedestrian route choice behavior and accessibility?

- Estimate how street attributes and urban microclimate affect pedestrian route choice preferences
- Operationalize effects as "willingness to walk" measures
- Distinguish built environment effects from heat effect on pedestrian accessibility to public transit

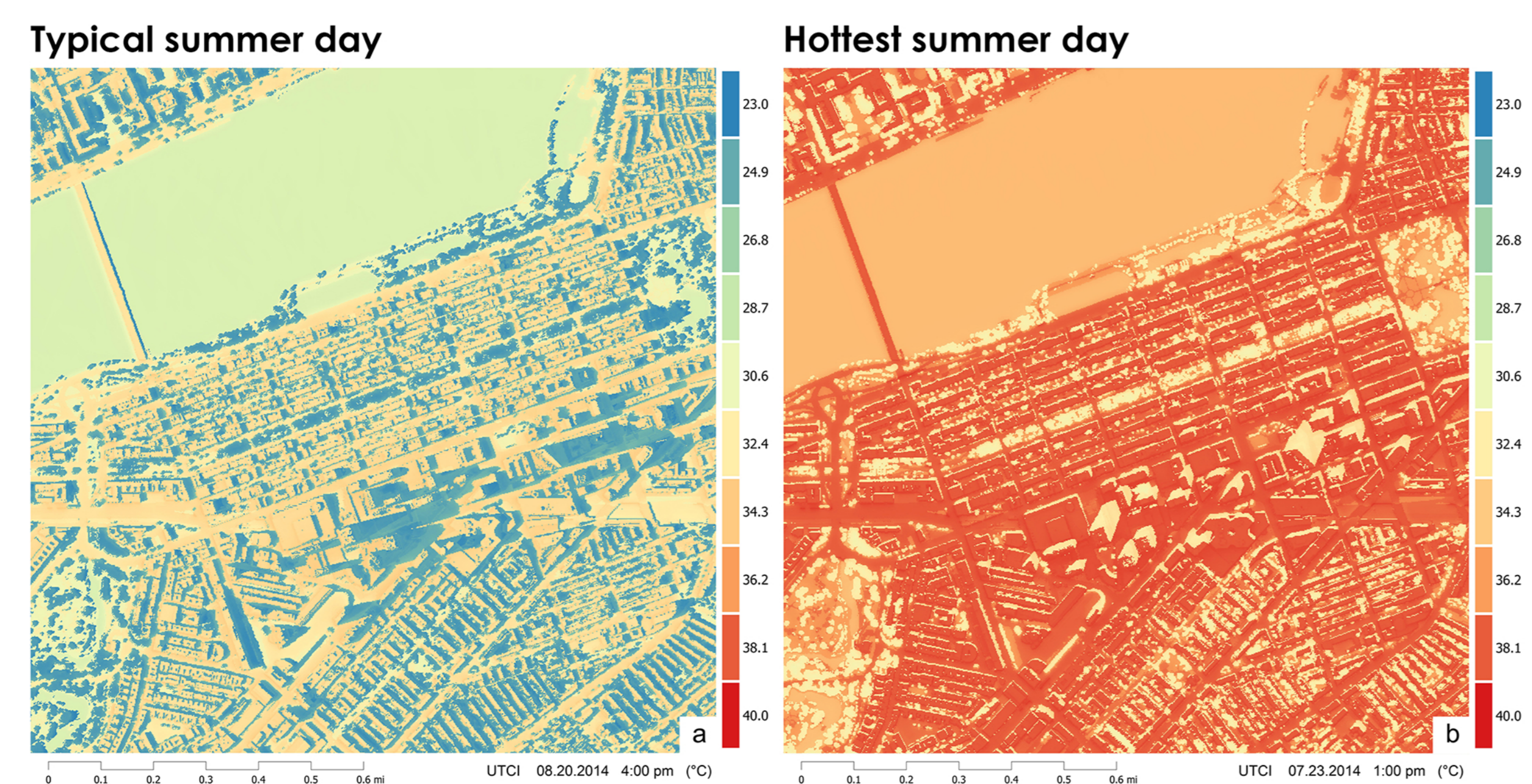
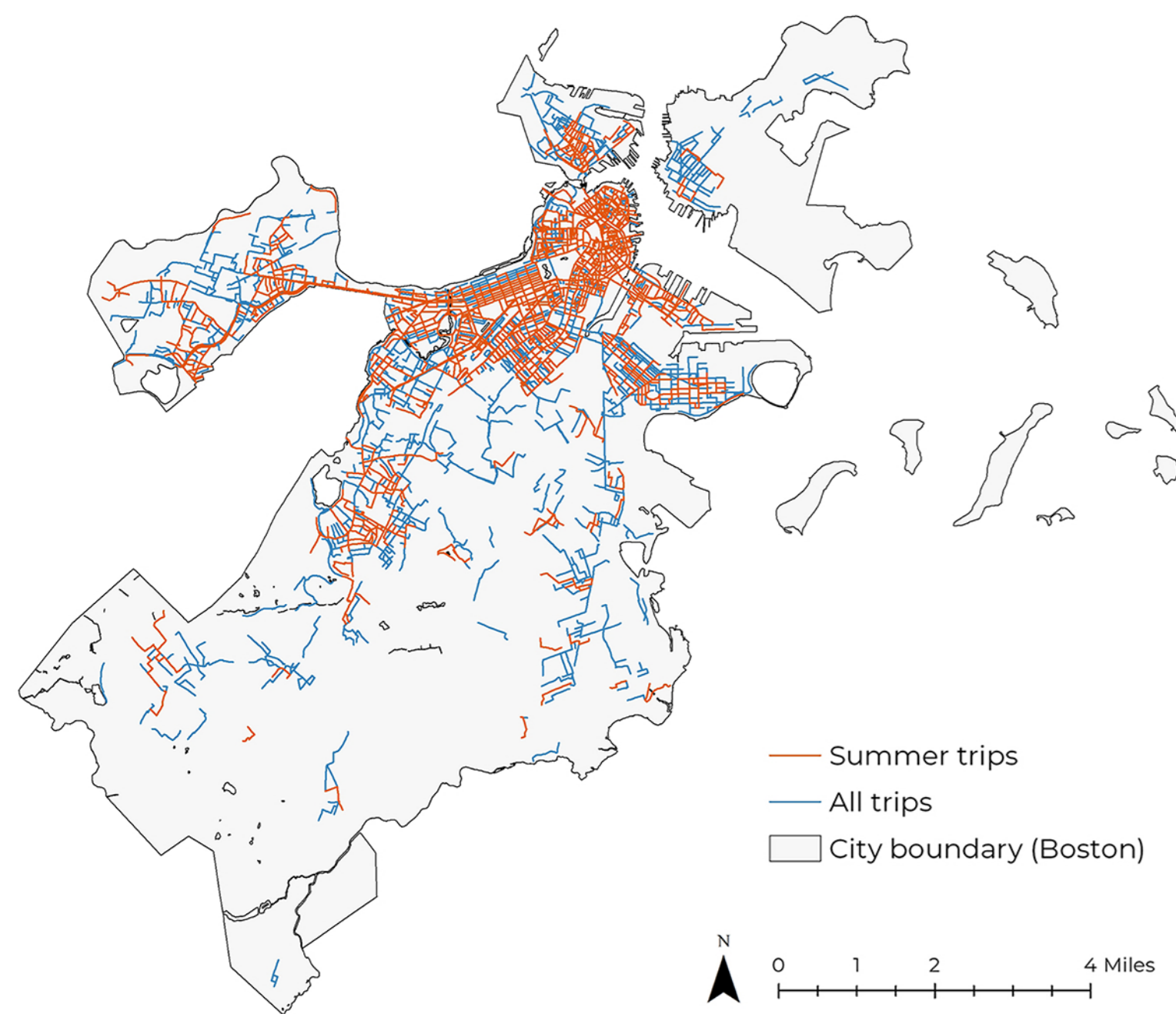
### RESEARCH METHODS

#### Pedestrian Trajectory Data

- Walking GPS traces (May 2014 – 2015)
- Raw GPS traces map-matched to street center-lines using Hidden Markov Map-Matching (HMM)
- Summer trips (N = 2,165) selected between June 7 and October 17

#### Heat Stress Data

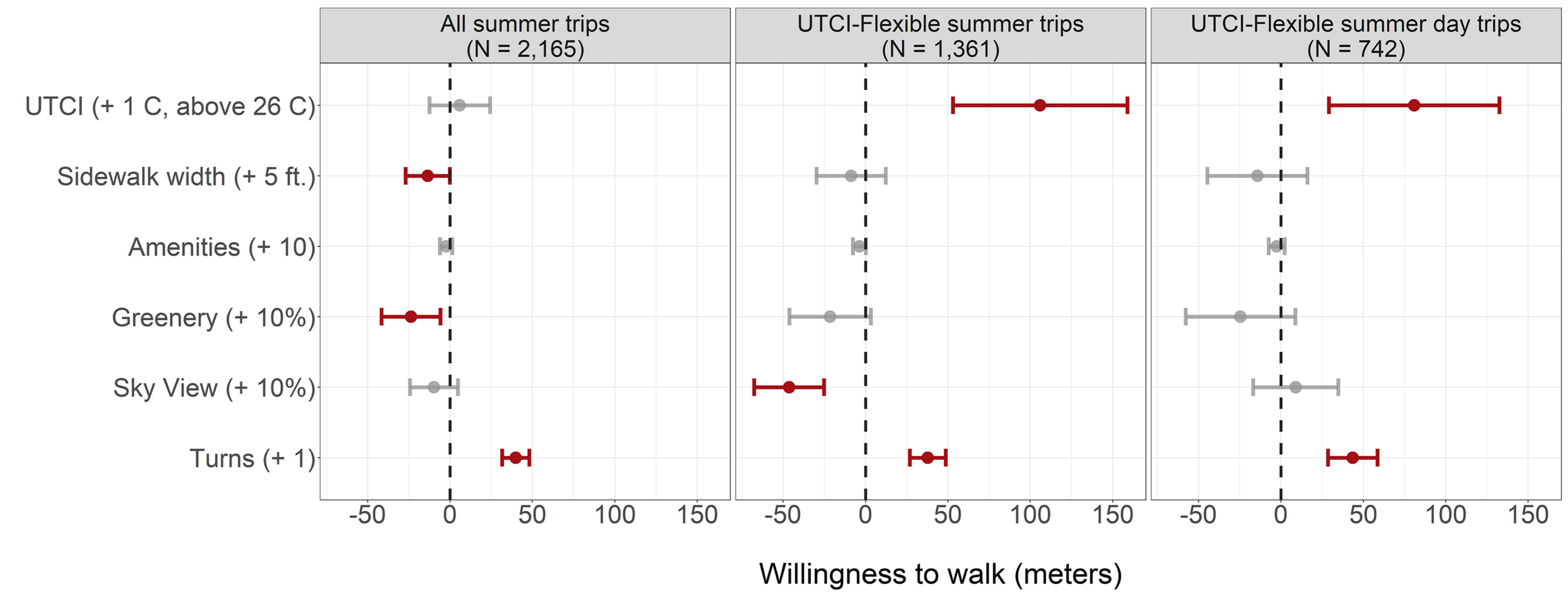
- Universal Thermal Climate Index (UTCI) =  $f(\text{Air temperature, Mean radiant temperature, Wind speed, Humidity})$
- No thermal stress:  $+9\text{ }^\circ\text{C} < \text{UTCI} < +26\text{ }^\circ\text{C}$
- Thermal stress:  $\text{UTCI} > +26\text{ }^\circ\text{C}$



#### Modeling Framework

- Constructed choice set of up to 3 alternatives for each route using constrained enumeration approach
- Independent variables comprise built environment attributes and UTCI
- Used Path Size Logit (PSL) model that accounts for overlap between alternatives through the PS factor

### HOW DOES HEAT AFFECT PEDESTRIAN ROUTE CHOICE?

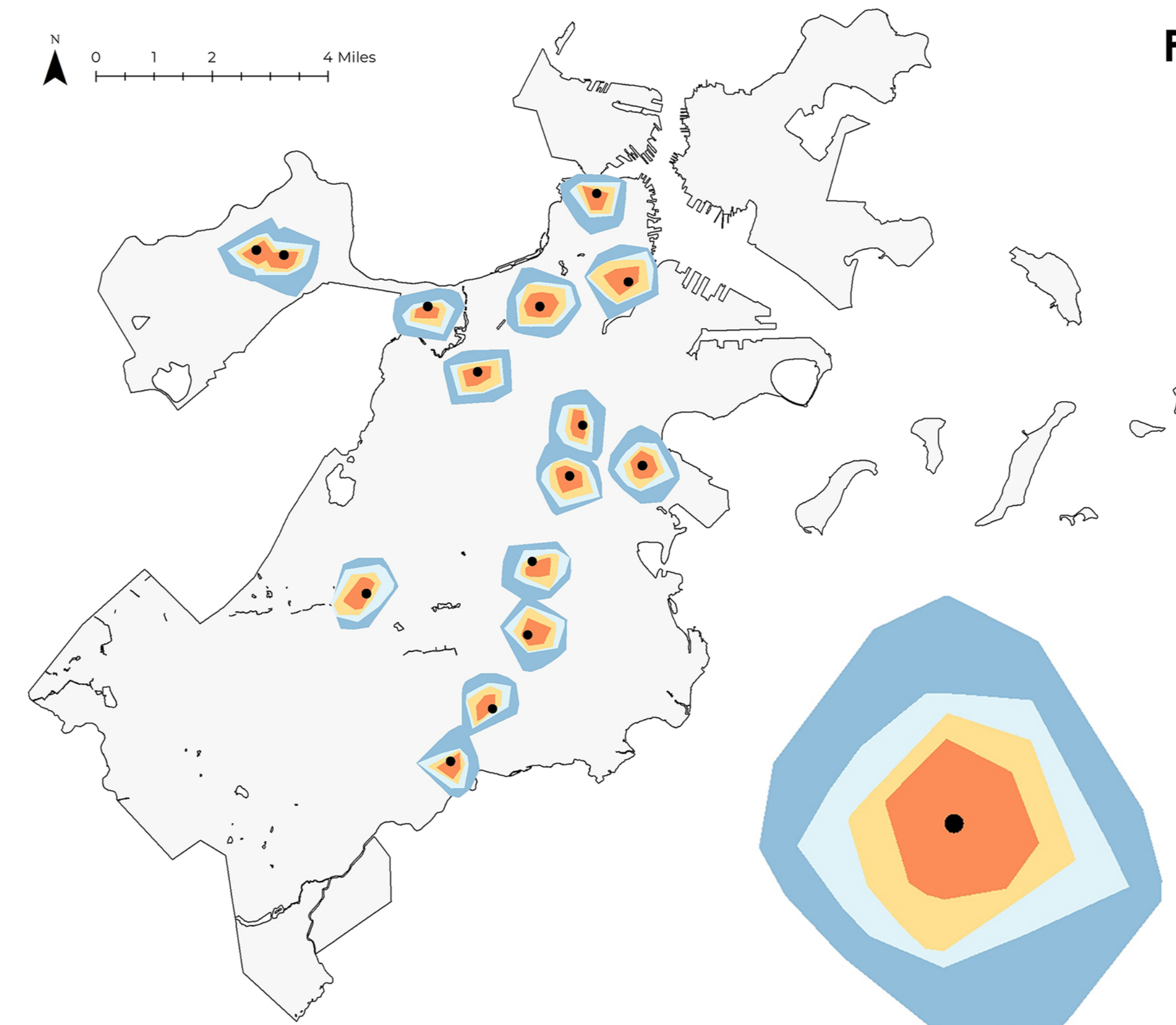


#### Findings

- Consideration of heat stress does not feature in route choice decision-making for all pedestrian trips, even during the summer
- When a cooler feasible alternative is available, pedestrians prefer choosing that route (all else equal)
- Each degree increase in heat stress is perceived as 81 m of additional walking on average

Increase in UTCI (°C)	UTCI range (°C)	WTW effect (m)
	> 26	80.8
+1	26 C to 29	21.7
	29 C to 32	44.0
	> 32	64.3

### HOW DOES HEAT AFFECT PEDESTRIAN ACCESSIBILITY?



#### Public transit accessibility

- Transit station catchment area computed using network distance (800 m)
- Objective walkshed
- Perceived walkshed
  - Only built environment effects
  - Combining built environment & heat stress effects

Geometric walkshed	100%
Perceived (w/o UTCI)	47%
Perceived (w/ UTCI, typical day)	28%
Perceived (w/ UTCI, hottest day)	12%