Urban Heat Islands and Climate Change: Planning for Extreme Heat in Cities

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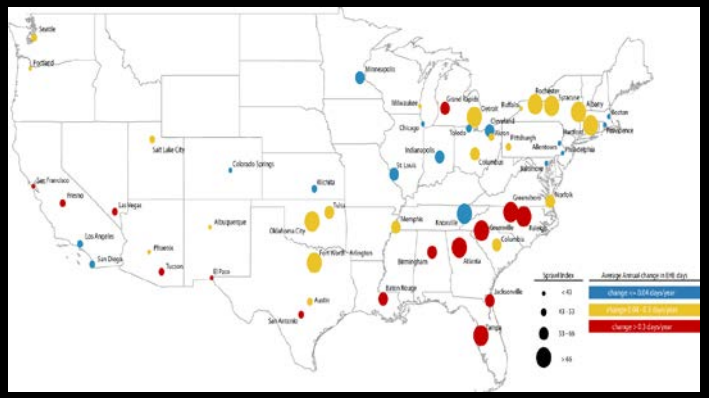
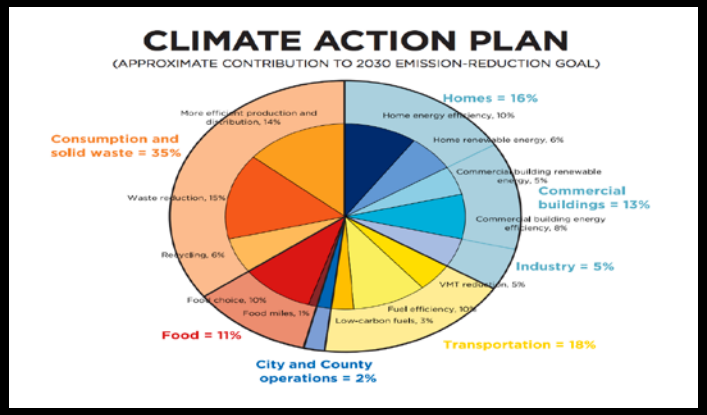
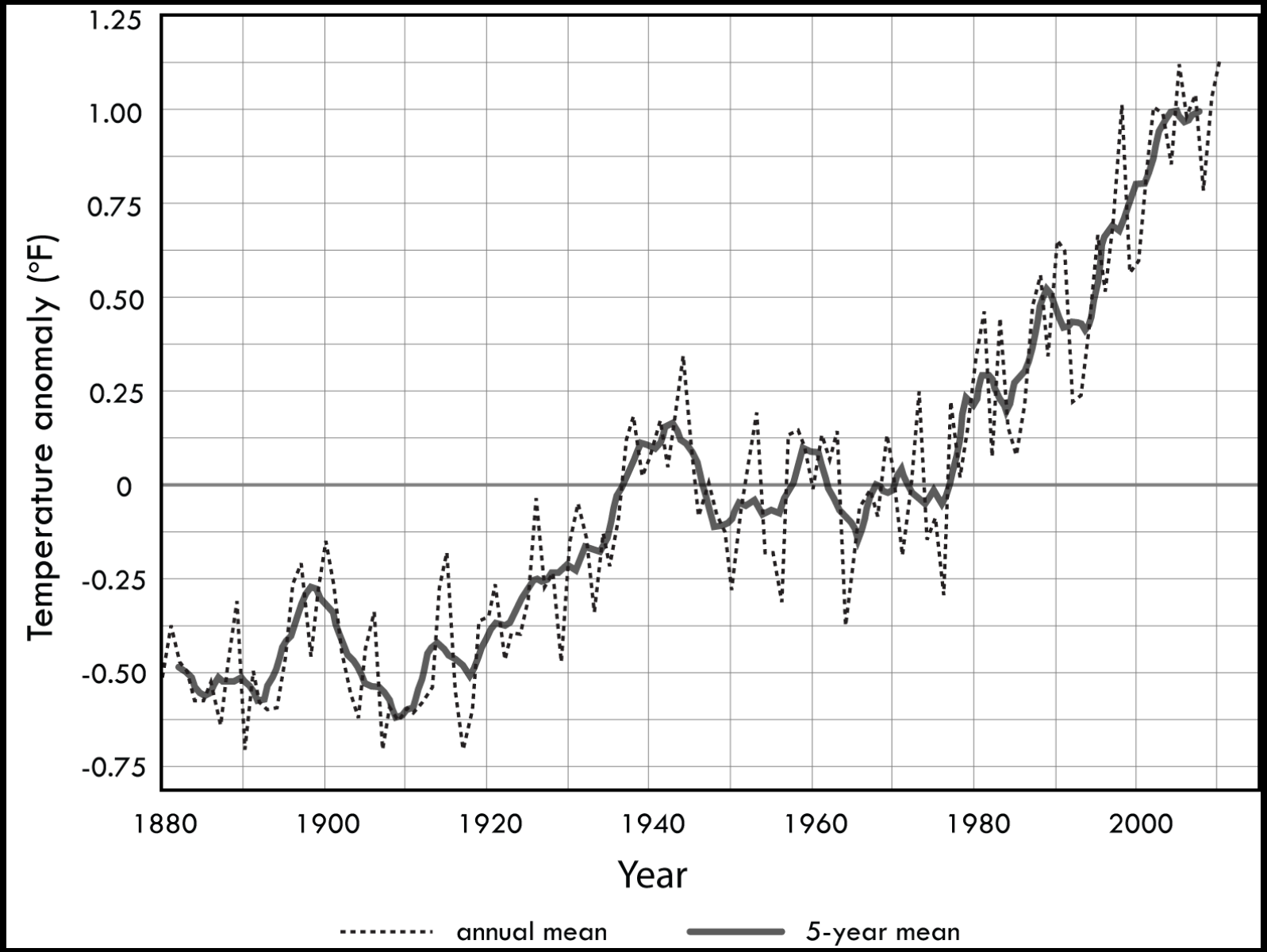


Overview

- Global vs. local climate change
- Trends in extreme heat
- Health & infrastructure impacts
- Urban climate change planning



Global temperature anomaly



Goddard Institute for Space Studies, NASA

Drivers of the urban heat island

1. Loss of natural vegetation

Thepolisblog.com

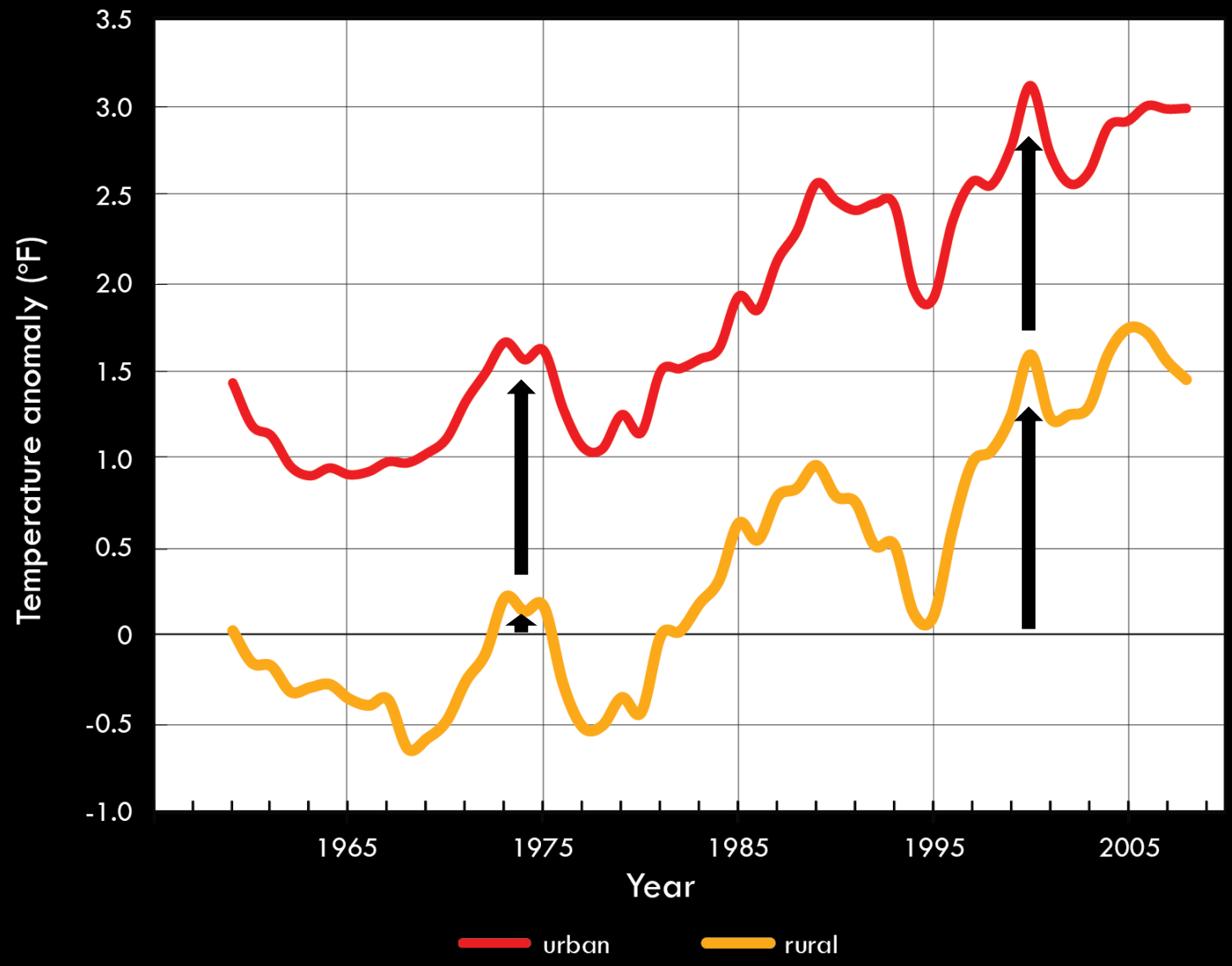
2. Replacement of vegetation with impervious materials

Kingsley 2009

3. Waste heat from vehicles, industry, building air conditioning

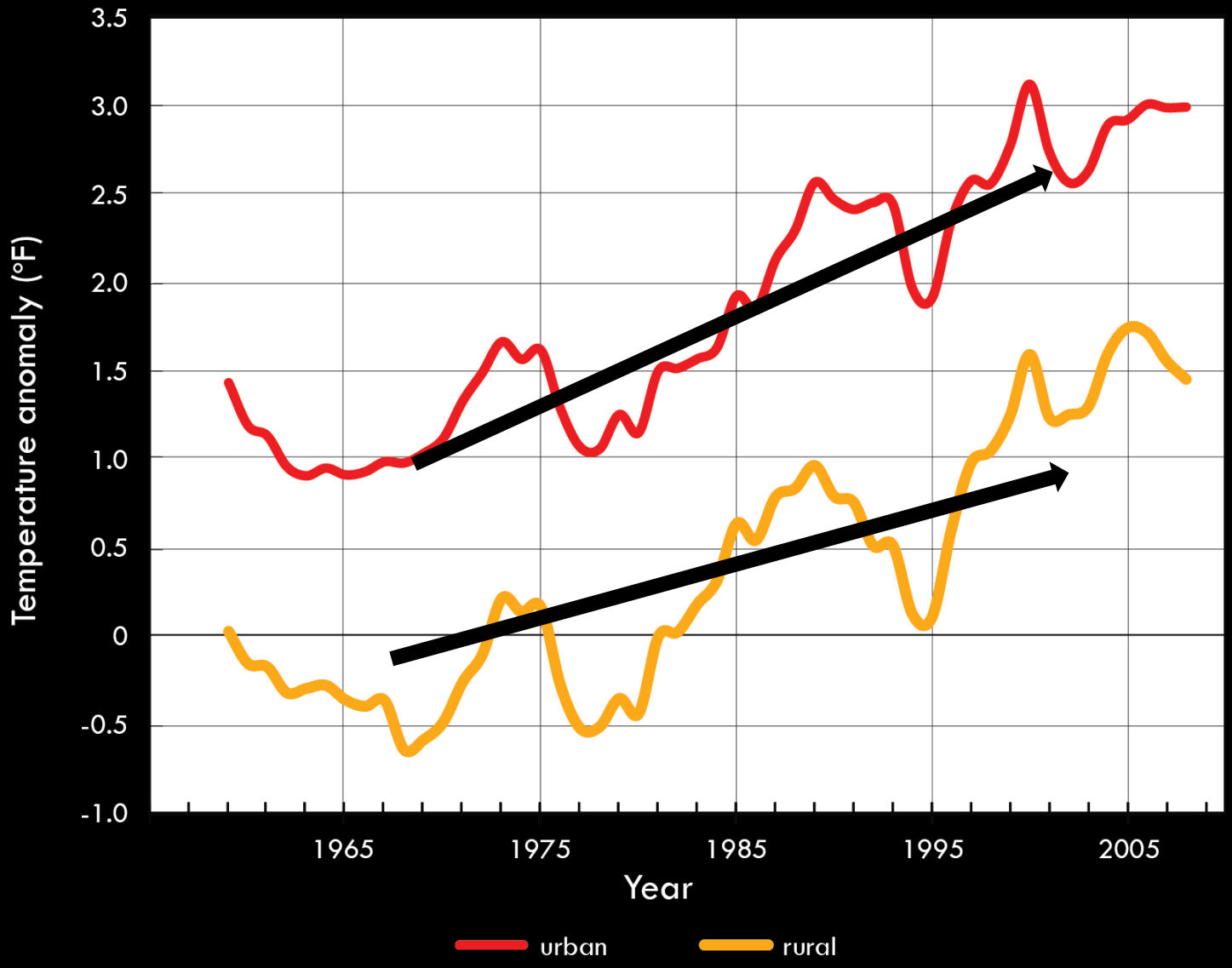
Nicholes 2009

Heat island effect > greenhouse effect

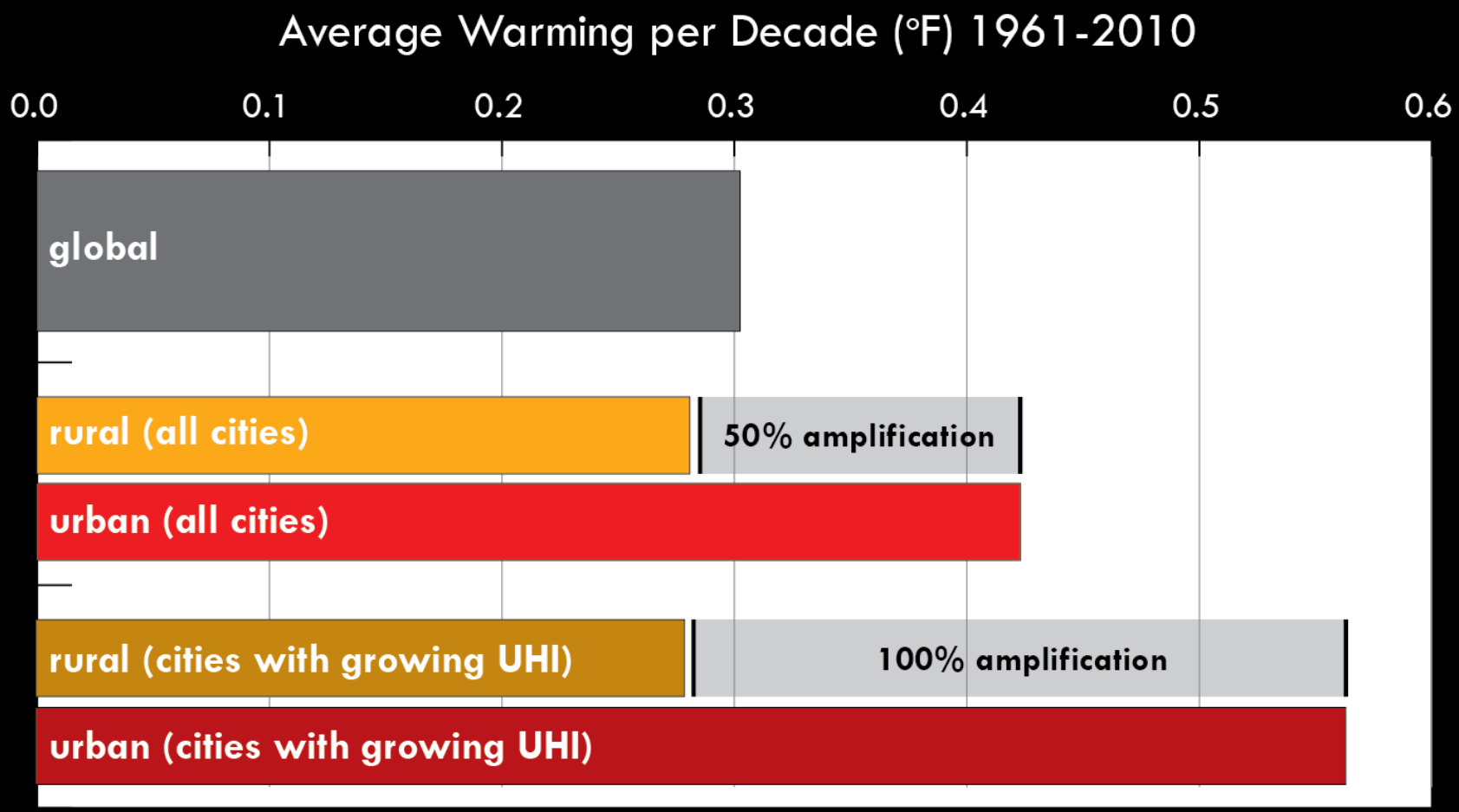


Most of the temperature anomaly in cities is attributable to heat island effect

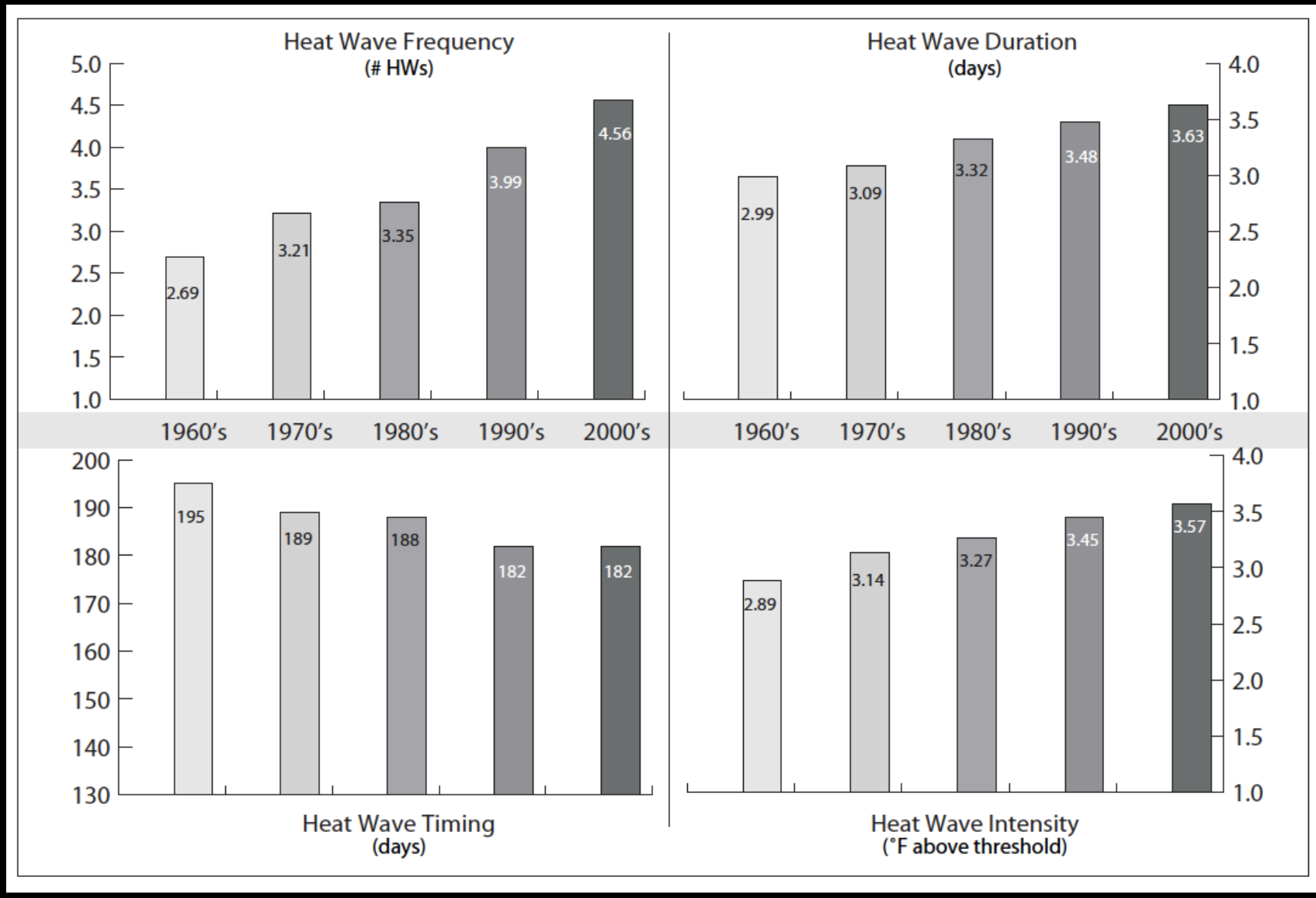
Heat island effect > greenhouse effect



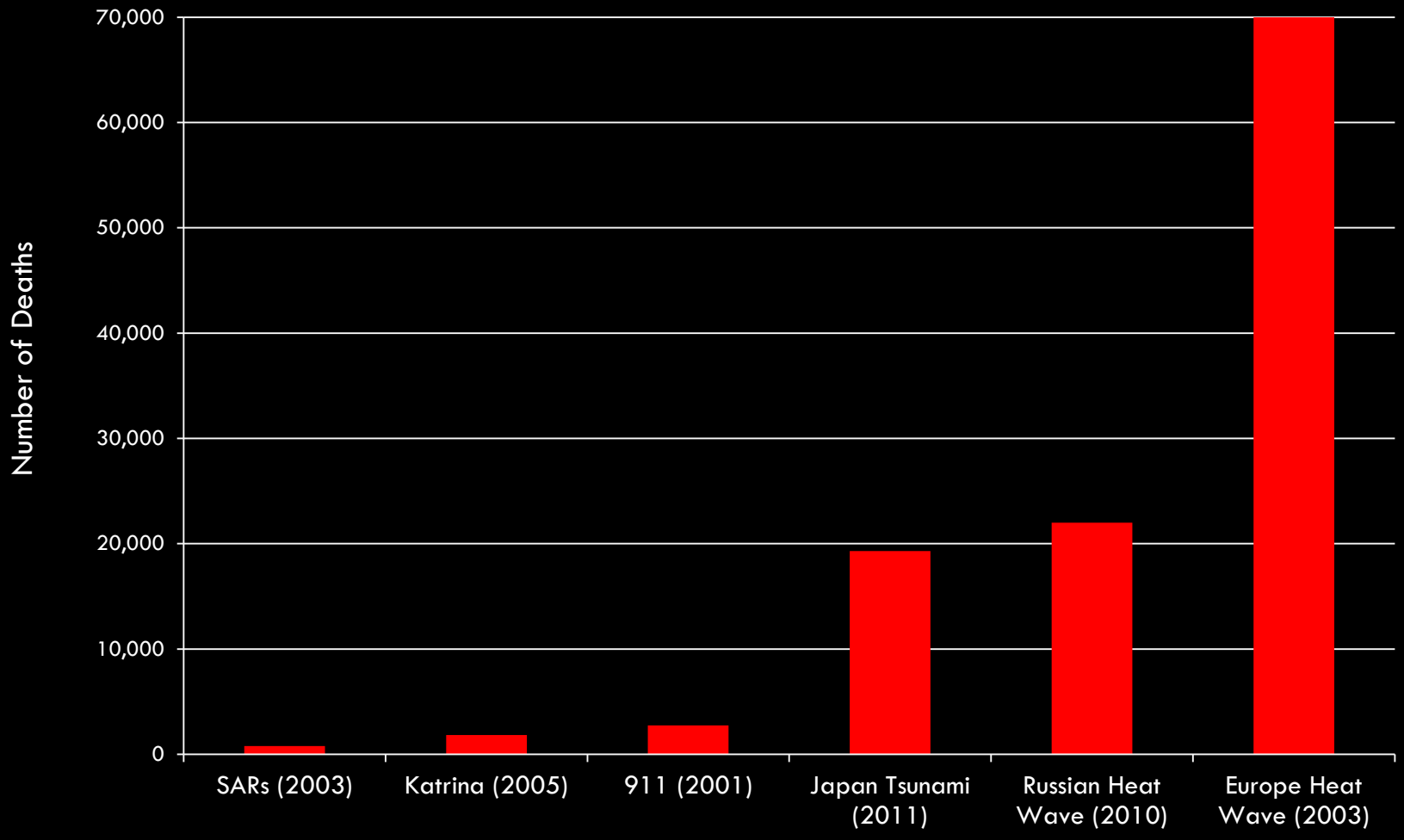
Urban areas are warming more rapidly over time than rural areas

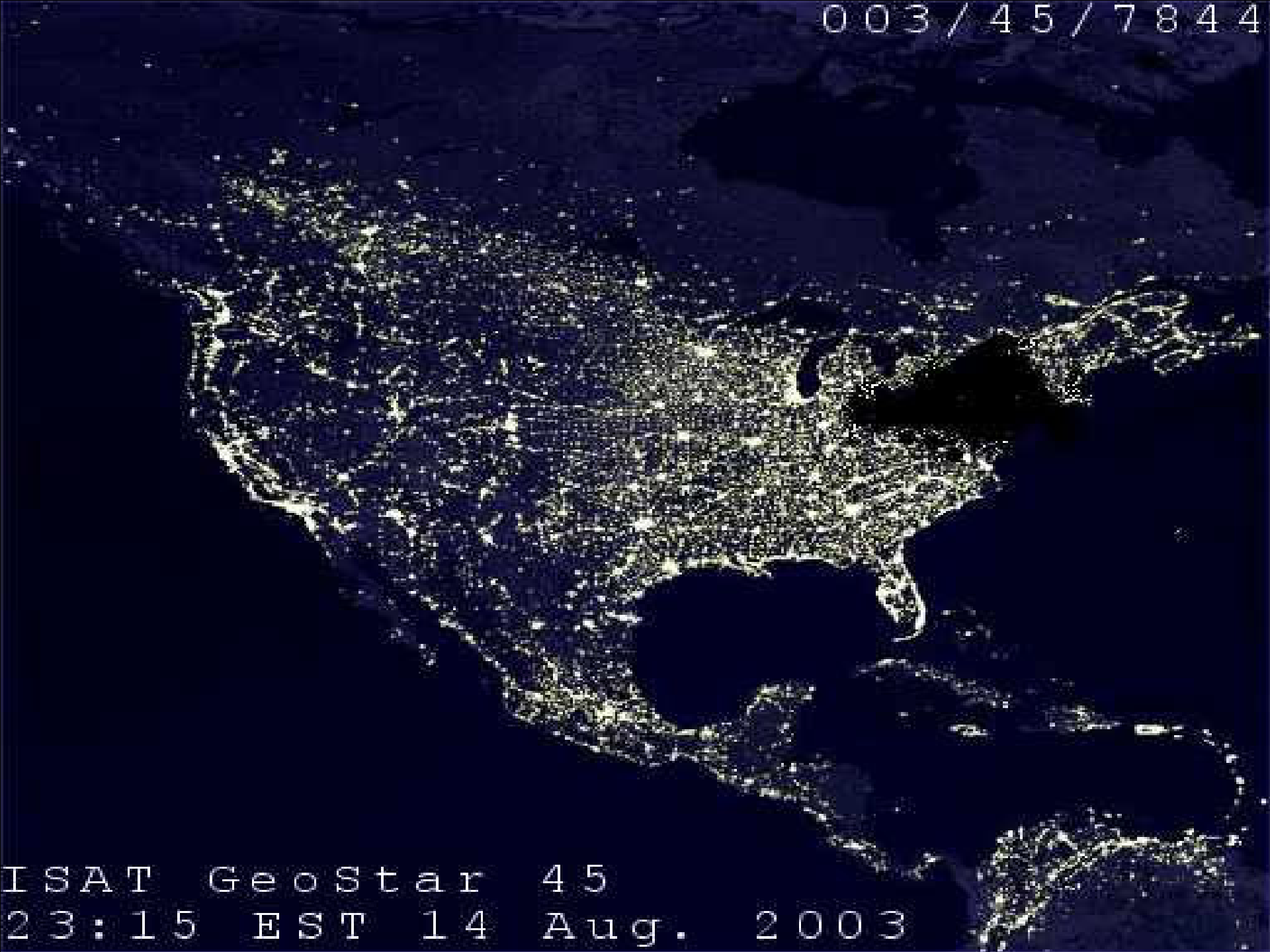

Average Warming per Decade (°F) 1961-2010
0.0
0.1
0.2
0.3
0.4
0.5
0.6
global
rural (all cities)
50% amplification
urban (all cities)
rural (cities with growing UHI)
100% amplification
urban (cities with growing UHI)

Changing heat wave characteristics

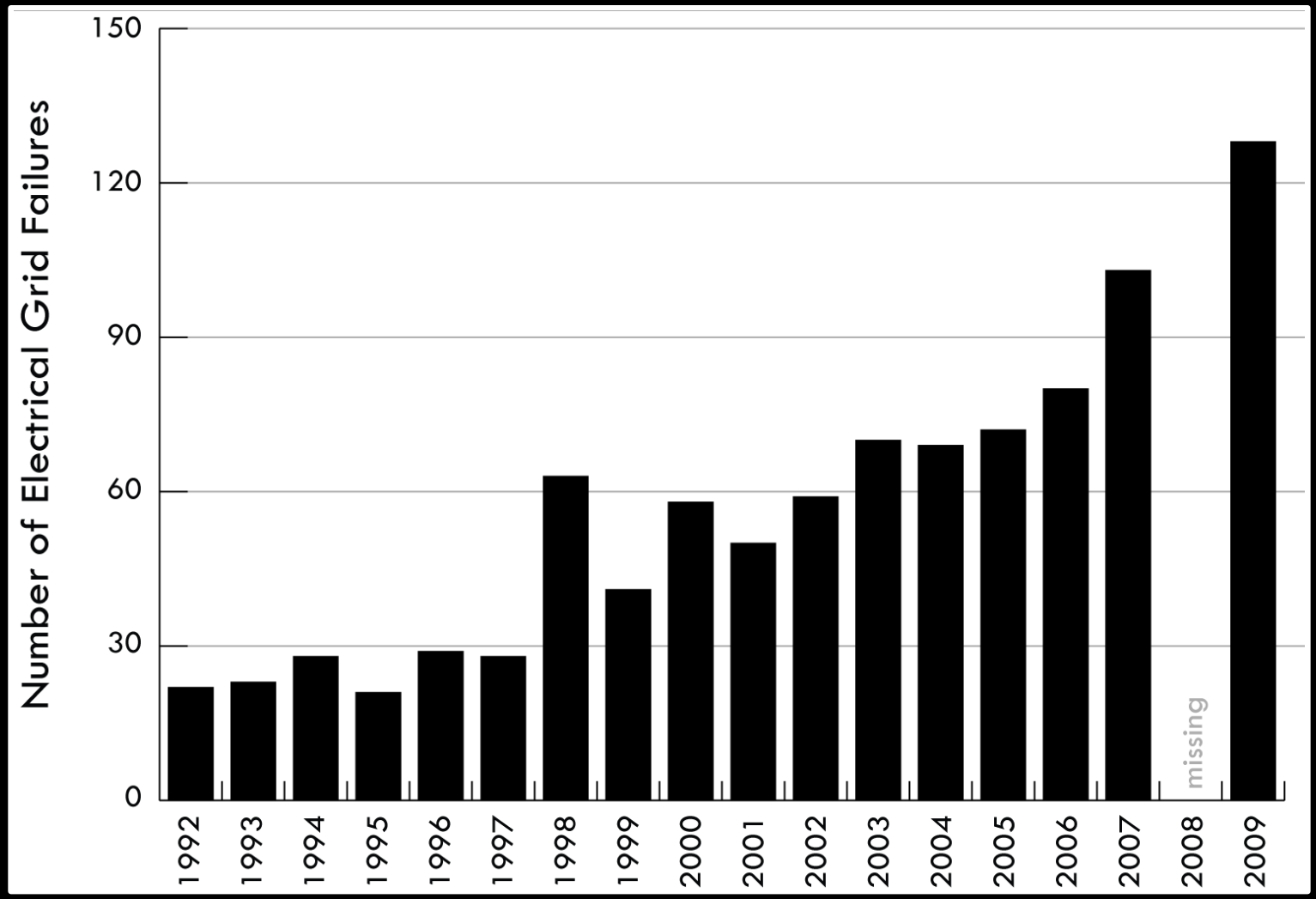


Recent heat wave mortality




003/45/7844
ISAT GeoStar 45
23:15 EST 14 Aug. 2003

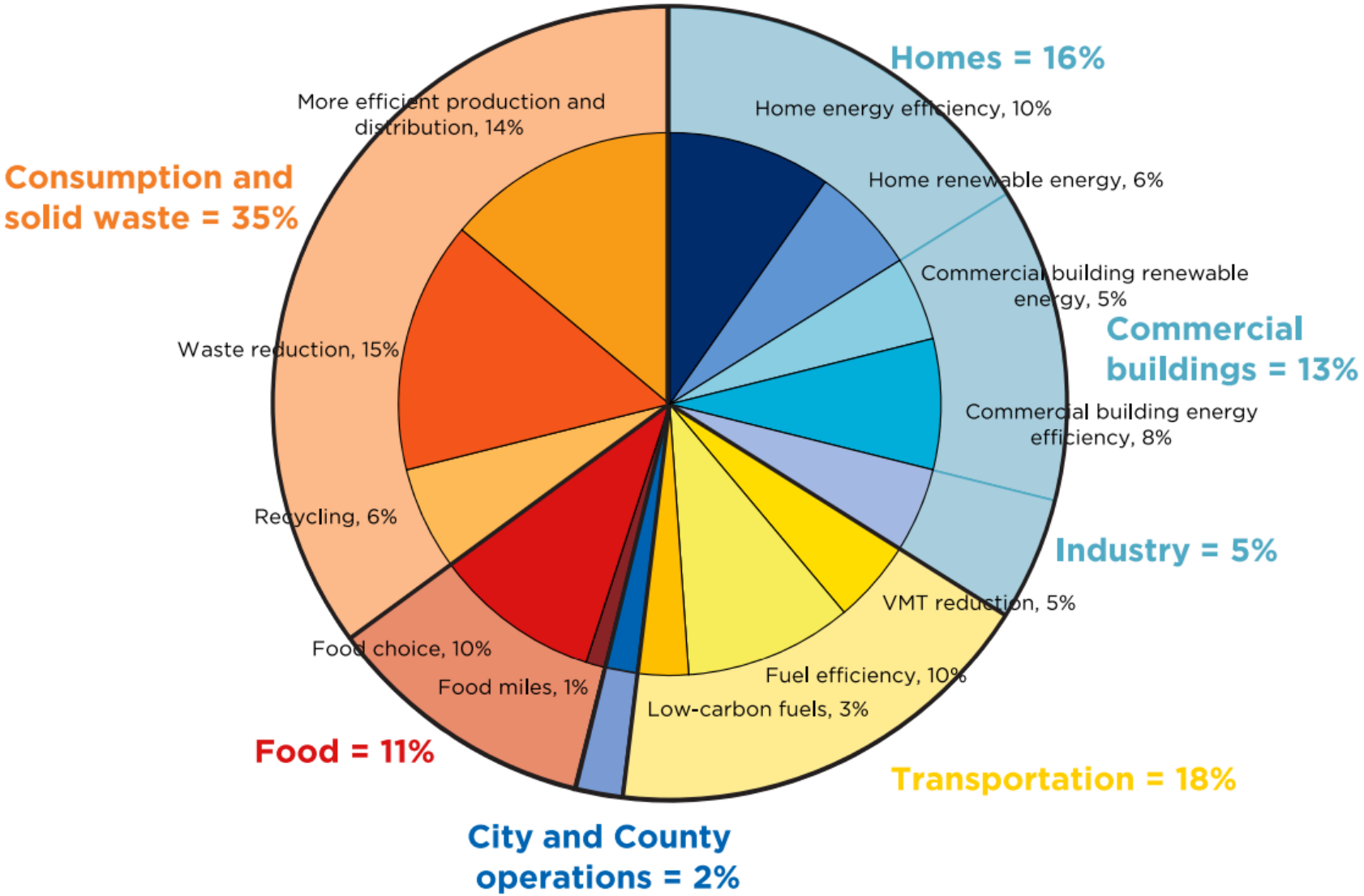
Trends in electrical system failures



NERC, 2010

CLIMATE ACTION PLAN

(APPROXIMATE CONTRIBUTION TO 2030 EMISSION-REDUCTION GOAL)

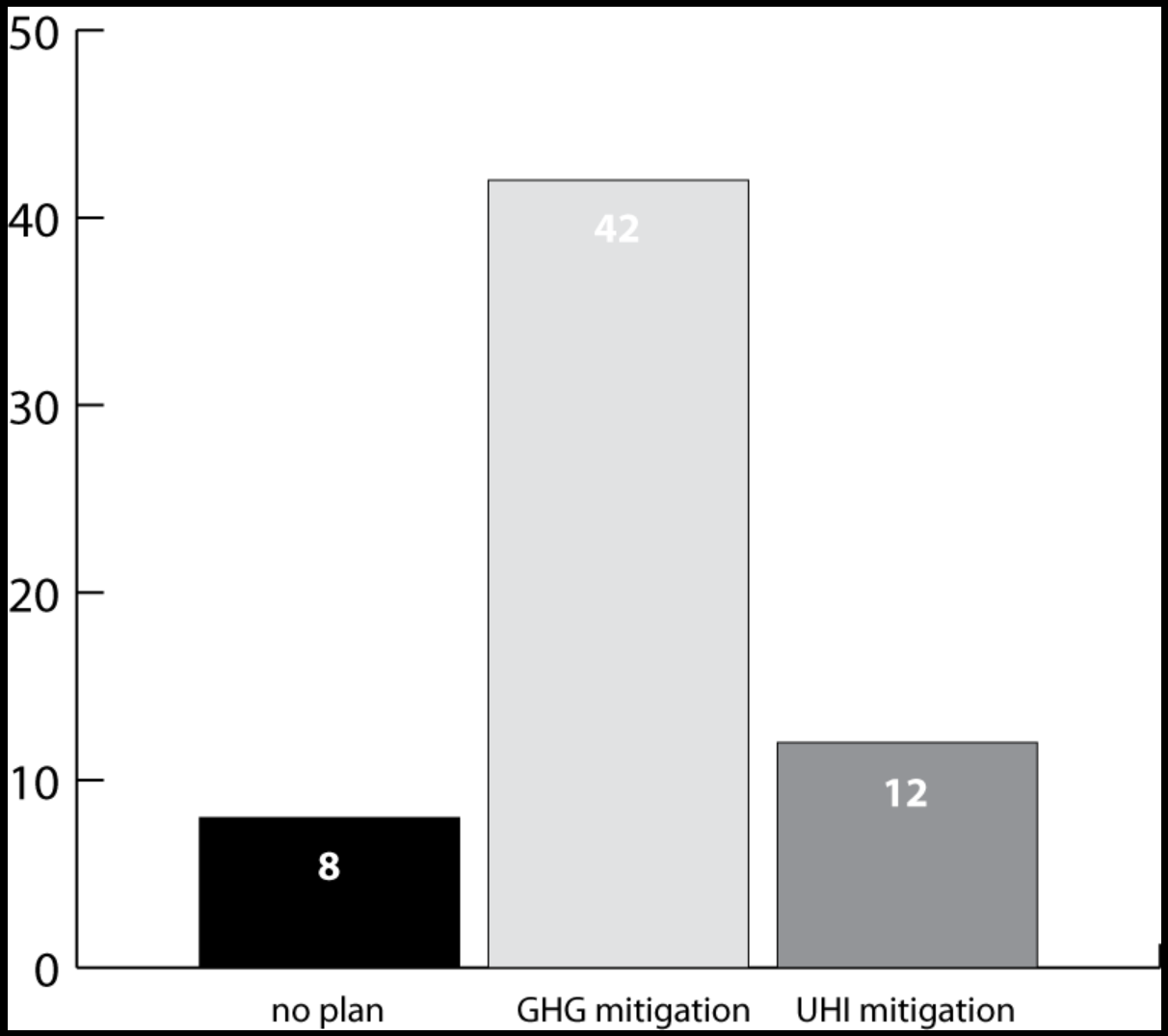


Portland, OR Climate Action Plan, 2009

What actions are cities taking to counteract rising levels of extreme heat?

Management Strategy	Common Components	Category
Albedo Enhancement	Installation of highly reflective roofing or paving materials	Albedo Enhancement
Building Energy Efficiency	Minimum insulation values in building codes; efficient light fixtures and appliances	Energy Efficiency
Green Roofs	Installation of vegetative roofing materials	Vegetation Enhancement
Regional Forest Management	Requirements for the protection of regional forest cover in proximity to urbanized areas	Vegetation Enhancement
Renewable Energy Programs	Requirements for wind, solar, geothermal, or other renewable energy sources	Energy Efficiency
Urban Tree Management	Municipal tree planting programs; requirements for tree protection ordinances	Vegetation Enhancement
Vehicle Energy Efficiency	Minimum fuel efficiency standards for municipal fleets; acquisition of alternatively fueled vehicles	Energy Efficiency
Vehicle Travel Demand Management	Ride sharing programs; transit investments; provision of pedestrian and cycling facilities	Energy Efficiency

Climate management strategy by type in climate action plans

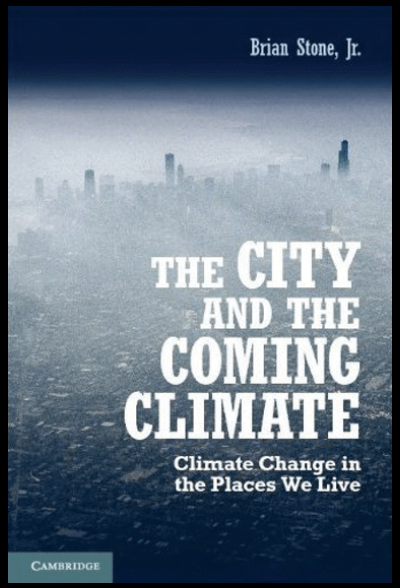


Key conclusions for cities

- Pace of temperature change at the scale of large cities is most often double that of the planet
- All measurable characteristics of urban heat waves are increasing rapidly; heat waves are responsible for more weather-related deaths in the US than all other forms of extreme weather combined
- Most climate action plans will yield no measurable benefits for extreme heat at the urban scale – these plans should be broadened to include aggressive heat island management

Resources from the Urban Climate Lab

The city and the coming climate: Climate change in the places we live (available from Amazon.com)



Managing climate change in cities: Will climate action plans work? (www.urbanclimate.gatech.edu)

Urban form and extreme heat events: Are sprawling cities more vulnerable to climate change than compact cities? (www.urbanclimate.gatech.edu)

Urban heat and air pollution: An emerging role for planners in the climate change debate (www.urbanclimate.gatech.edu)