California Heat Assessment Tool (CHAT)

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Goals for the Decision Support Tool

Provide **decision support** for a range of public health practitioners involved in long-term planning.

Data

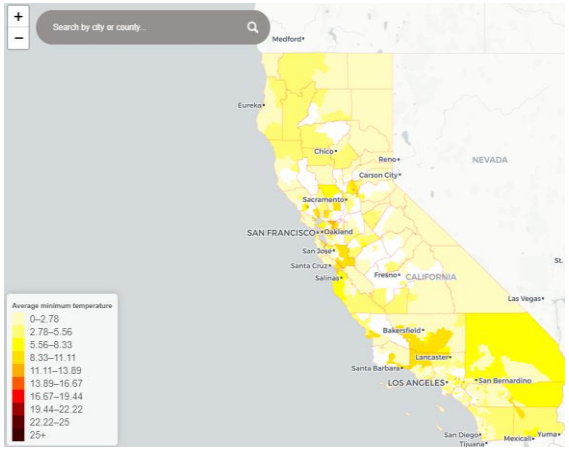
1. Integrate health sensitivity into extreme heat thresholds
   - Rate-response of past heat waves by subpopulation and geography

2. Climate projections
   - Probabilistic estimates by time of year covering frequency, duration, temperature and relative humidity

3. Vulnerability layers:
   - Highlight key equity issues across geographies and easy to understand ratings of combined heat and health vulnerability

Problem Statement

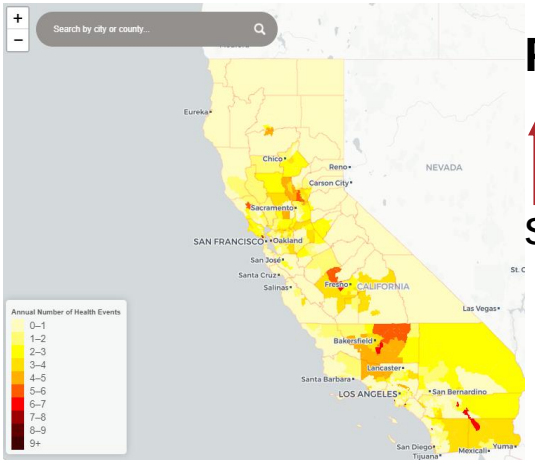
California heat waves are changing, and occurring in places not accustomed to extreme heat



Temp Severity

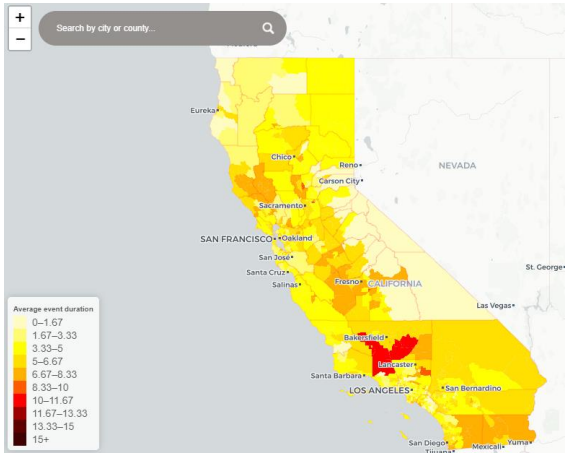
daytime

nighttime



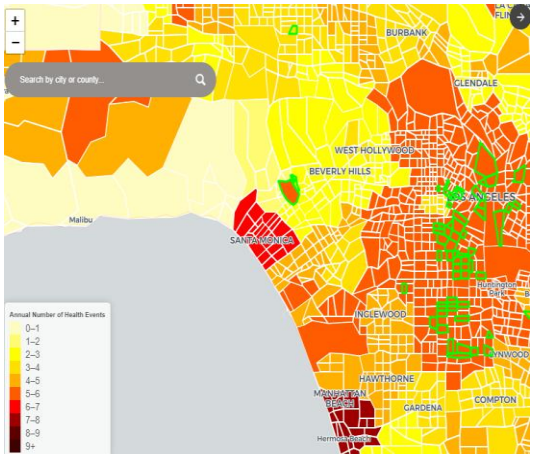
Frequency

Late season



Event Duration

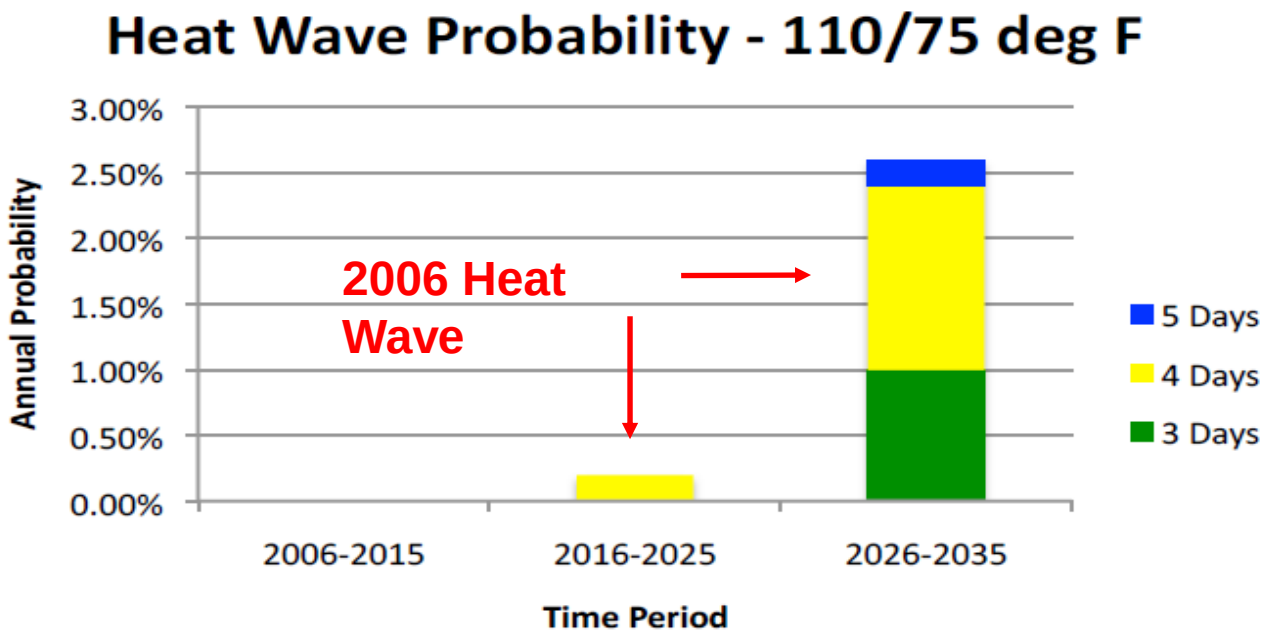
2+ weeks in Central Valley by 2050



Vulnerability

High deltas in poorest areas

Heat Waves & Heat Impacts



Health stressor	Premature death	Hospitalization	ED visits	Outpatient visits	Estimated number of people exposed	
Ozone air pollution	795	4,150	485	365,468	287,803,914	US Ozone Air Pollution, 2000–02
Heat wave	655	1,620	16,166	252,095	35,979,208	California Heat Wave, 2006
Hurricane	144	2,197	2,633	160,387	17,375,259	Florida Hurricane Season, 2004
Infectious disease outbreak	24	204	135	5,767	4,466,068	West Nile Outbreak, Louisiana, 2002
River flooding	2	43	263	3,076	139,918	Red River Flooding, North Dakota, 2009
Wildfires	69	778	1,431	47,605	20,078,194	Southern California Wildfires, 2003
Total	1,689	8,992	21,113	734,398	365,842,561	

1. Argos Analytics, 2014
2. Knowlton *et al.*, 2011

Historical barriers to adaptation

Heat impacts are avoidable yet public health impacts continue to occur

Thresholds for alerts

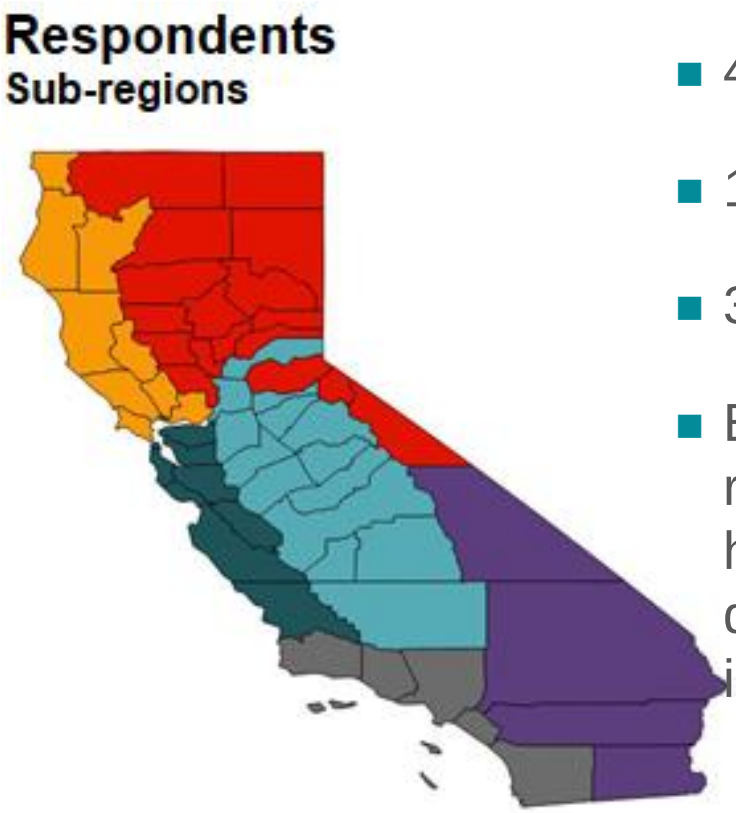
Interventions

- Historically inadequate:
  - NWS issued only six heat alerts from 2000 to 2009 in California, despite evidence showing heat events resulting in negative health outcomes occurred 19 times during this period[1]
- Effectiveness varies by
  - Rural vs. urban
  - Race and age of target population
  - Government resources

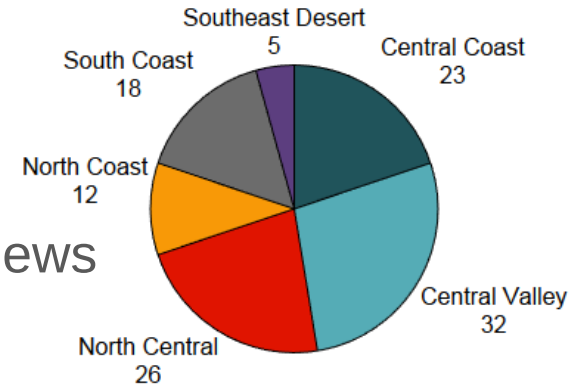
1. Guirguis *et al*., (2014)

Ask the decision makers

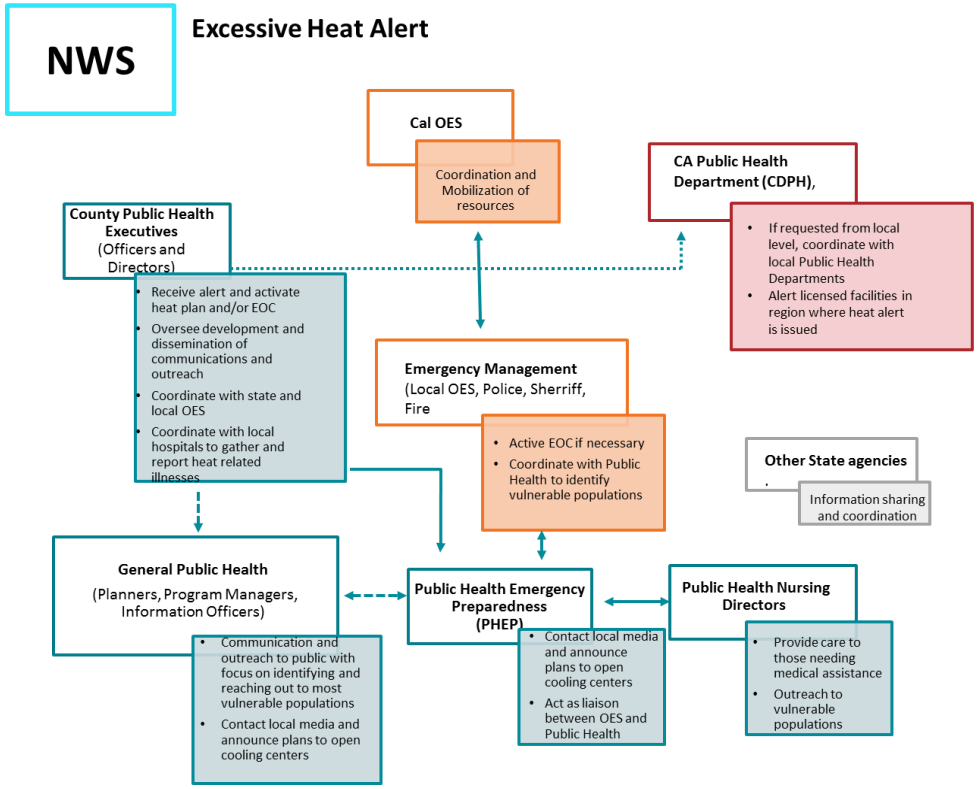
Explore if improved weather/climate forecasts would actually help public health officials adapt to current levels of climate variability



- 43 counties
- 116 surveys
- 30+ phone interviews
- Emergency responders, planners, health officers, directors, nurses, information officers



Roles & Responsibilities



Short-term

- Medical Officers
- Physicians
- Ambulatory care

Long-term

- Health Community Planners
- PH Climate Change Liaisons
- Community Health Specialists
- Emergency Preparedness Planne
- Resilience Officers

Decision mapping – Identify gaps

	Information Needed								
	Climate & Weather			Population			Built Environment		
● = Applicable ○ = Not Applicable Activity & Decisions	Sub/ Seasonal outlooks	Long-term outlooks	Triggers/ thresholds	Access to cooling centers	Vulnerable groups	Vulnerable individuals	Urban heat island	Housing density	Other green design
Heat response in the short-term									
Alert communication & outreach	○	○	●	●	○	●	○	○	○
Inter-agency coordination	○	○	●	●	●	●	○	○	○
Planning for heat in the long-term									
Urban planning	○	●	●	●	●	○	●	●	●
Policy	○	●	●	●	●	○	●	●	●

Decision Mapping – Tier 2

● = Majority response ○ = Minority All Activities & Decisions	Information Needed Vulnerable Populations Medical Conditions	Occupational Conditions	Social & demographic factors	Air quality	Built environment/ UHI	Air conditioning
Importance						
Not important	○	○	○	○	○	○
Somewhat	○	○	○	○	●	○
Moderate	○	○	●	●	○	●
Important	○	○	○	○	○	○
Very important	●	●	○	○	○	○

Methods

Assemble and classify heat wave signatures from over 30 years

Assemble medical data and quantity rate of response over 7 years

Select heat wave signatures and thresholds based on rate of response during 63 different heat wave types

Run 24 downscaled climate models over heat health thresholds out to end of century

Delineated by:

- Decade
- Time of season
- Vulnerable and General cohort
- RCP scenario
- Percentiles

Key Findings

- Susceptible communities:
  - We found that the appropriate heat wave definition for vulnerable subgroups may be up to 6-8 degrees Fahrenheit lower than the general population in some areas.
  - Low-income urban areas projected to experience relatively significant increases in the frequency, duration, and temperature severity of future heat waves when compared to upper income areas*
- Statewide:
  - Climate change appears to be manifesting itself primarily through changes in the character of heat waves, and not just their frequency
  - After applying climate projections to these definitions, which we call Heat-Health Events (HHEs), we found increases in the severity, duration, and shifts in timing of HHEs throughout the century and under all emission pathway scenarios.
  - In addition to more frequent and longer HHEs, public health risk is expected to increase due to increasingly warm nights (limiting the opportunity for physiological recovery and prolonging the period for which negative health outcomes can occur), and the presence of Urban Heat Islands, both of which pose serious risk to households without air conditioning.

Late season heat severity on the rise

		HHE Tmax (F)	Projected HHE Tmax, Relative Change (%)		HHE Tmin (F)	Projected HHE Tmin, Relative Change (%)	
Climate Impact Region	Time Period	Historical	2050	2090	Historical	2050	2090
Bay Area	AM	88.4	-0.8%	-1.9%	58.3	**2.0%**	**4.4%**
	JJA	91.2	**1.9%**	**1.4%**	62.8	**2.9%**	**4.5%**
	SO	88.8	**3.5%**	**2.4%**	60.0	**5.8%**	**8.9%**
Central Coast	AM	85.2	**2.8%**	**2.2%**	55.9	**2.2%**	**2.2%**
	JJA	91.5	**2.6%**	**2.5%**	61.4	**4.1%**	**4.7%**
	SO	89.7	**4.5%**	**2.9%**	60.2	**6.3%**	**7.2%**
Desert	AM	98.7	**1.9%**	**1.9%**	64.2	**1.8%**	**2.6%**
	JJA	104.3	**3.7%**	**3.7%**	74.5	**1.1%**	**2.7%**
	SO	100.5	**5.5%**	**6.2%**	72.9	**1.7%**	**2.7%**
North	AM	92.7	-1.2%	**2.5%**	58.5	**1.2%**	-2.1%
	JJA	100.1	**2.0%**	**4.7%**	68.0	**0.8%**	**3.6%**
	SO	96.2	**2.4%**	**3.7%**	60.7	**2.7%**	**3.7%**
North Central Valley	AM	96.3	**1.1%**	**1.0%**	61.0	**4.1%**	**4.8%**
	JJA	104.2	**1.8%**	**1.6%**	68.6	**3.2%**	**4.3%**
	SO	91.3	**7.1%**	**6.6%**	63.7	**2.6%**	**3.4%**
North Coast	AM	86.7	-3.8%	-3.2%	55.0	**1.5%**	**0.1%**
	JJA	89.9	**2.4%**	**1.6%**	60.9	-2.5%	**0.1%**
	SO	89.7	**4.3%**	**4.4%**	59.0	**2.1%**	**3.4%**
North Sierra	AM	90.3	-0.3%	**0.7%**	57.3	**4.4%**	**5.1%**
	JJA	101.0	**1.4%**	**1.6%**	66.0	**5.0%**	**6.5%**
	SO	89.7	**5.4%**	**4.9%**	62.0	**4.0%**	**5.4%**
South Coast	AM	90.1	-0.3%	-0.7%	62.6	**3.0%**	**3.8%**
	JJA	93.8	**3.4%**	**2.7%**	71.4	**2.0%**	**3.0%**
	SO	93.7	**4.0%**	**3.7%**	69.9	**3.4%**	**4.5%**
Southern Central Valley	AM	98.3	**1.3%**	**1.2%**	64.8	**2.7%**	**3.7%**
	JJA	104.8	**1.1%**	**2.3%**	73.2	**0.0%**	**0.0%**
	SO	95.4	**5.3%**	**5.5%**	69.3	**0.6%**	**1.2%**

Mid- and late-season Heat Health Events on the rise

Chart: Max temp changes between historical and 2050, RCP 8.5, 50th percentile

Frequency (and timing) of Heat Health Events

Mid- and late-season Heat Health Event occurrence likely to increase

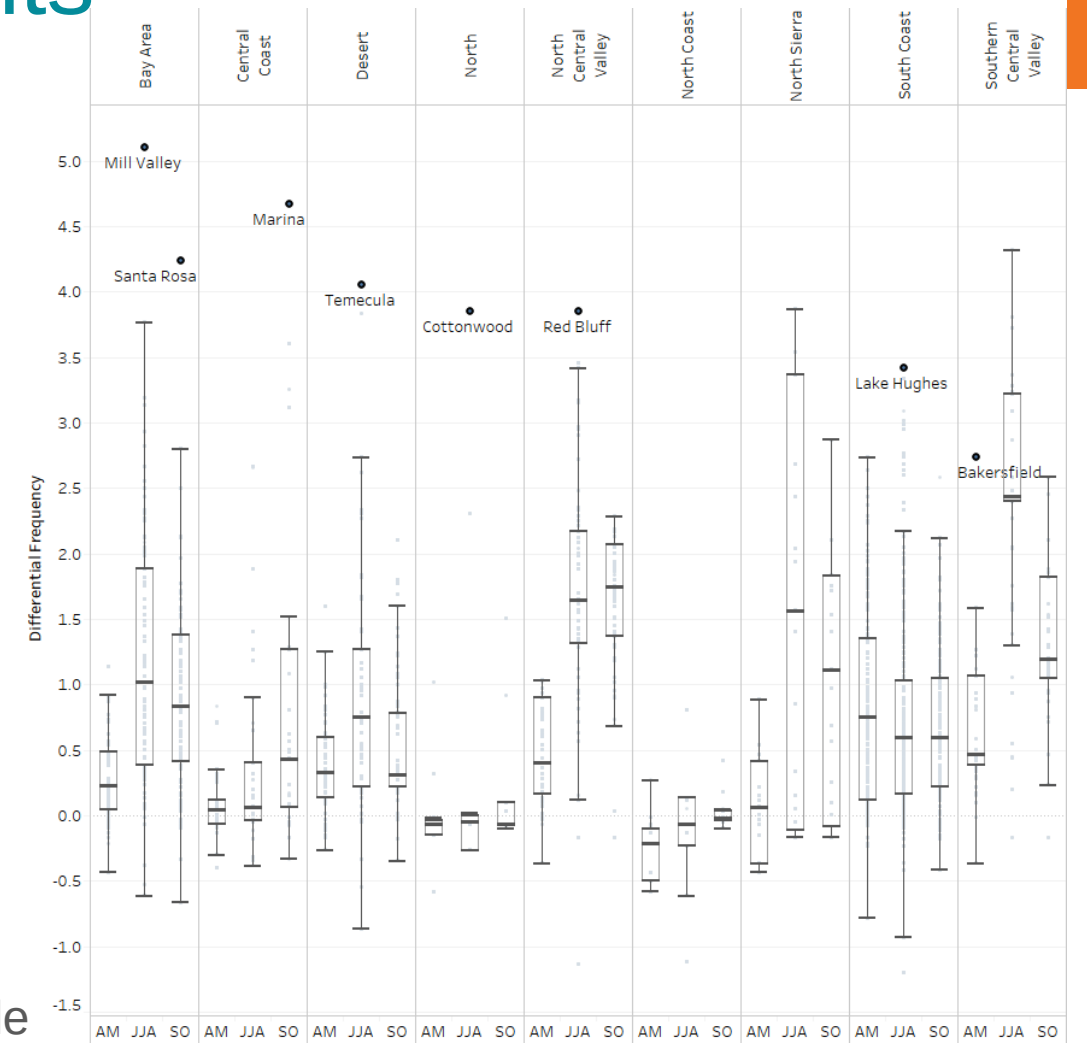


Chart: Frequency changes between historical and 2050, RCP 8.5, 50th percentile

Duration of Heat Health Events

Mid- and late-season HHEs duration on the rise, especially in the greater Central Valley

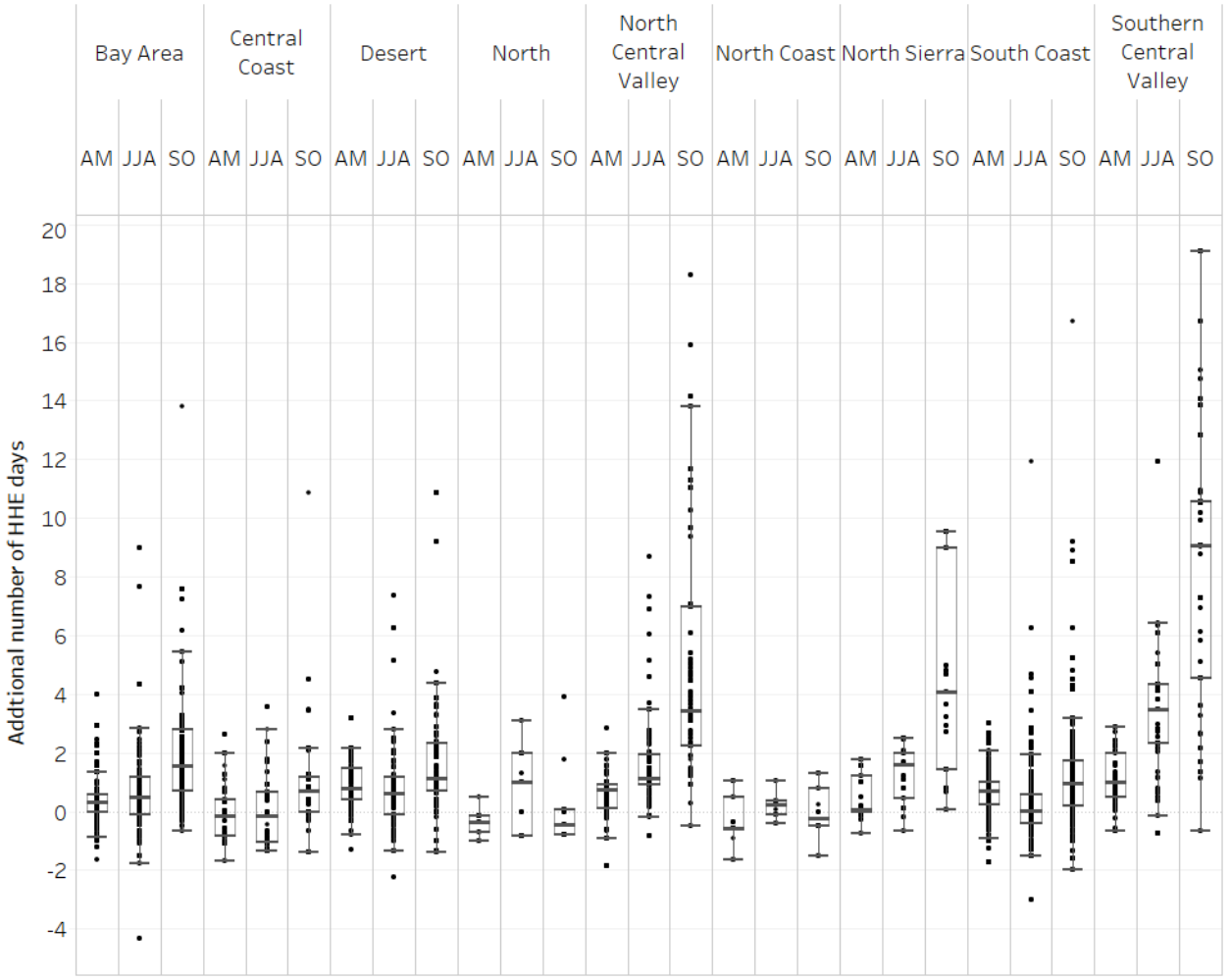


Chart: Duration changes between historical and 2050, RCP 8.5, 50th percentile

Vulnerability

Delta signatures often higher in frontline communities

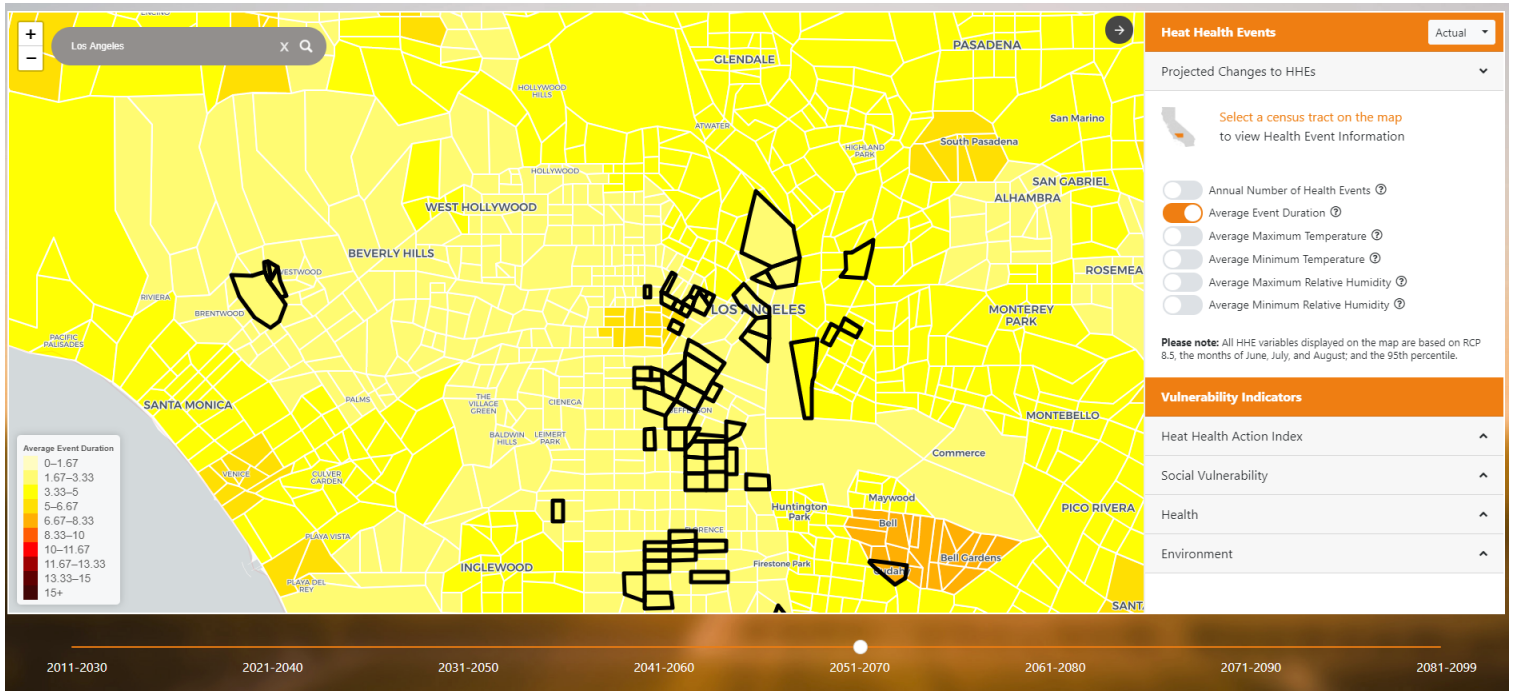


Chart: Duration changes between historical and 2060, RCP 8.5, 50th percentile; and census tracts with relatively higher number of households living under the poverty line

Project 5A: Preparing Public Health Officials for Climate Change – A Decision Support Tool

Project Partners:

- **Four Twenty Seven**
  - Climate risk intelligence
- **Public Health Institute**
  - An independent, nonprofit organization committed to the development, implementation, and management of public health programs
- **Argos Analytics**
  - Climate data services provider
- **Habitat Seven**
  - Climate-focused software development and design studio (National Climate Assessment, IPCC, Risky Business Project, etc.)

California Heat Assessment Tool

Cal-heat.org

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