CENTER FOR
CLIMATE RESILIENCE
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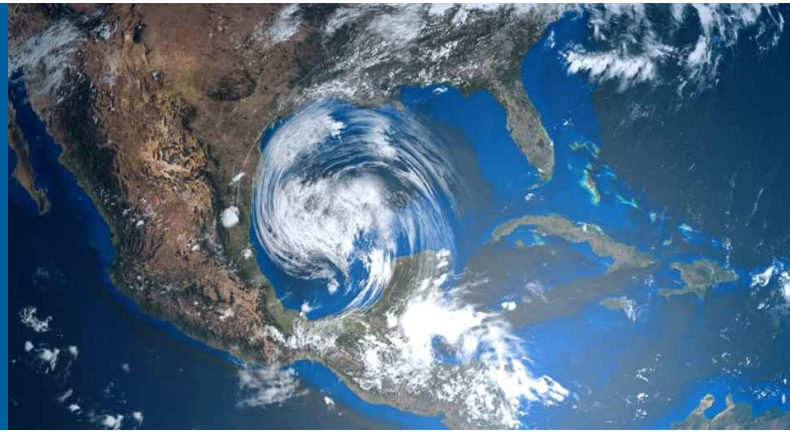
Argonne National Laboratory

DYNAMICALLY DOWNSCALED CLIMATE DATA TO IMPROVE RESILIENCE PLANNING



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U.S. DEPARTMENT OF ENERGY
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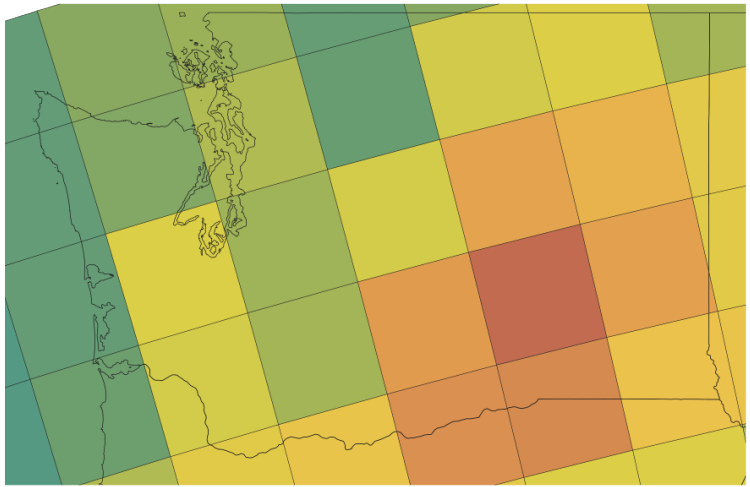
PLANNING FOR A FUTURE CLIMATE

- Increasingly destructive storms, wildfires, and other climate-related hazards have spurred the development of numerous climate resilience plans
  - Federal, state, and local governments; utilities; nonprofits; private entities; etc
- Global climate models (GCMs) form the foundation for assessing future climate risk



Typical GCM output
w/ 100km grid cells

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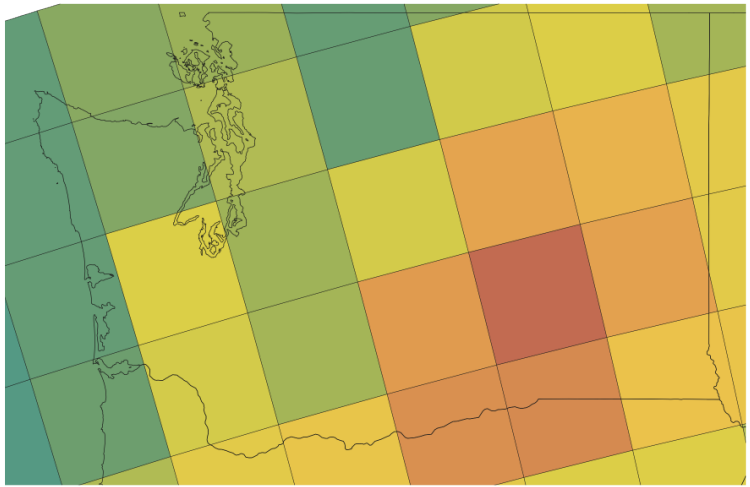

Typical GCM output w/ 100km grid cells

The coarseness of GCMs complicates localized risk assessments

THE CLIMATE RISK AND RESILIENCE PORTAL

- Scientists at Argonne have sought to address this limitation by *dynamically downscaling* 3 different GCMs to derive local-scale (12km) projections
- Dynamical downscaling: a physics-based approach using high-resolution regional climate modeling with the boundary conditions from each GCM

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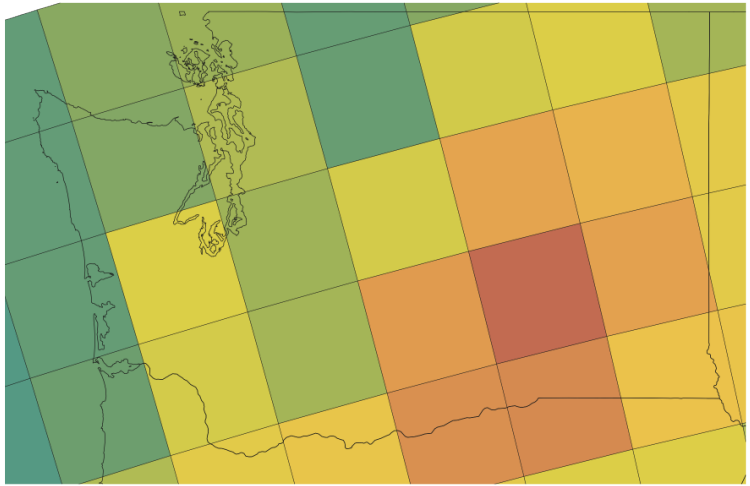

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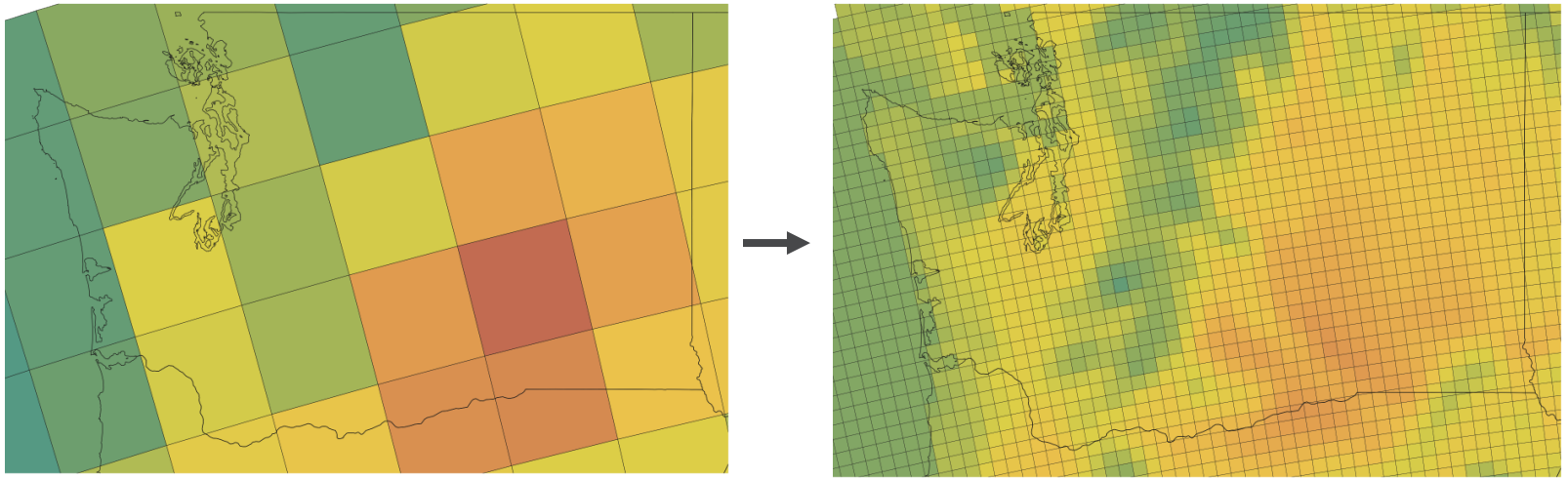

THE CLIMATE RISK AND RESILIENCE PORTAL

- Through a public-private partnership, this data is now (or will soon be) publicly available
- The goal of ClimRR is to provide free and equitable access to leading, peer-reviewed, high-resolution climate datasets.
- Aid community planners, emergency managers, infrastructure owners, and other stakeholders in making climate risk-informed decisions.
- The purpose of this study is to demonstrate how this high-resolution data can be used along with community characteristics to generate actionable insights.

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FEMA

AT&T

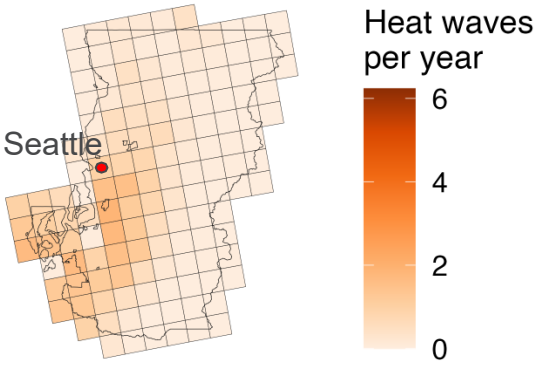
THIS STUDY:

- Explores historical and future heat wave patterns with the Seattle–Tacoma–Bellevue (WA) Metropolitan Statistical Area as a test case.
  - A heat wave is defined as a 3-day period in which the average daily temperatures exceed 90°F.
- Three time periods: historical (1995–2004), mid-century (2045–2054), and end-of-century (2084–2095).
- Two emissions scenarios: RCP4.5 (moderate) and RCP8.5 (high).
- Evaluates areas of greater vulnerability to heat waves across the Metro, focusing on access to residential air conditioning and older populations.
- Primary data come from the 5-year American Community Survey and empirically-derived probabilities of air conditioning access (Romitti et al. 2022)

HEAT WAVE LIKELIHOOD IN SEATTLE METRO

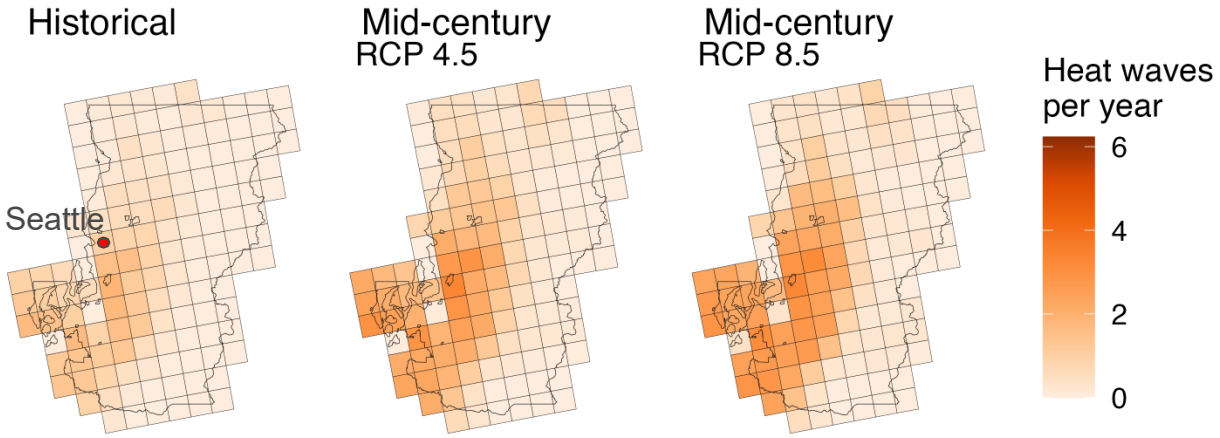
- Historically has had limited exposure to heat waves
  - Average grid cell: 1 heat wave every 3 years
  - 14.5% of grid cells average greater than 1 heat wave per year
  - No grid cell exceeded 2 heat waves per year

Historical



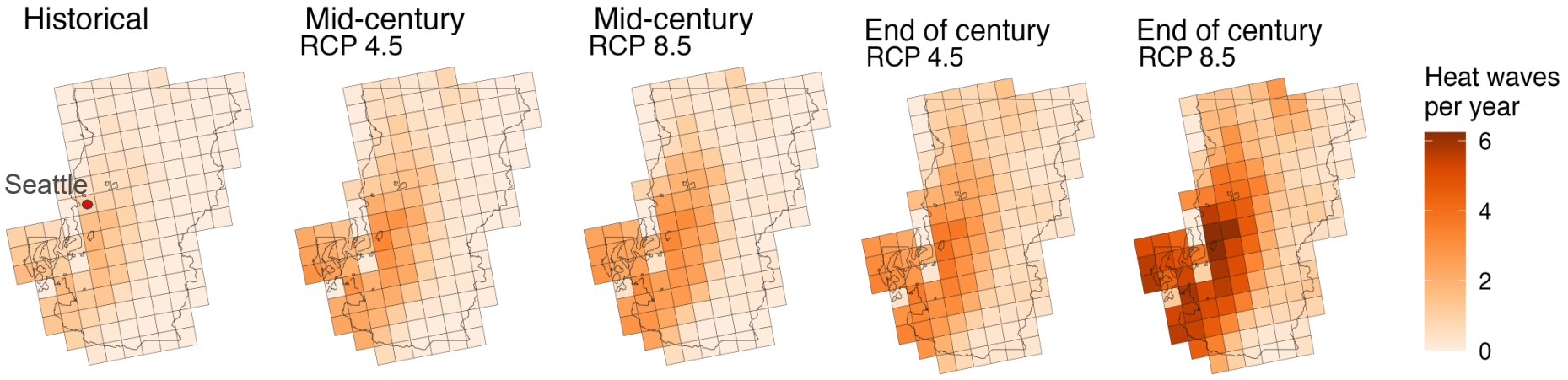
HEAT WAVE LIKELIHOOD IN SEATTLE METRO

- By mid-century, heat waves are projected to occur:
  - 3.7x more often under RCP4.5
  - 4.8x more often under RCP8.5



HEAT WAVE LIKELIHOOD IN SEATTLE METRO

- By the end of the century, heat waves are projected to occur:
  - 25.3x more often under RCP4.5
  - 48.3x more often under RCP8.5

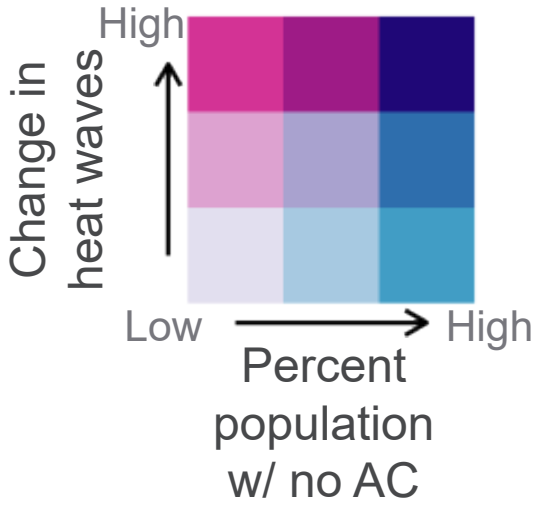


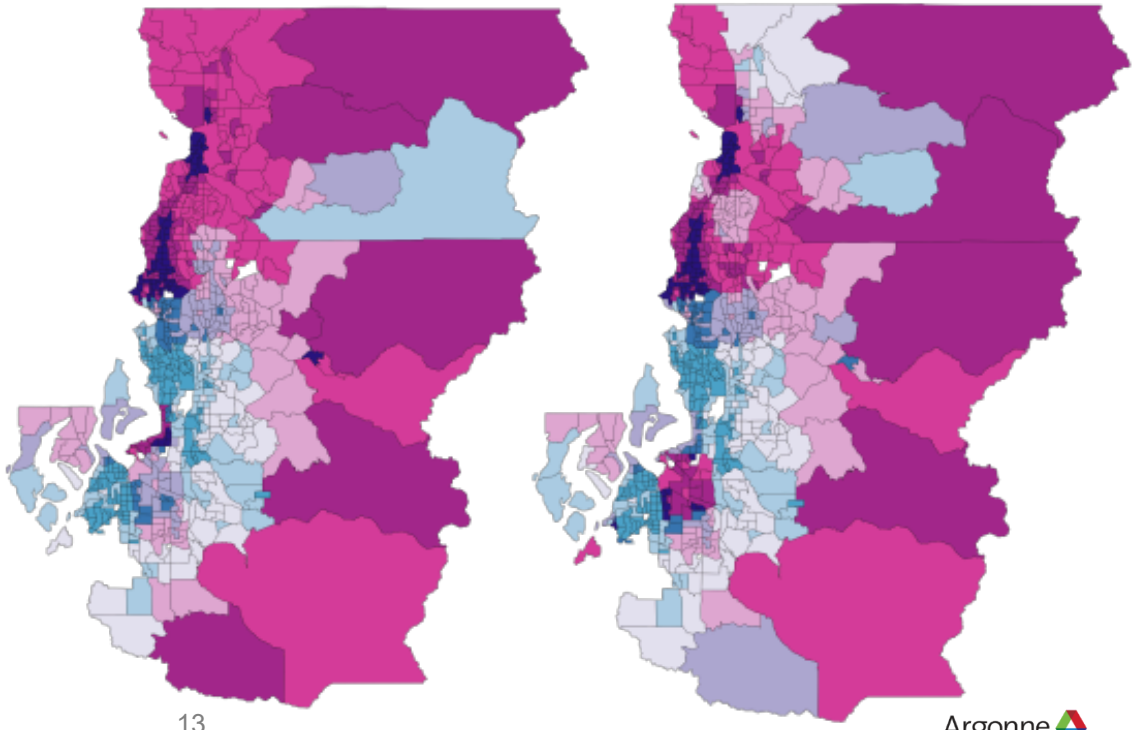
RISKS TO VULNERABLE POPULATIONS

- A driving concern during heat waves is impacts to particularly vulnerable populations, such as those lacking access to air conditioning.
- Reduces ability to cope with with heat and creates need for cooling centers
- Bivariate maps can help identify overlapping threats and vulnerabilities

ACCESS TO AC & HEAT WAVE LIKELIHOOD

Mid-Century: RCP4.5 RCP8.5





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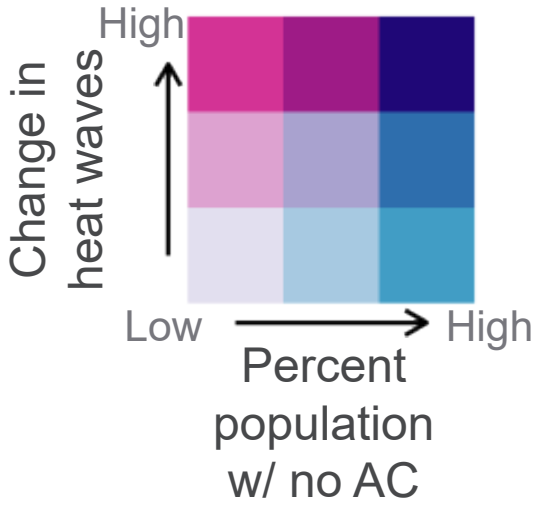
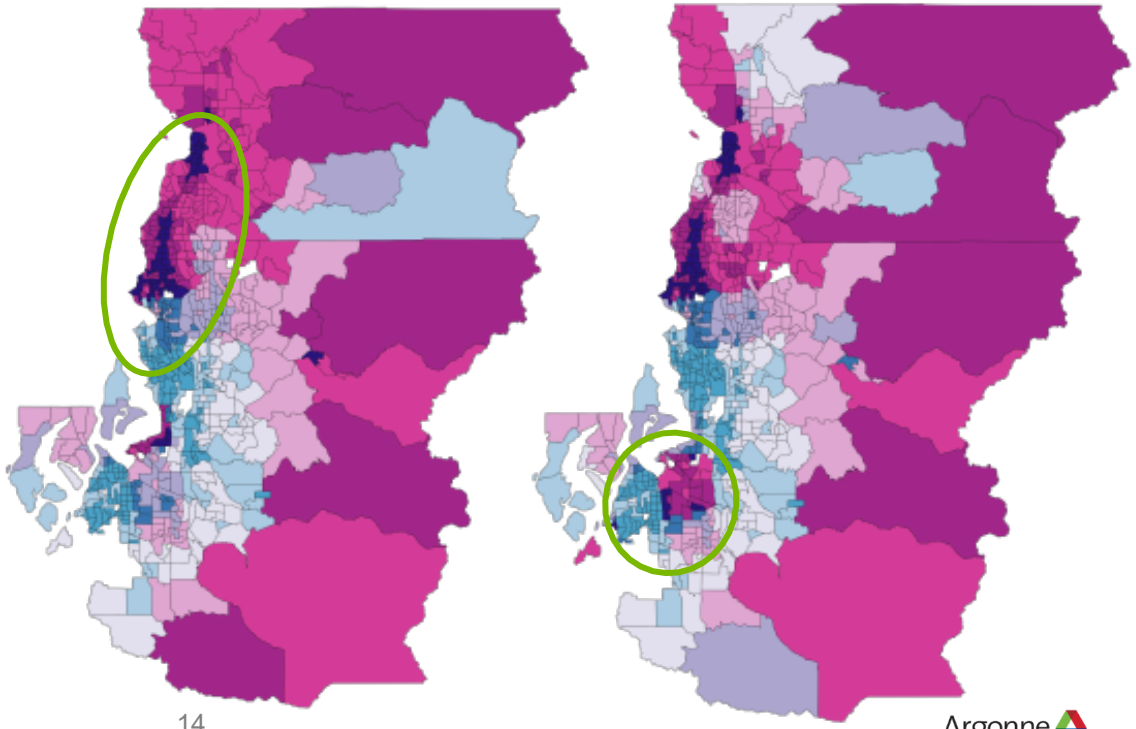
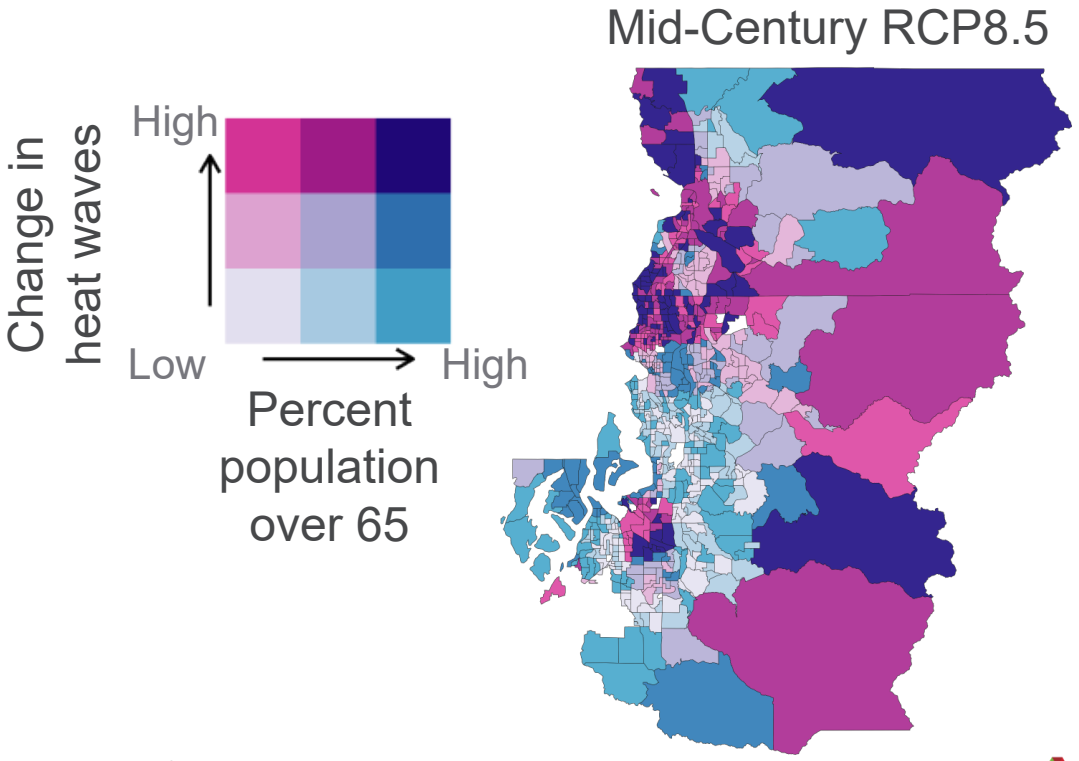




RISKS TO ELDERLY POPULATIONS

- Heat waves are particularly perilous for older populations
- Example: in the 1995 Chicago heat wave, many of the more than 700 estimated deaths were amongst individuals 65 & up
- Here we examine the overlap between heat waves and the over 65 population



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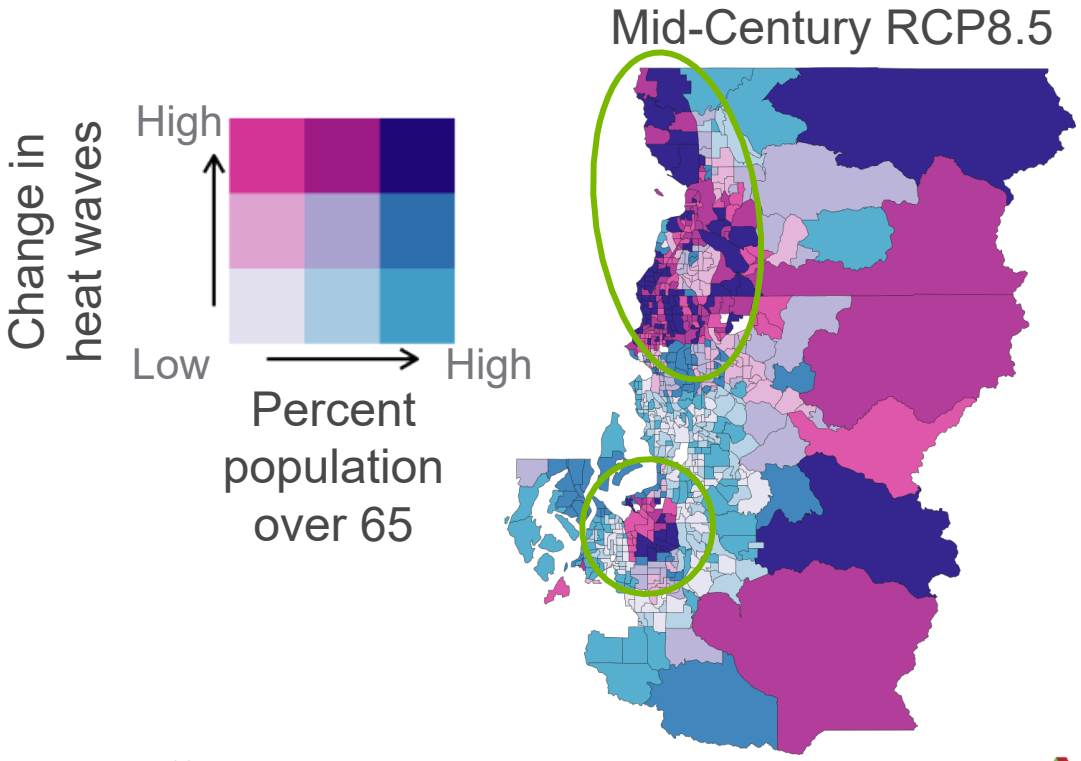
- Here we examine the overlap between heat waves and the over 65 population
  - Overlap with at-risk areas with limited AC

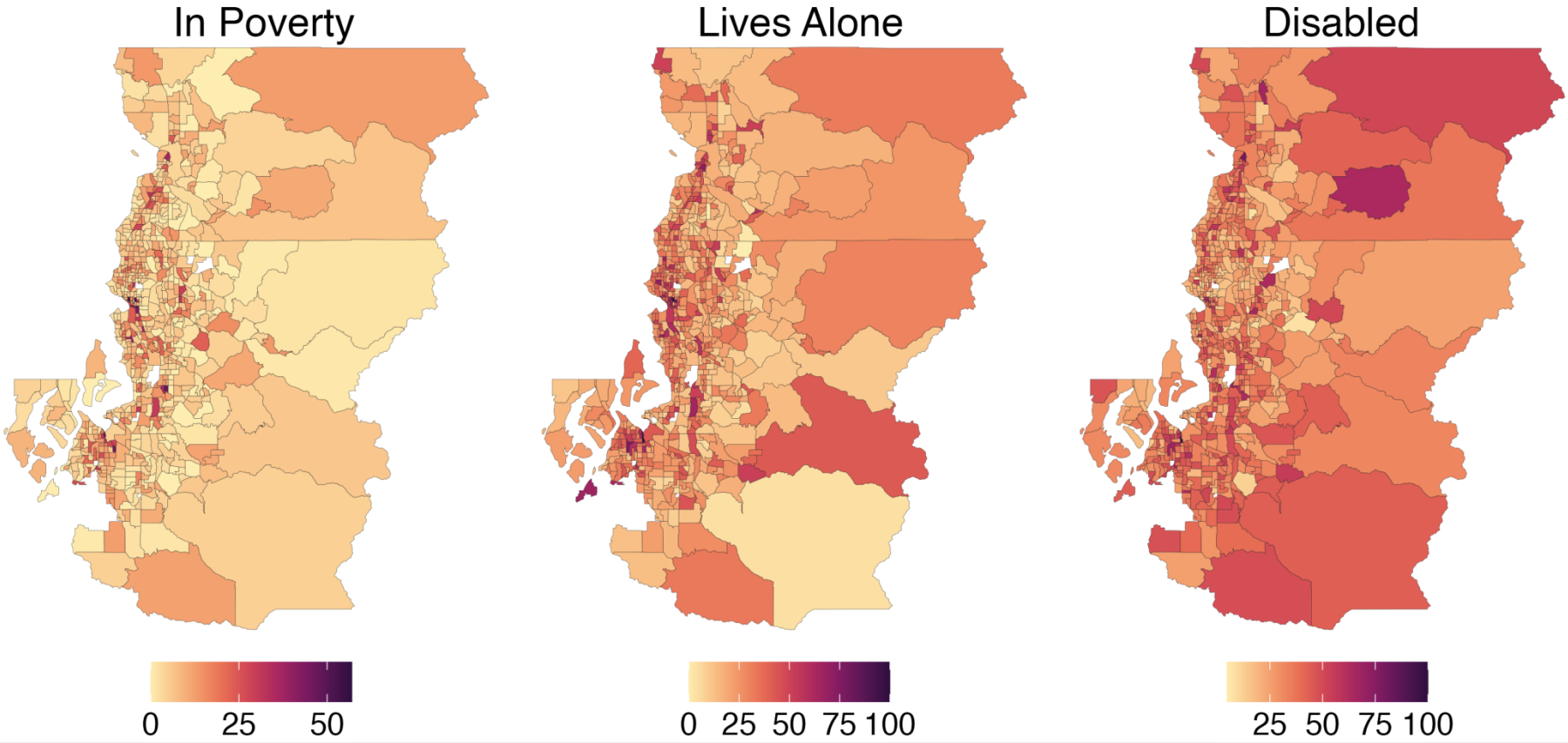


COMPOUNDING VULNERABILITIES

- Vulnerability amongst a single demographic, such as the over 65 population, is not uniform.
  - Those with disability or in poverty may have difficulty accessing a local cooling center.
  - Those living alone may lack a social safety net to check on their well-being.

- In the Chicago heat wave, the individual risk factors amongst older populations included living alone, lacking access to transportation, being sick, and not having AC.
- Important to consider where these overlapping risk factors might be concentrated within a community.

Percentage of over 65 population:



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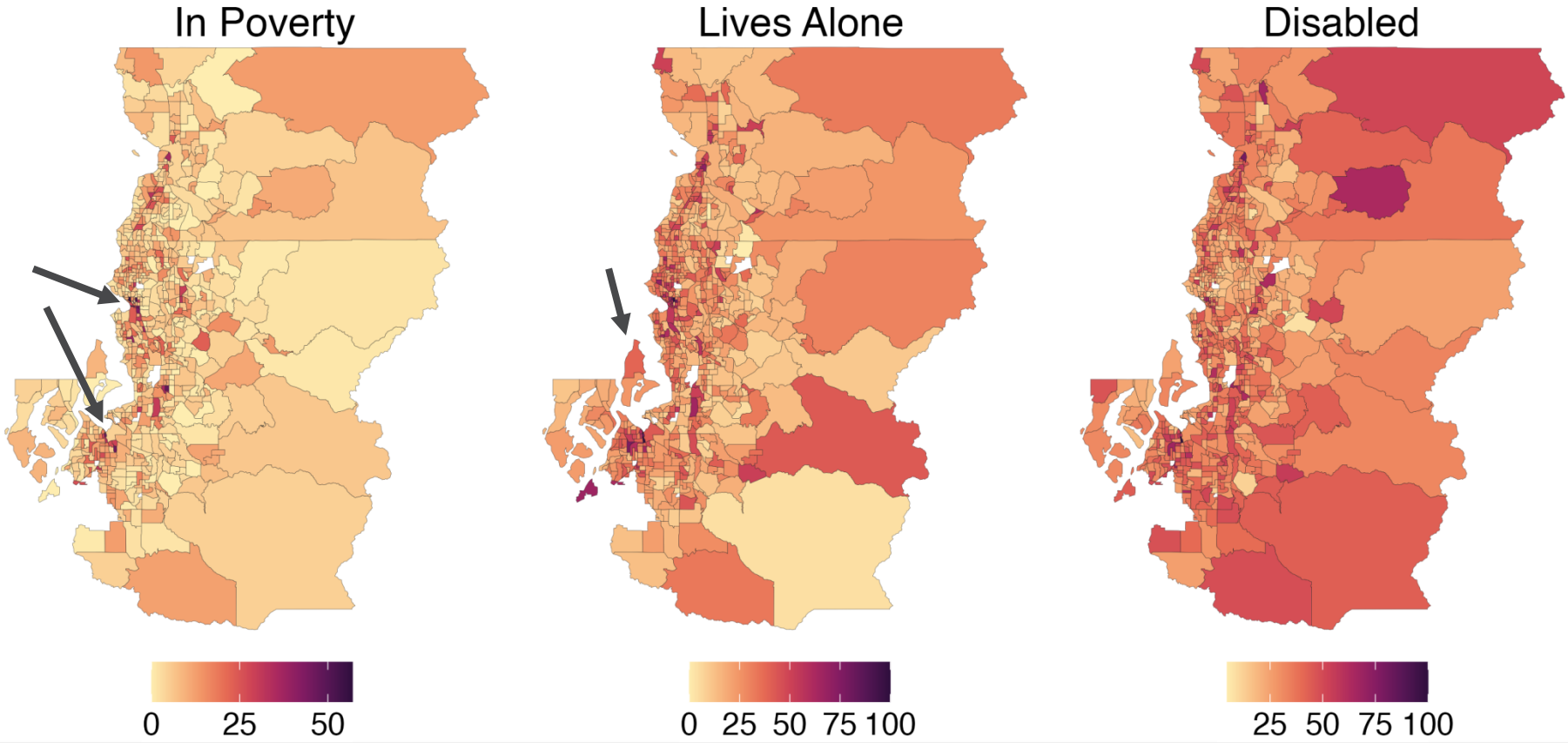

TAKEAWAYS

1. Vulnerability varies significantly across space. It is critically important that resilience planning considers how social vulnerability overlaps with physical vulnerability to produce high levels of risk
2. The climate data we use matters. It affects policies, investment priorities, and ultimately, people. Data with a strong scientific foundation will help ensure planning engages with areas of high need.
3. New data and unique tools – such as bivariate maps – can help target investments, policies, and emergency responses.

THANK YOU!

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