San Diego Regional Report

California Fifth Climate Change Assessment

November 12, 2026

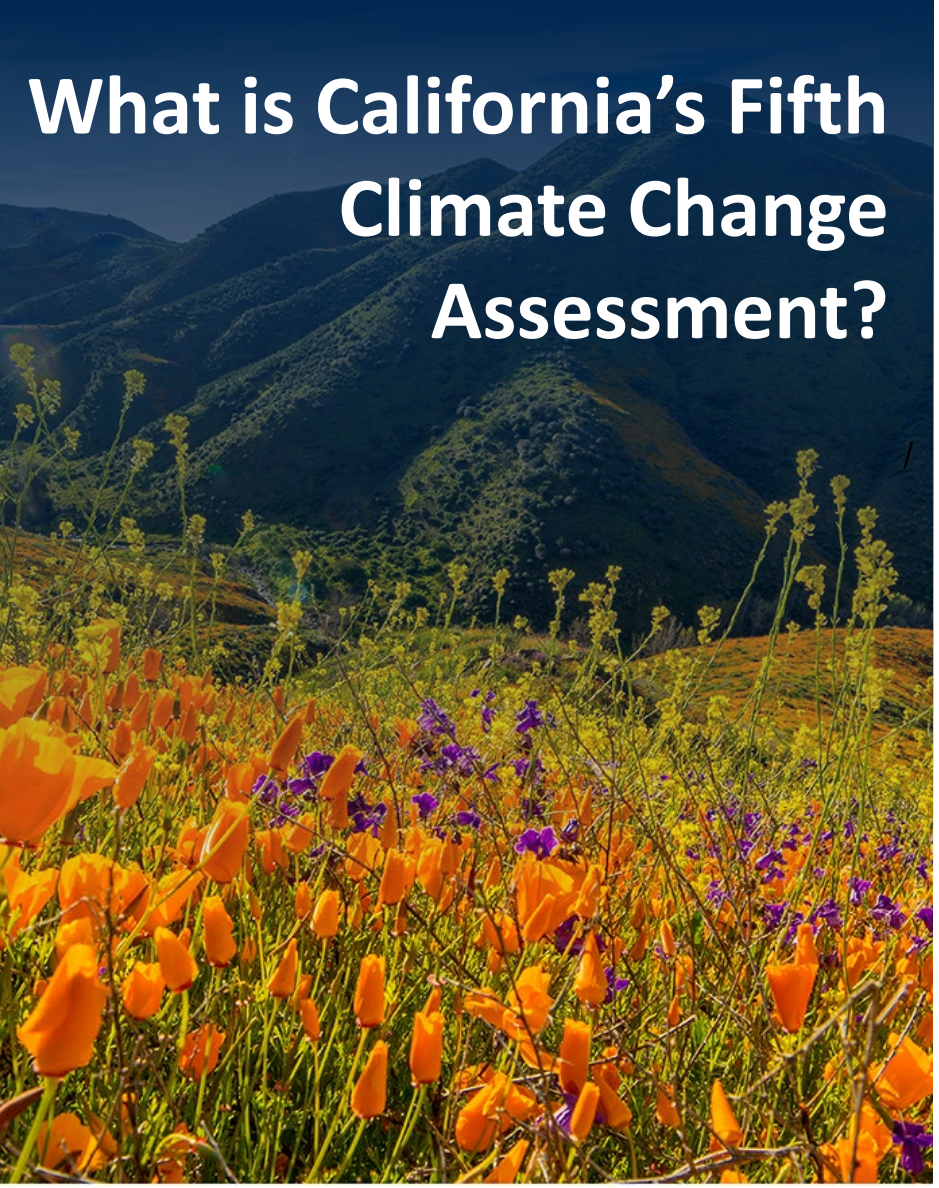
CA Governor's Office of Land Use and Climate Innovation

cnap California Nevada ADAPTATION PROGRAM a NOAA CAP team

SCRIPPS INSTITUTION OF OCEANOGRAPHY UC San Diego

CALIFORNIA'S FIFTH CLIMATE CHANGE ASSESSMENT

What is California's Fifth Climate Change Assessment?



The Fifth Assessment is a suite of research and tools that report the impacts of climate change to understand the risks to vulnerable communities and inform adaptation action.

It includes an inaugural Tribal Research Program, Indigenous Knowledges, community expertise, and lived experiences.

https://climateassessment.ca.gov

Key Focus Areas

- Climate Data & Scenarios
- Regional and Statewide Topical Reports
- Tribal Research Program
- Energy Reports
- Core Climate Reports

California Natural Resources Agency

CA Governor's Office of Land Use and Climate Innovation

California Strategic Growth Council

California Energy Commission

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THANK YOU!

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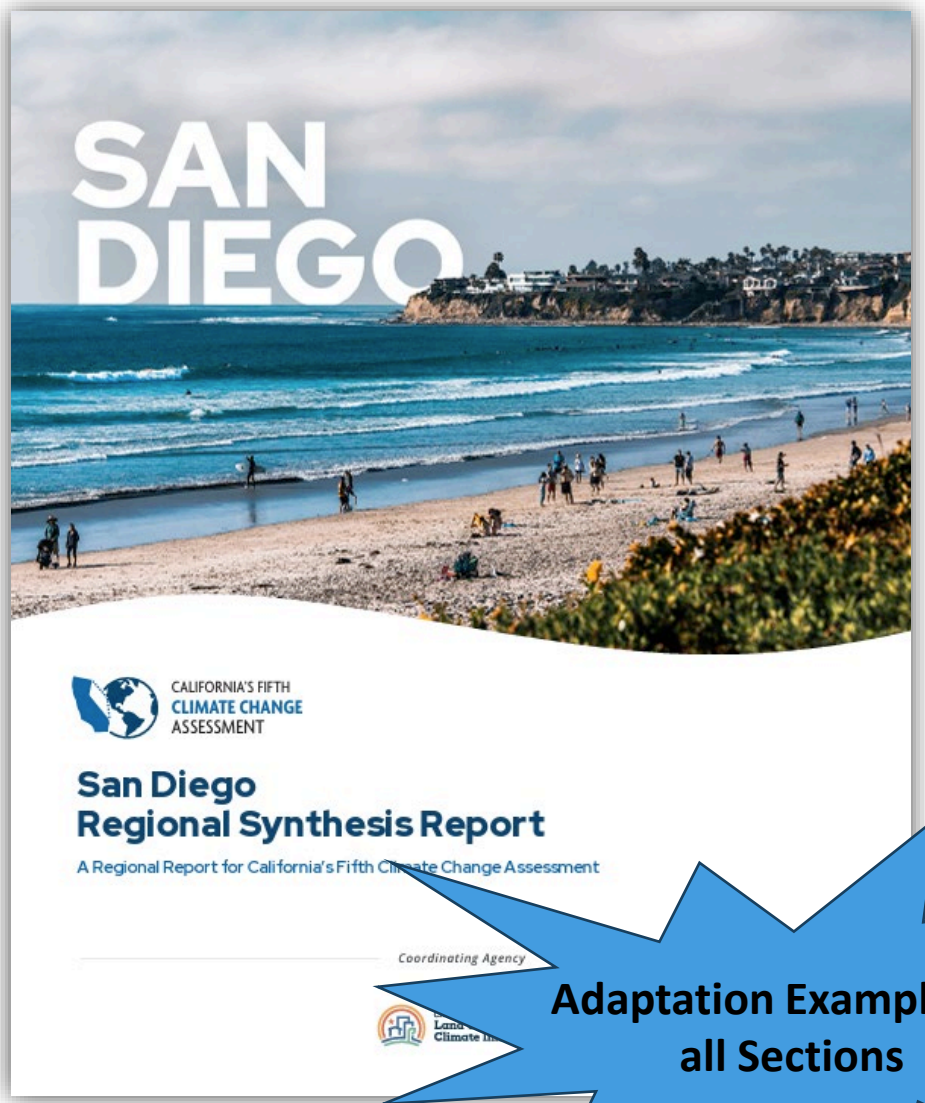
CALIFORNIA'S FIFTH CLIMATE CHANGE ASSESSMENT



Major Sections

Climate Science
Historical & Projected Trends

Natural and Working Lands
San Diego Coasts, Terrestrial Ecosystems, Agriculture & Food Systems

Built Systems
Energy, Water, Transportation

Social Systems
Public Health, Governance, Economy & Climate, Cross Border Resilience

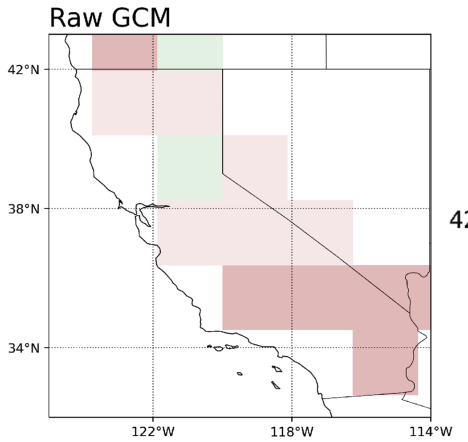
Adaptation Examples in all Sections

CA Governor's Office of Land Use and Climate Innovation

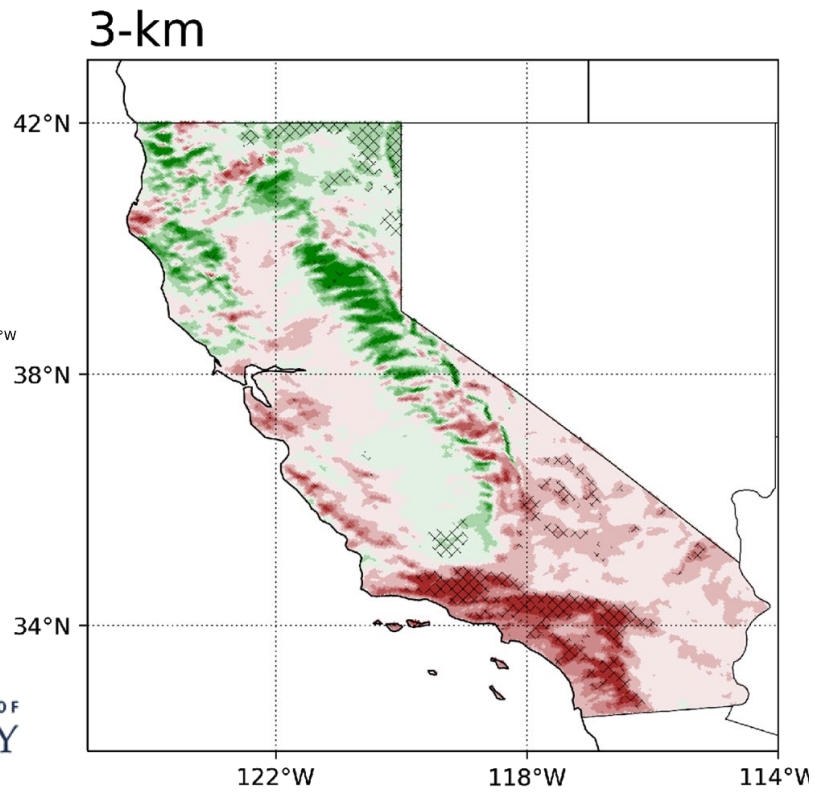
https://climateassessment.ca.gov/wp-content/uploads/CCCA5-LCI-San-Diego-Regional-Report.pdf

CALIFORNIA'S FIFTH CLIMATE CHANGE ASSESSMENT

World Class Robust Localized Climate Projection Data



S. Rahimi



- 2 types of downscaling: Dynamical (5 GCMs) & Hybrid-Statistical (15 GCMs)
- Hourly to daily temporal resolution
- Two different hydrologic models (run-off, snow, soil moisture)
- Hour total water level sea level rise projections
- Database of extremes temperature and precipitation of various lengths
- General Use Projections (common set as an entry point)

Dan Cayan, David Pierce, Stefan Rahimi, Ben Bass, Lu Su, Dennis Lettenmaier, Alex Hall, Peter Yao, Andrew Jones, Kripa Jagannathan, Nancy Freitas, Julie Kalansky & Martine Schmidt-Poolman

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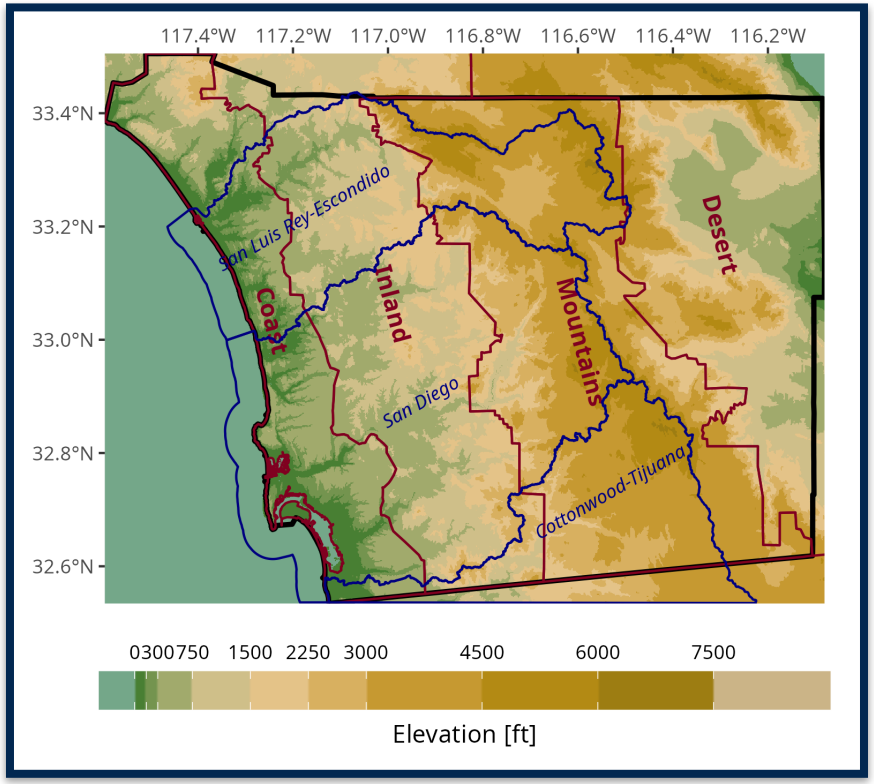
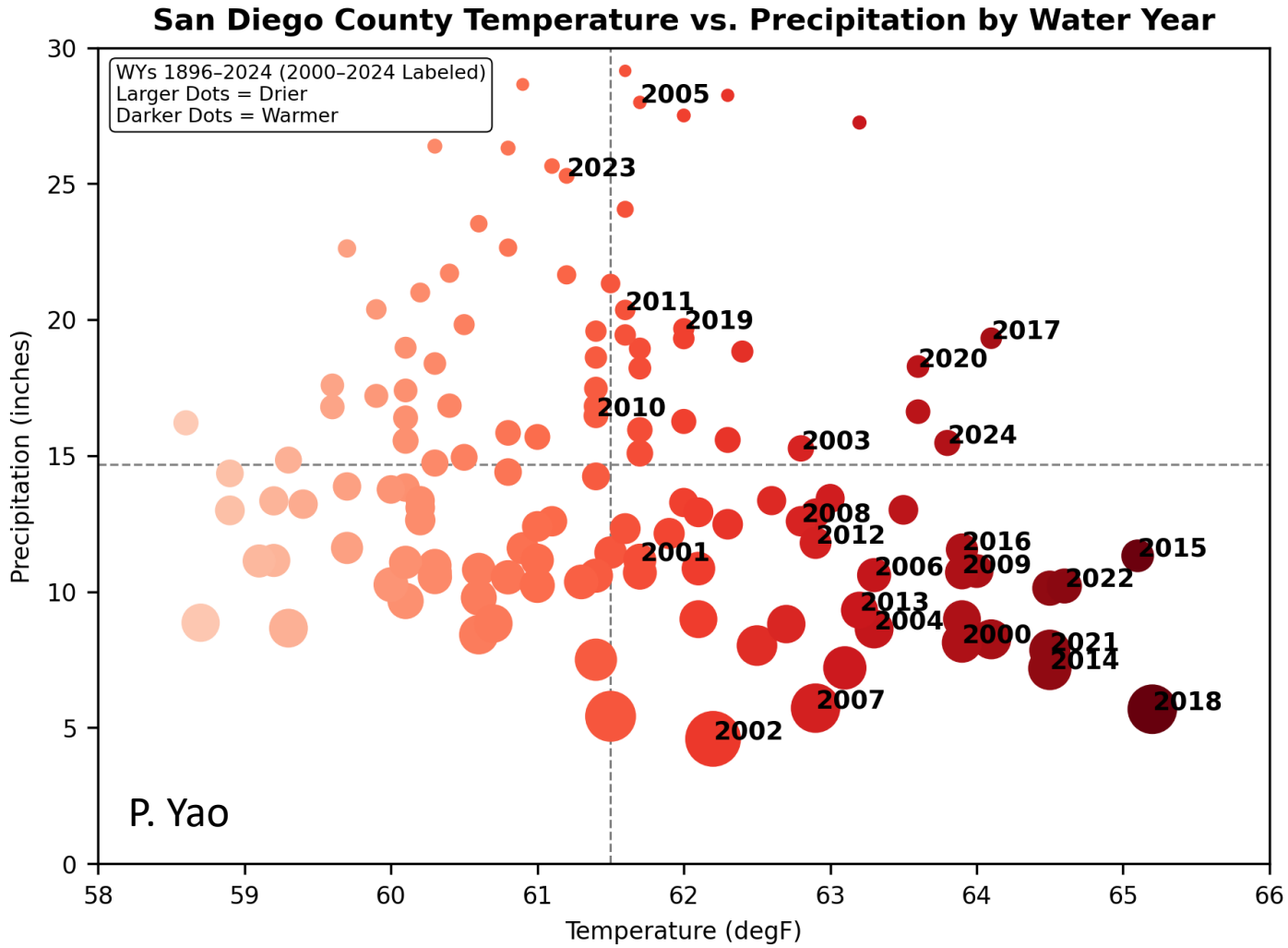


A. Weyant

What makes San Diego special?

- Mediterranean climate
- 4 different climate zones
- Southern edge of midlatitudes
- Highly variable precipitation regime
- Most biodiverse county in US
- 70 miles of coastline
- About half the land protected
- 3.3 million people (2nd most populated in California)
- $260 billon economy

What is changing?



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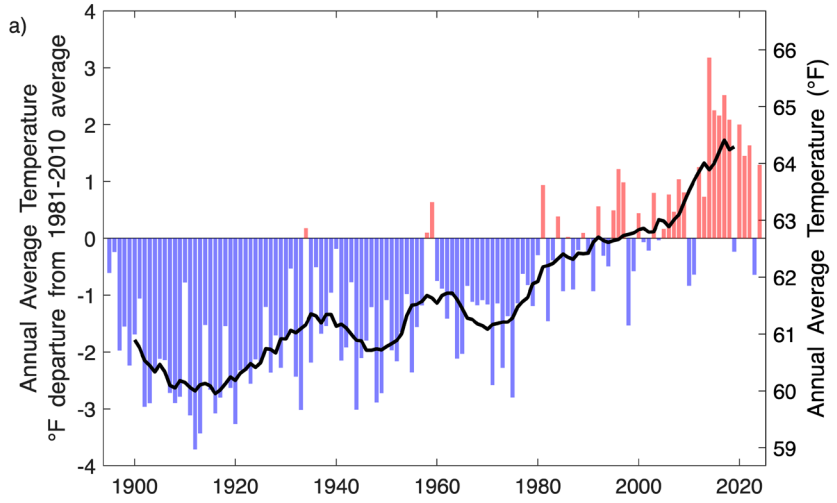
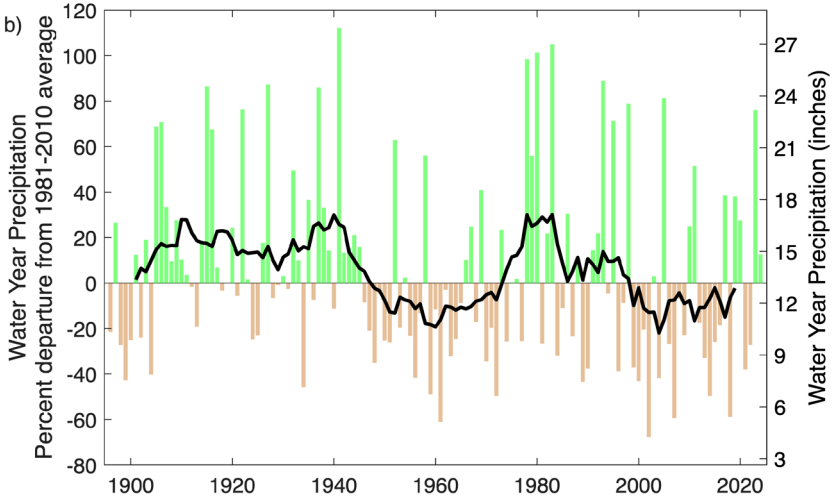
What is changing?

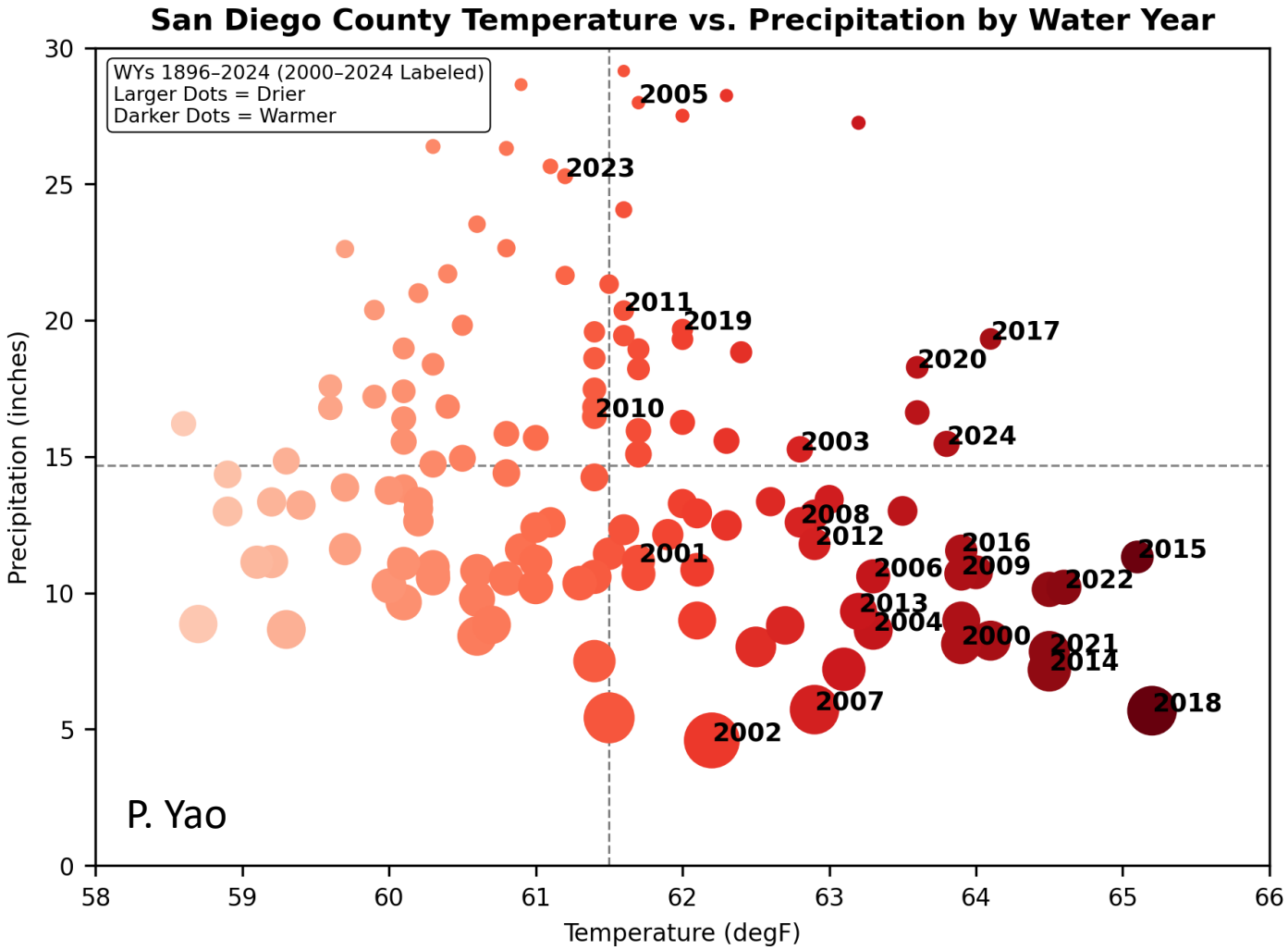
Temperature



Precipitation



J. Abatzoglou



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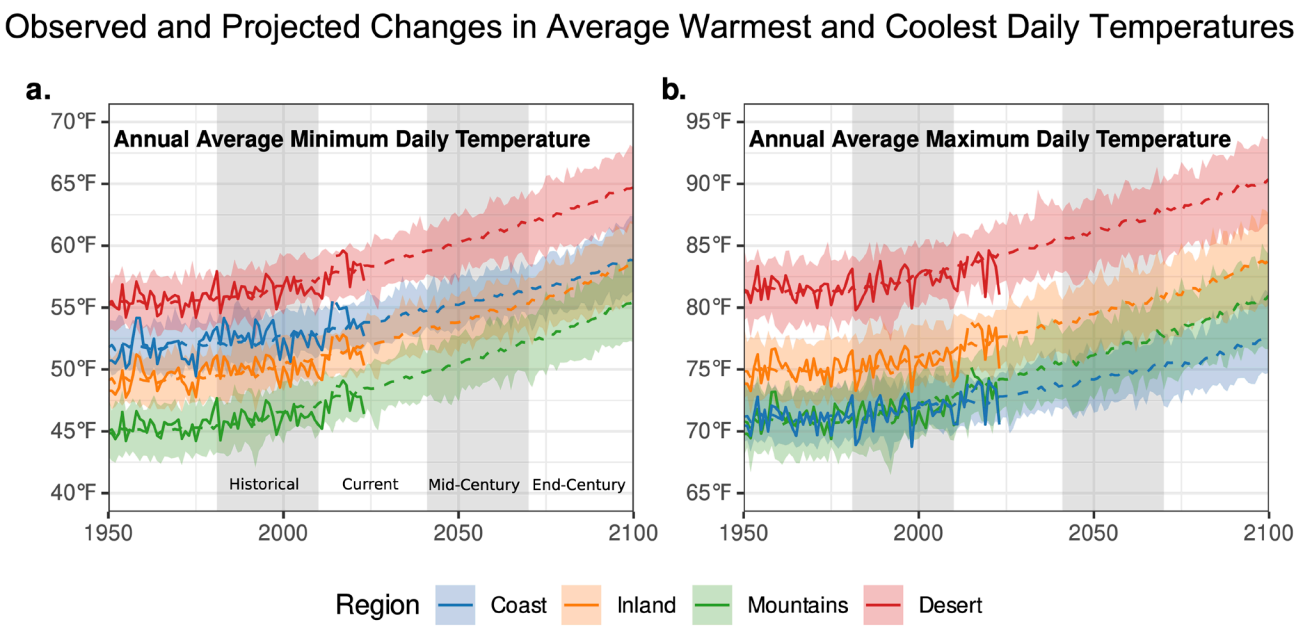
Temperature Trends

Different temperature scenarios diverge after 2050



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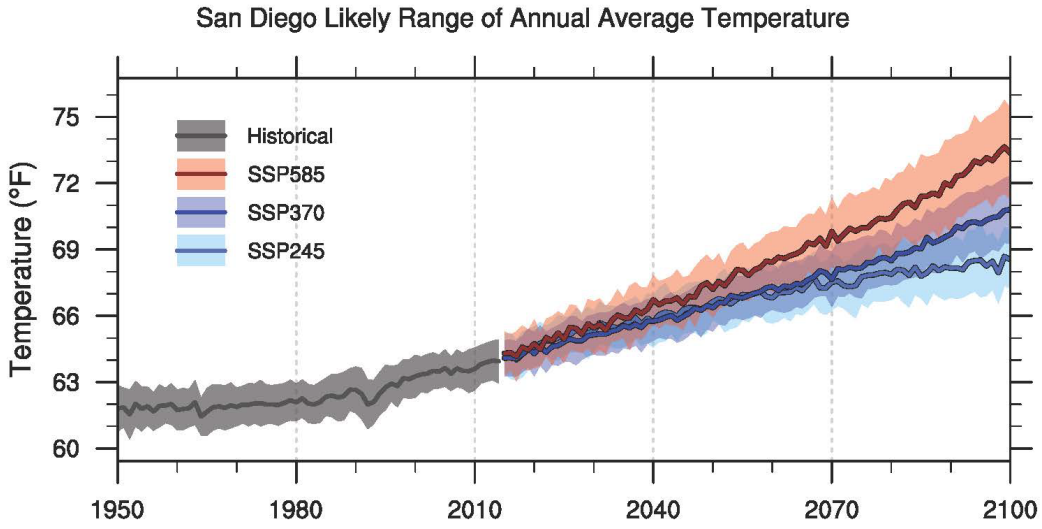

P. Ullrich

7-9 °F change in except at the Coast which has about 4°F change

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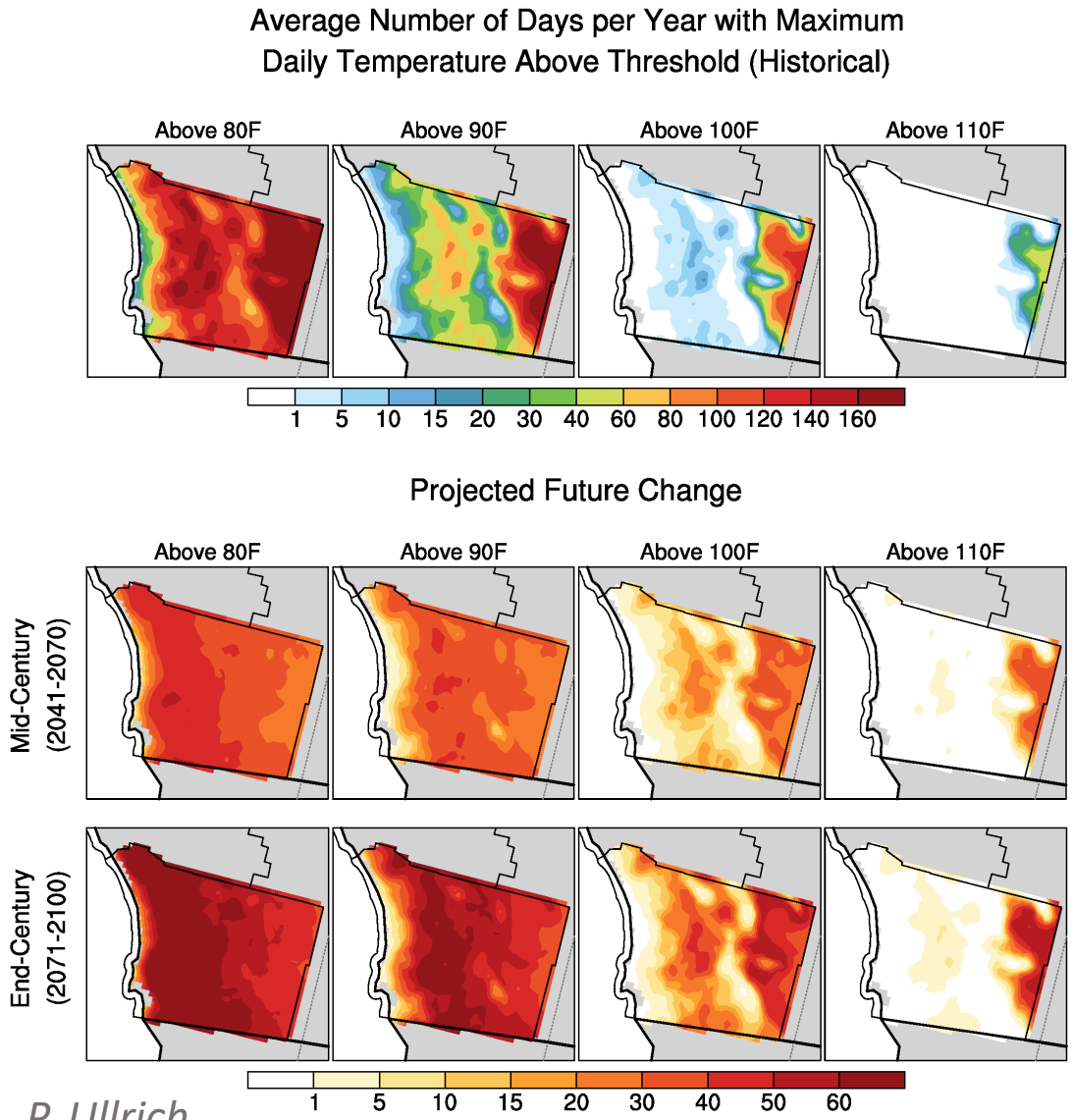
Temperature Extremes



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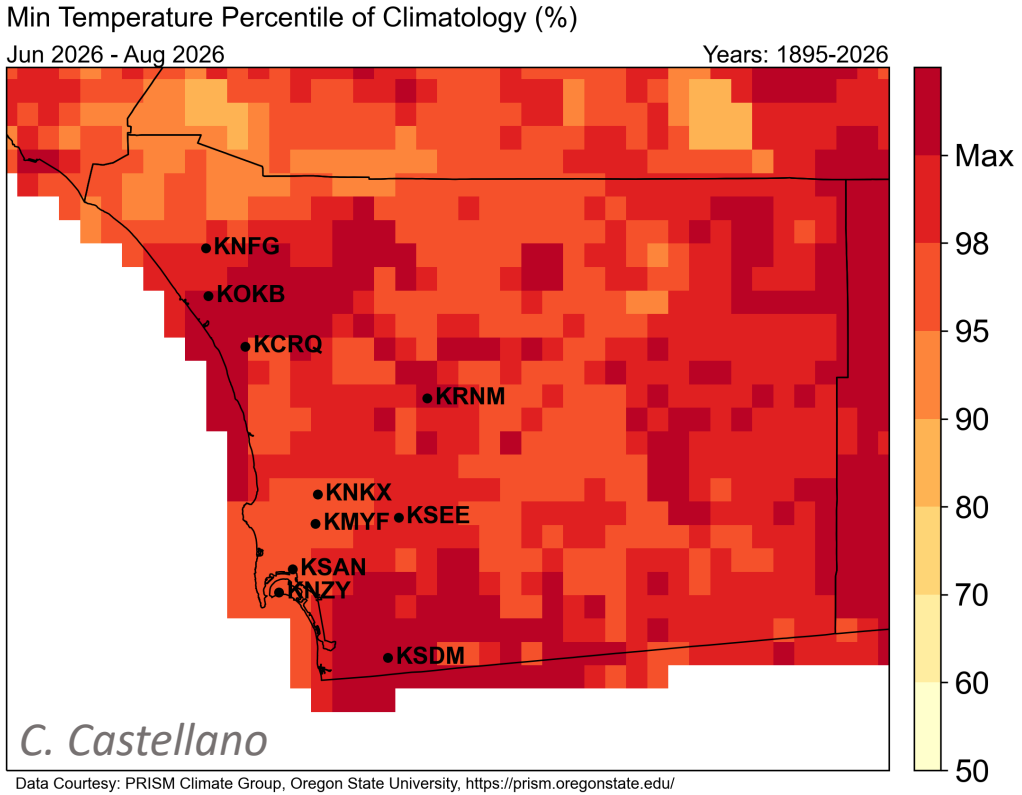

Lessons learned from Summer 2026 will help us prepare and plan for future heat waves

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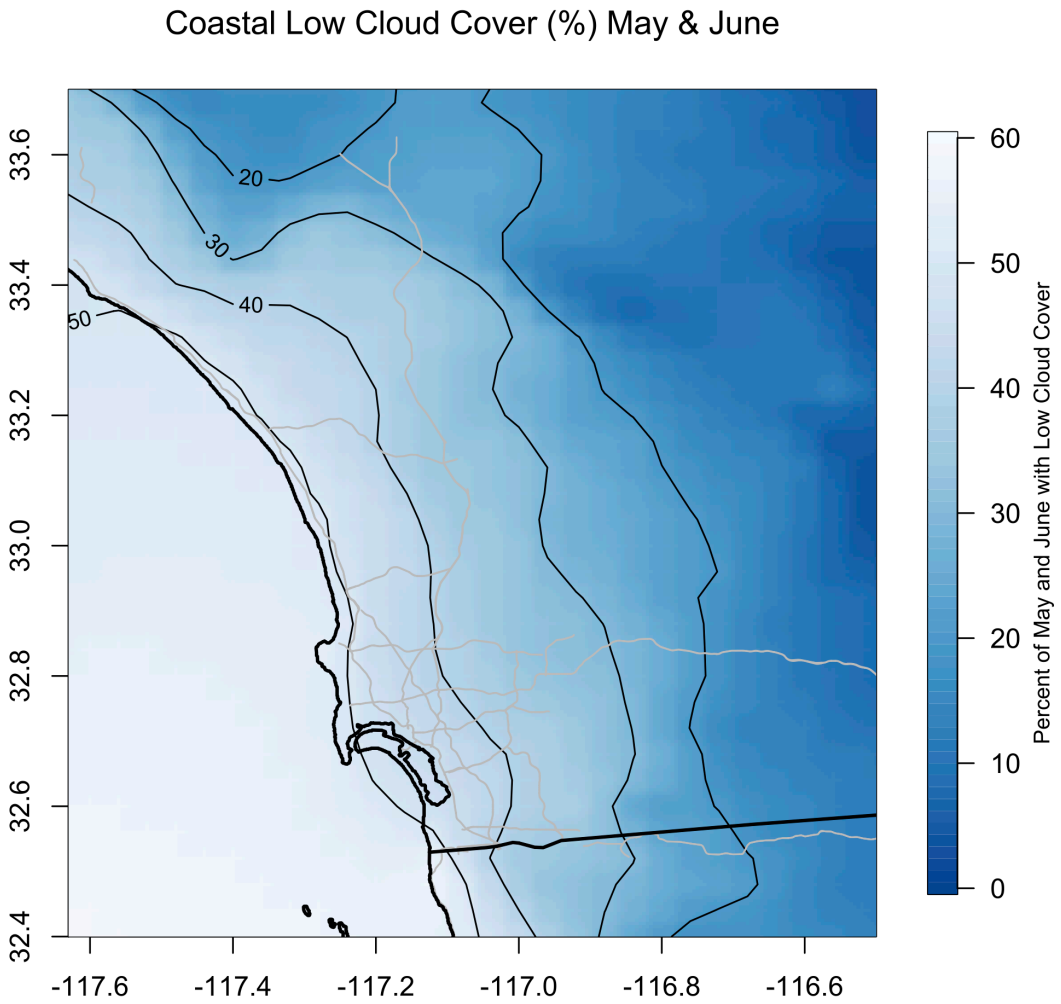
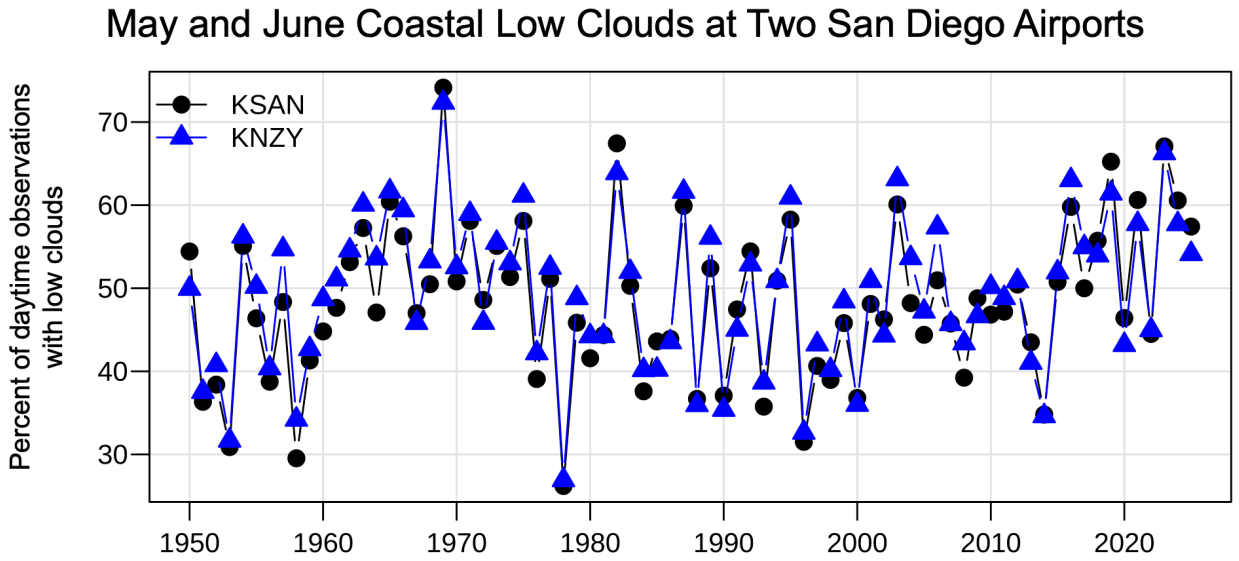
Coastal Low-Level Clouds



R. Clemesha

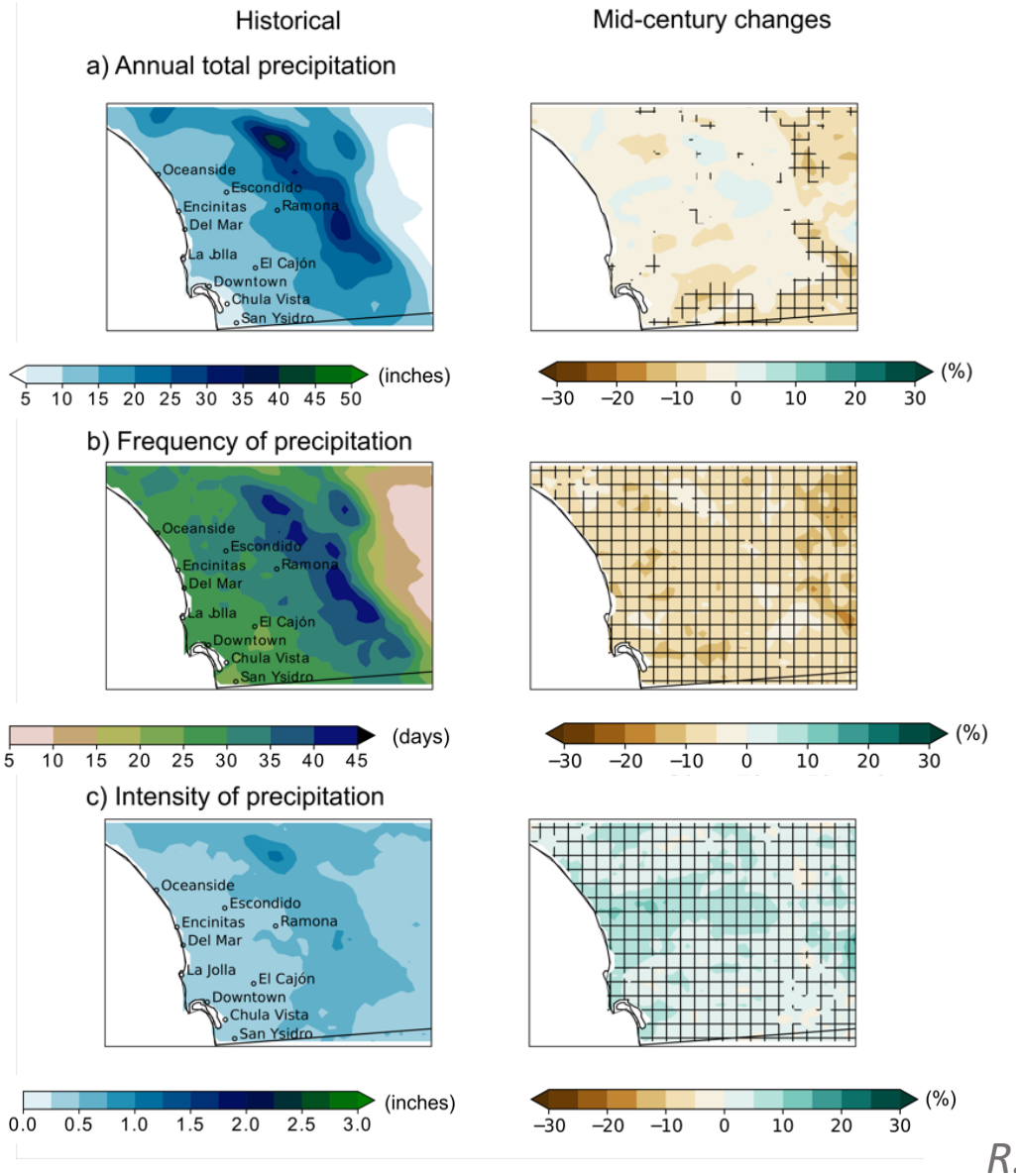


R. Clemesha

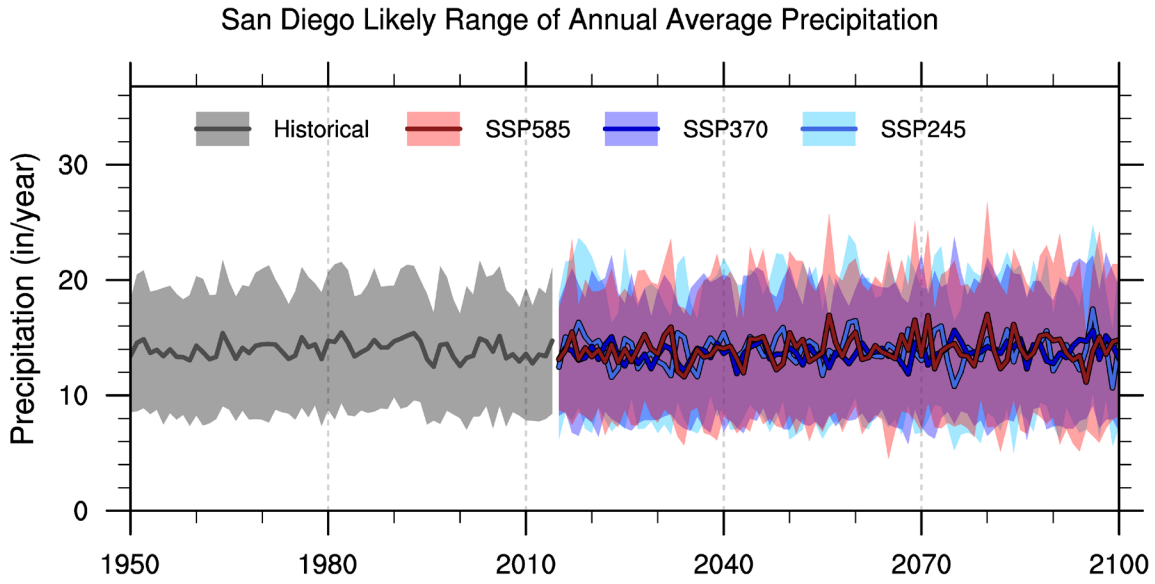
Coastal Low-Level Clouds are a defining feature of San Diego climate and have large year-to-year variability with no trend in a 75-year record.

Changing Precipitation Regime

More Extreme Atmospheric Rivers



R. Luna Nino



P. Ullrich

Projected Changes in AR and non-AR Precipitation in San Diego

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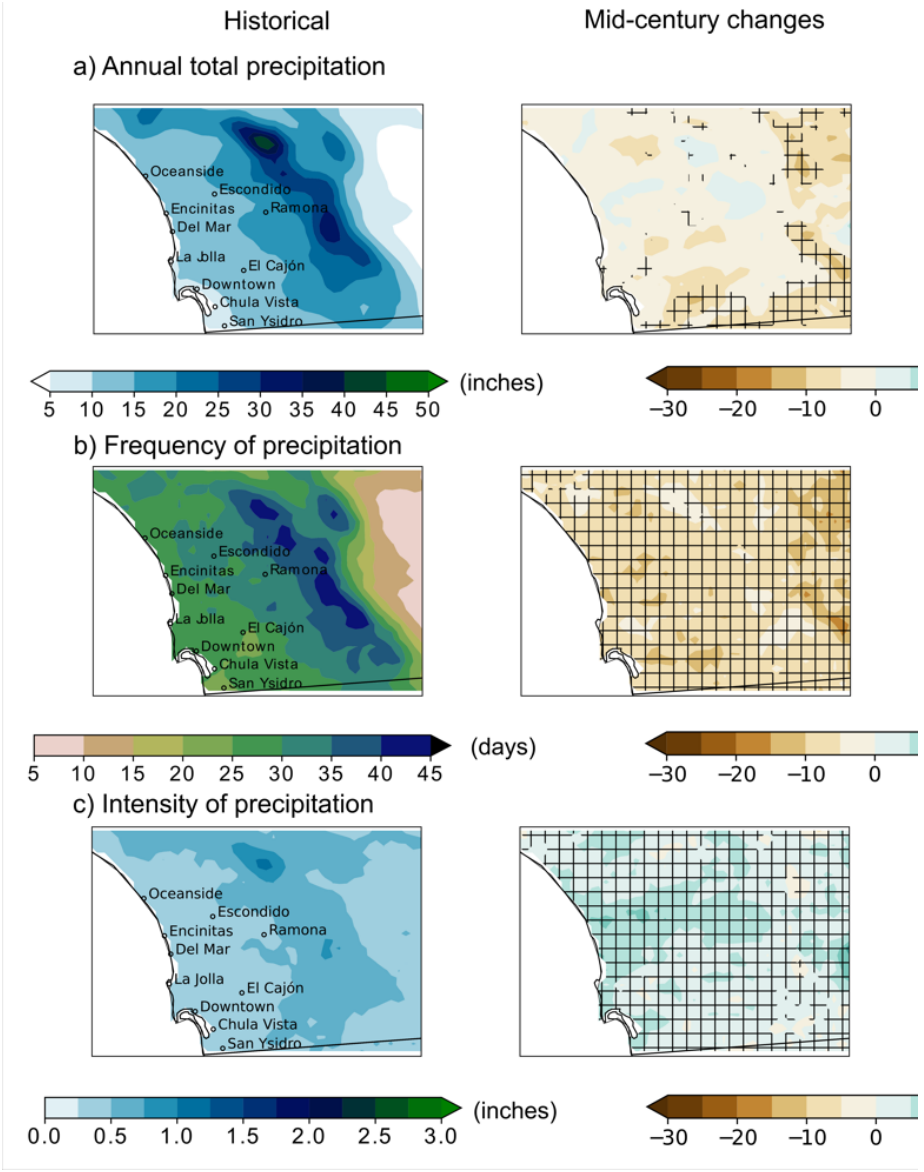
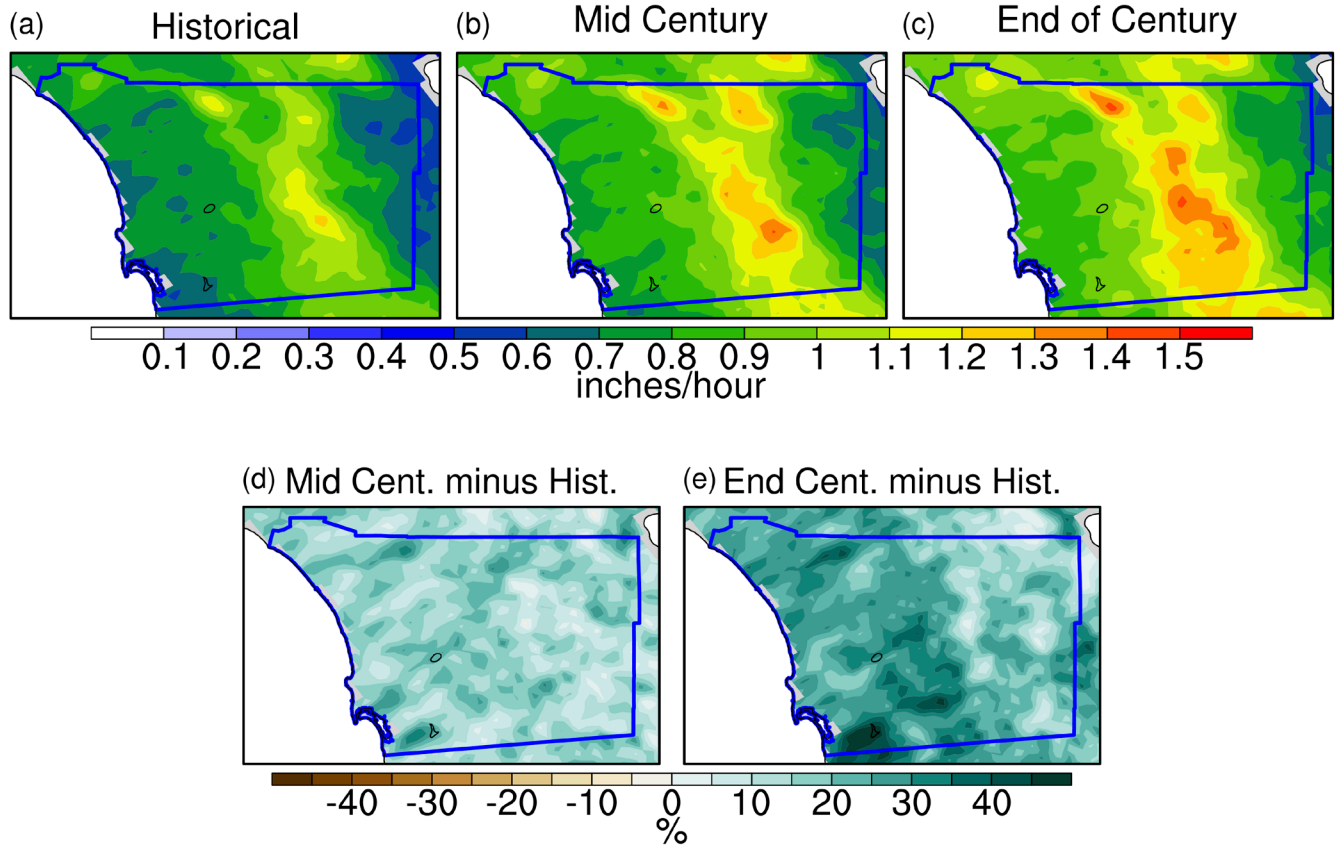
High Intensity Short Duration Rainfall

More Intense in the Future



R. Luna Nino

Annual Maximum Hourly Precipitation



J. Norris

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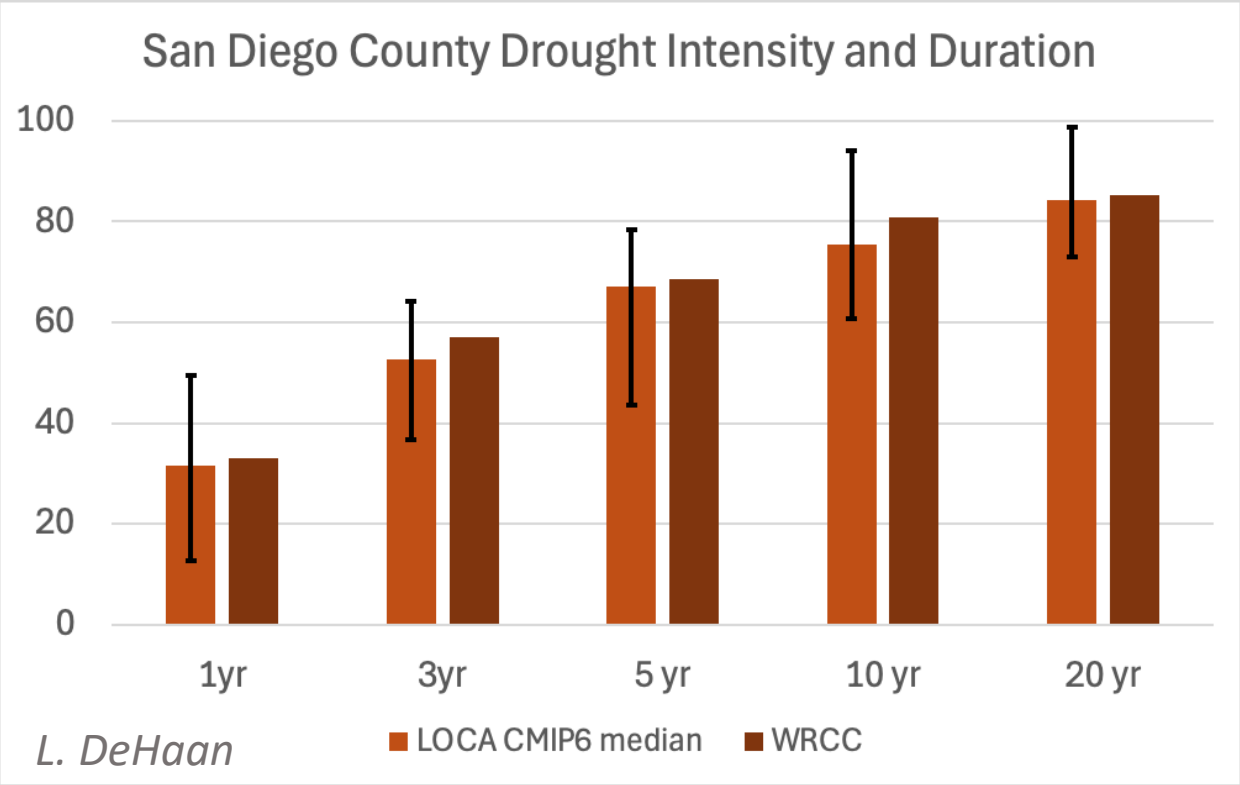
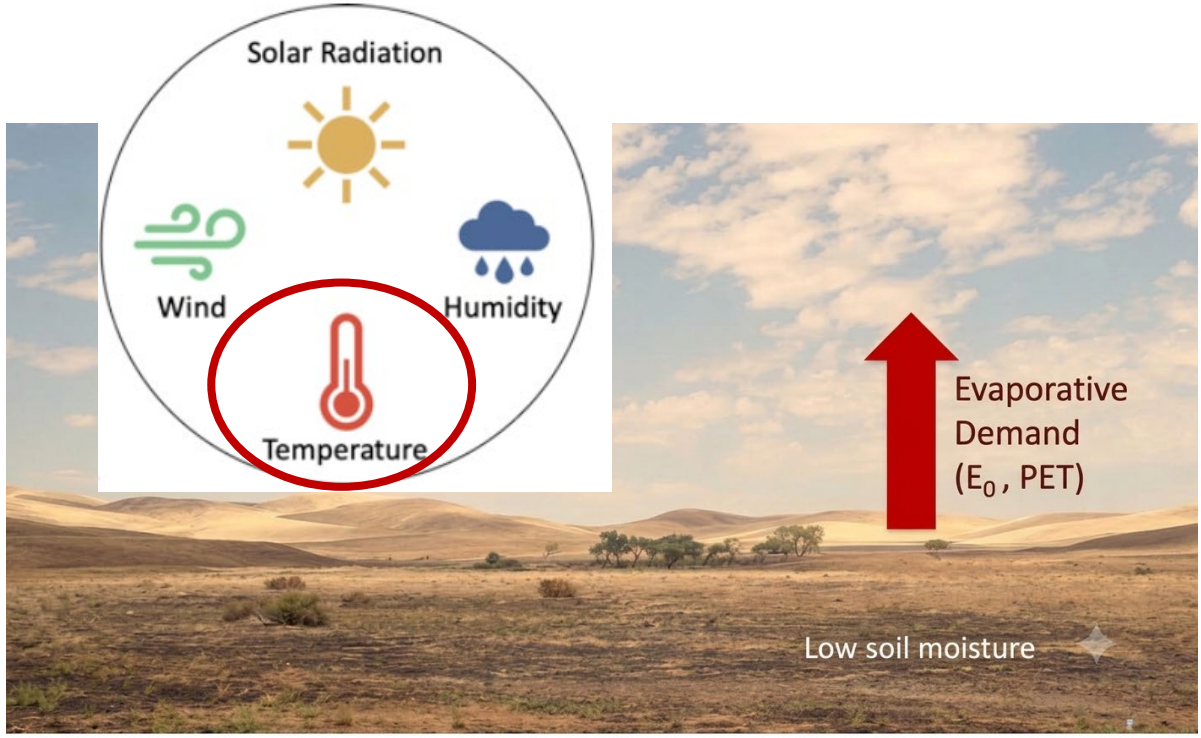
Drought Changes in the Future

Temperature is the Primary factor



Evaporative Demand



Drought Changes in the Future

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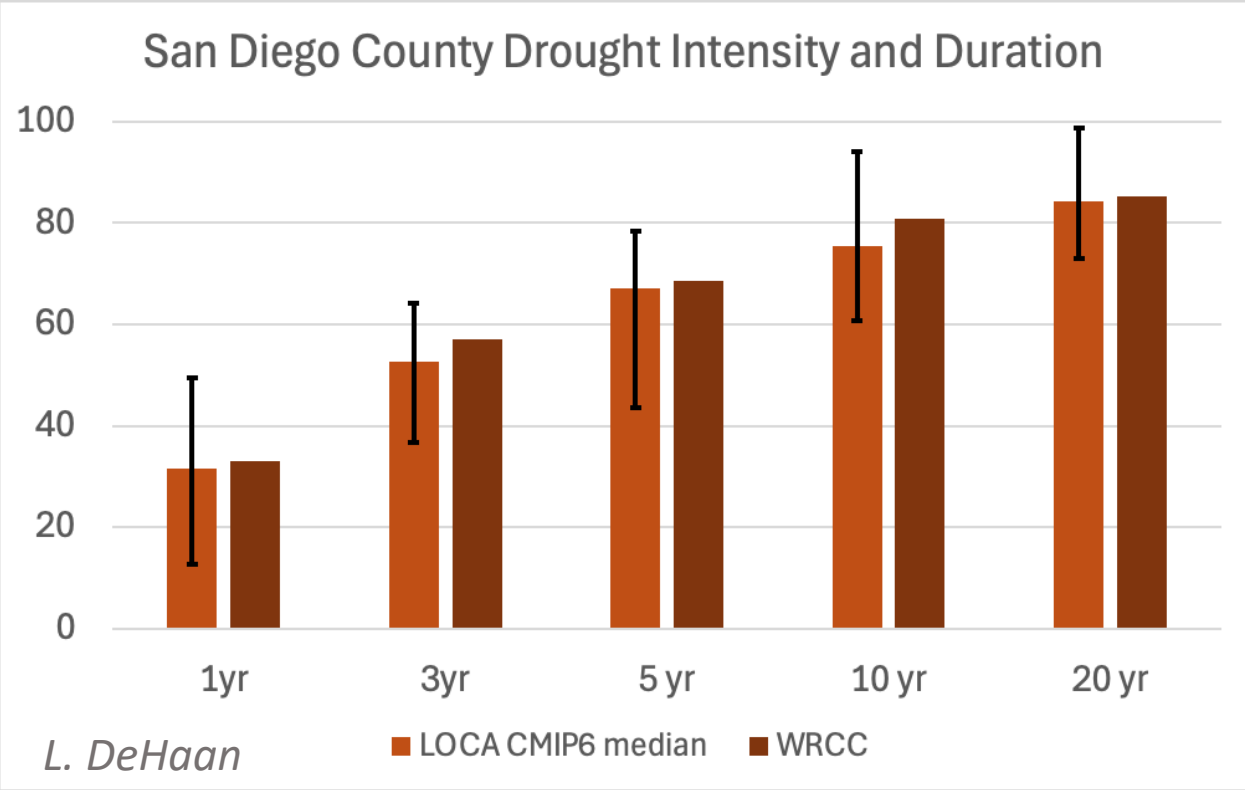

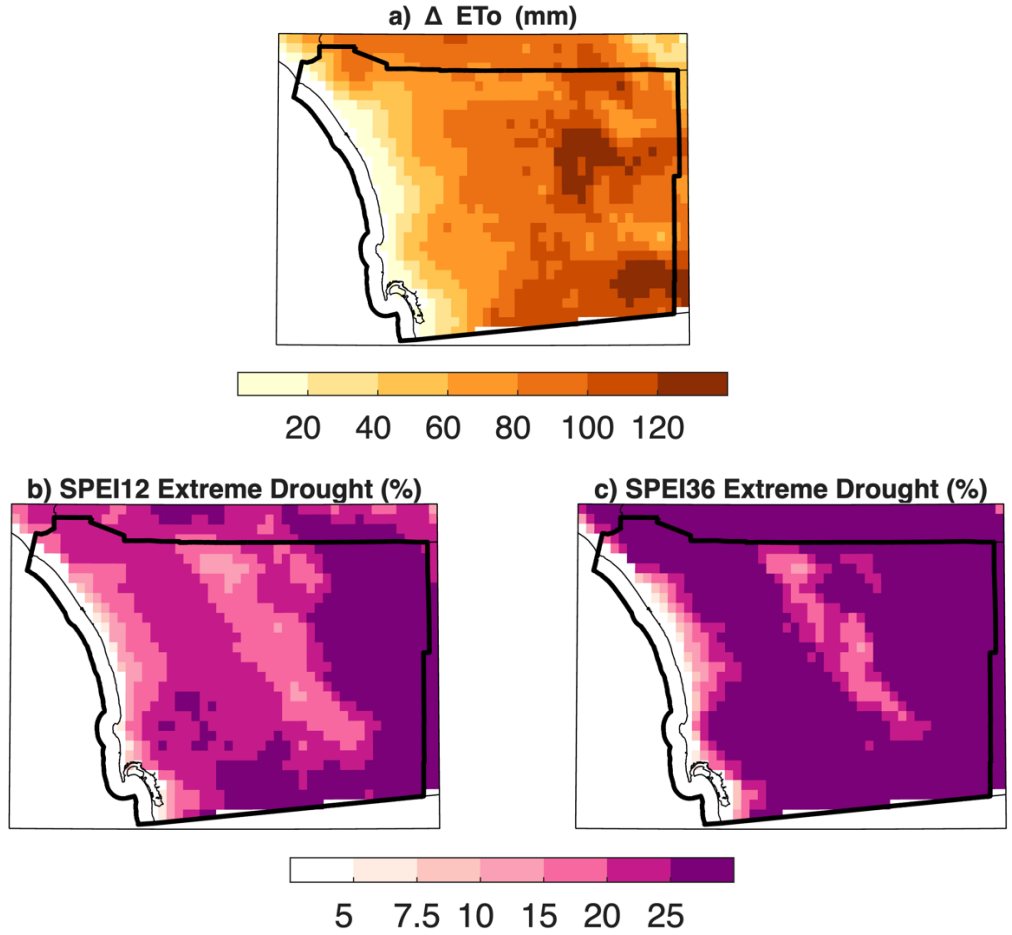

Drought will become 4-5 times worse due to evaporative demand, largely driven by temperature.

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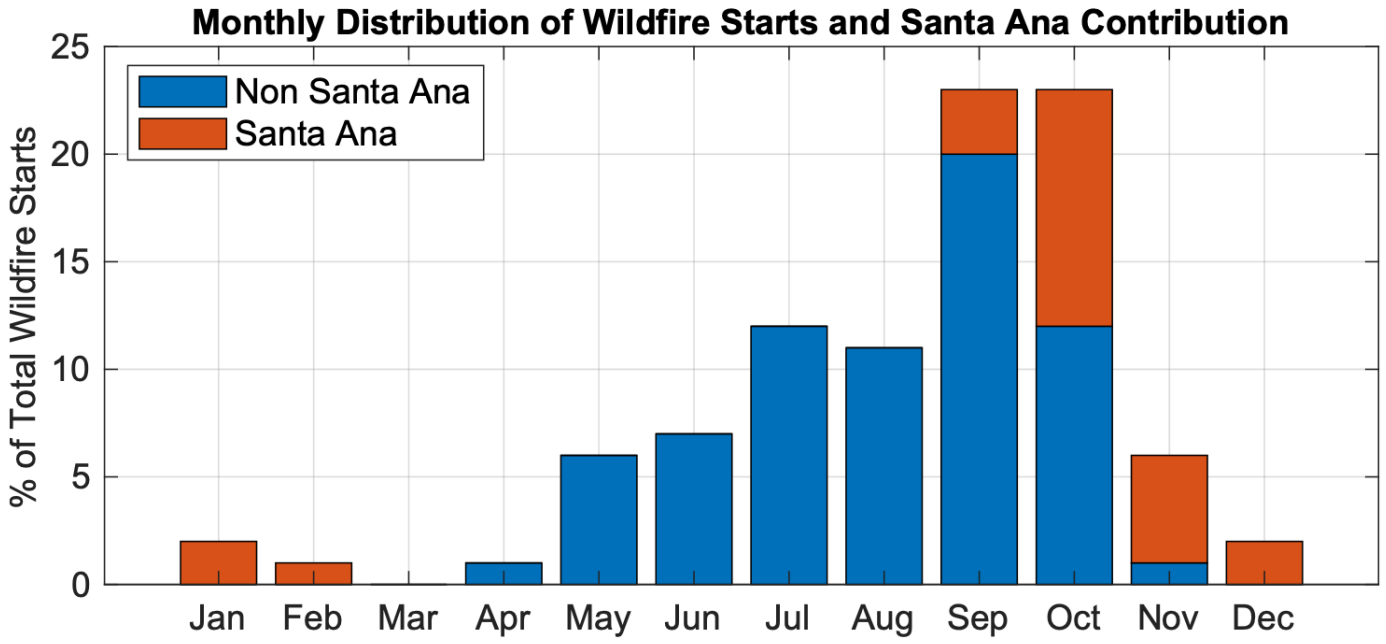
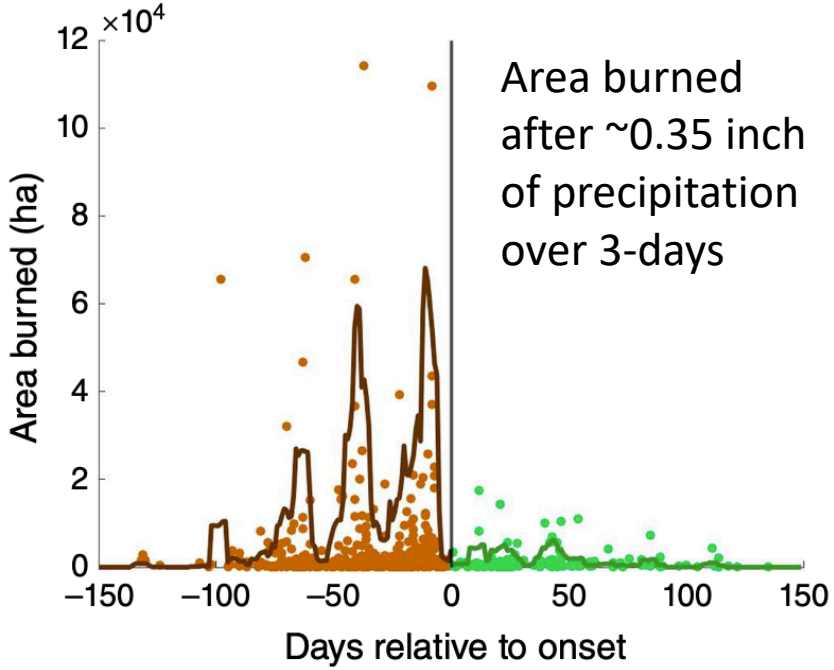
Wildfire Risk

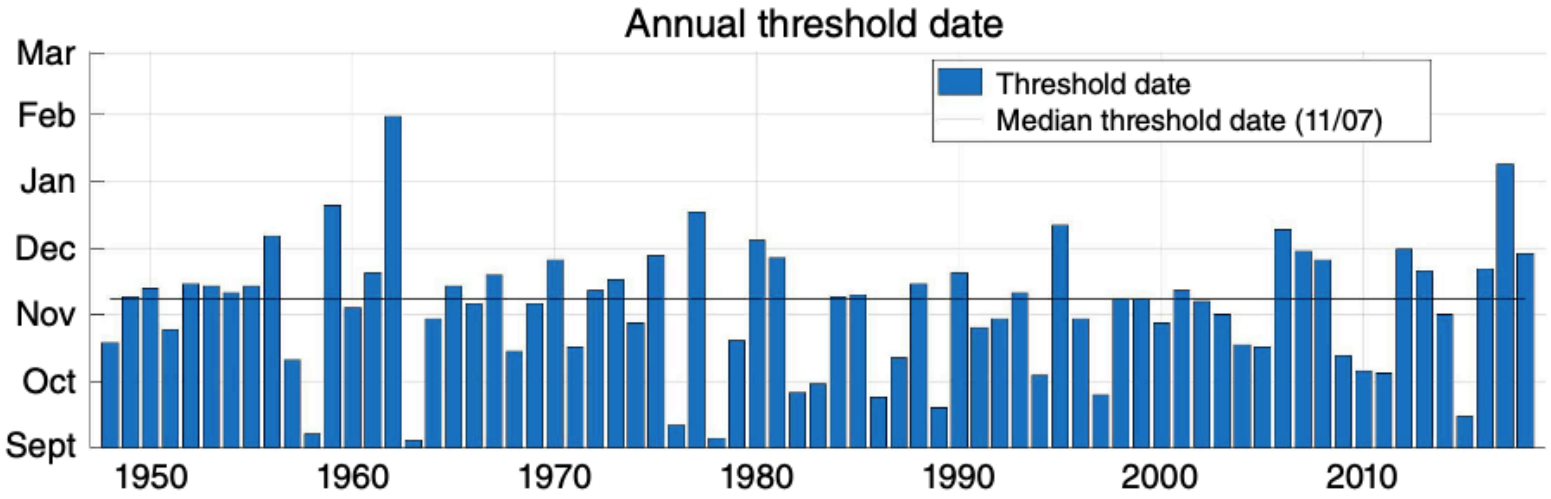


K. Guirguis



Area burned after ~0.35 inch of precipitation over 3-days

Cayan et al., 2022



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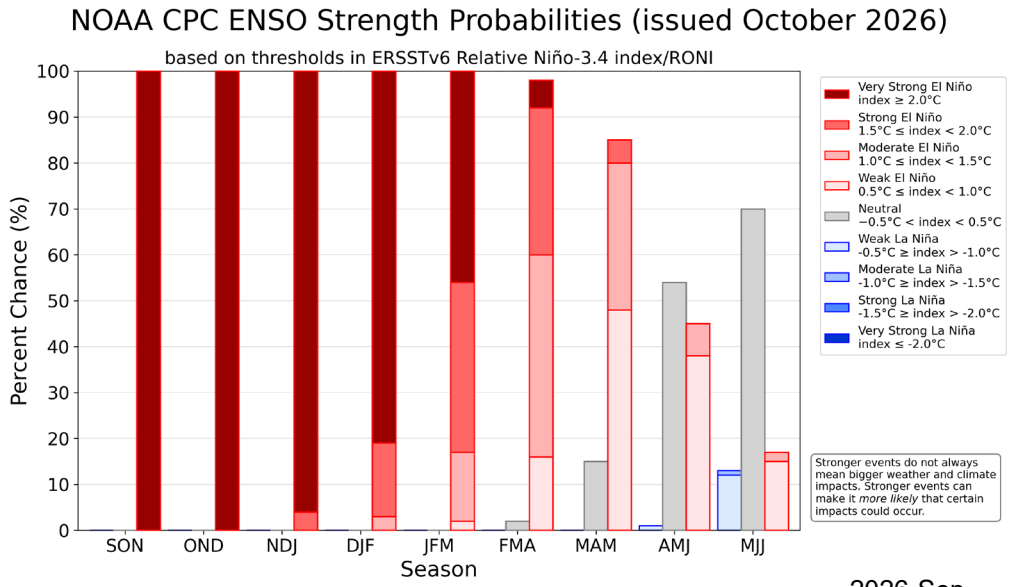
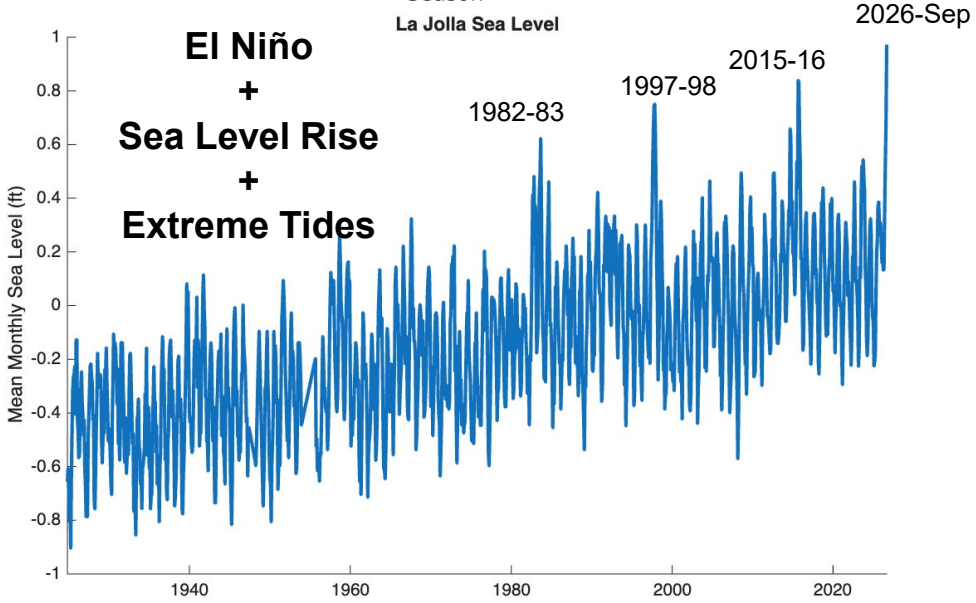
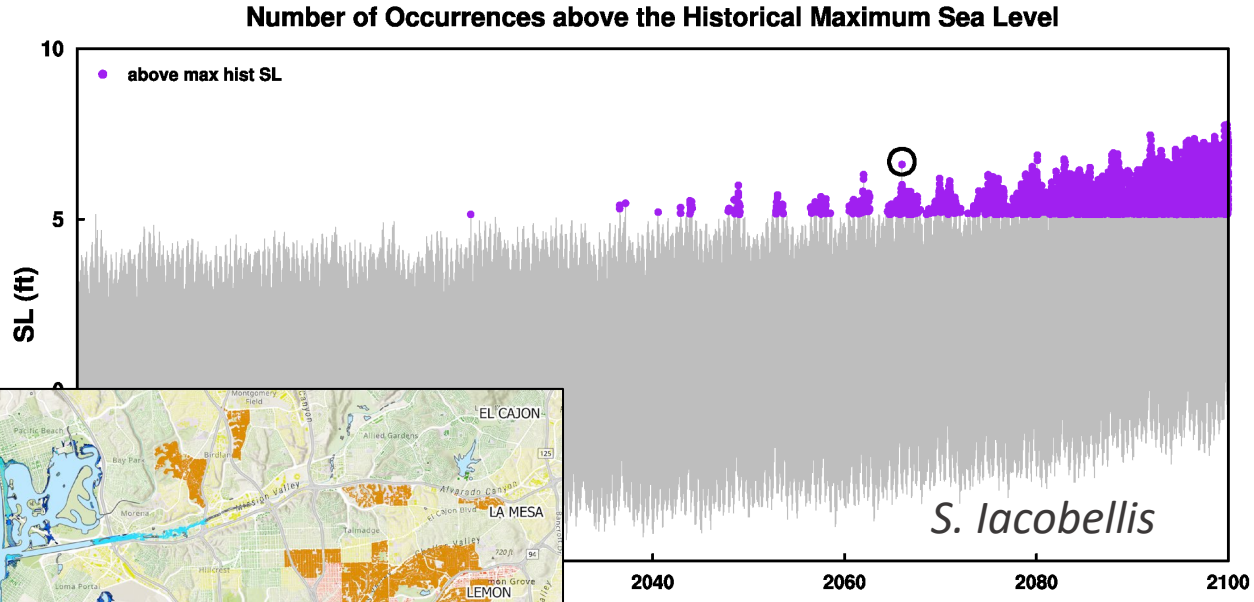
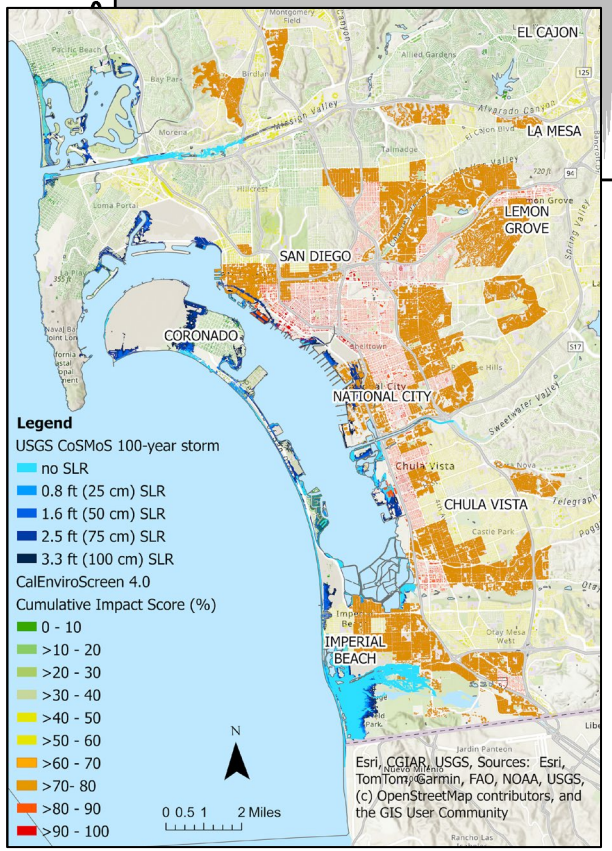
Preparing for El Niño is preparing for Coastal Extremes









D. Pinto

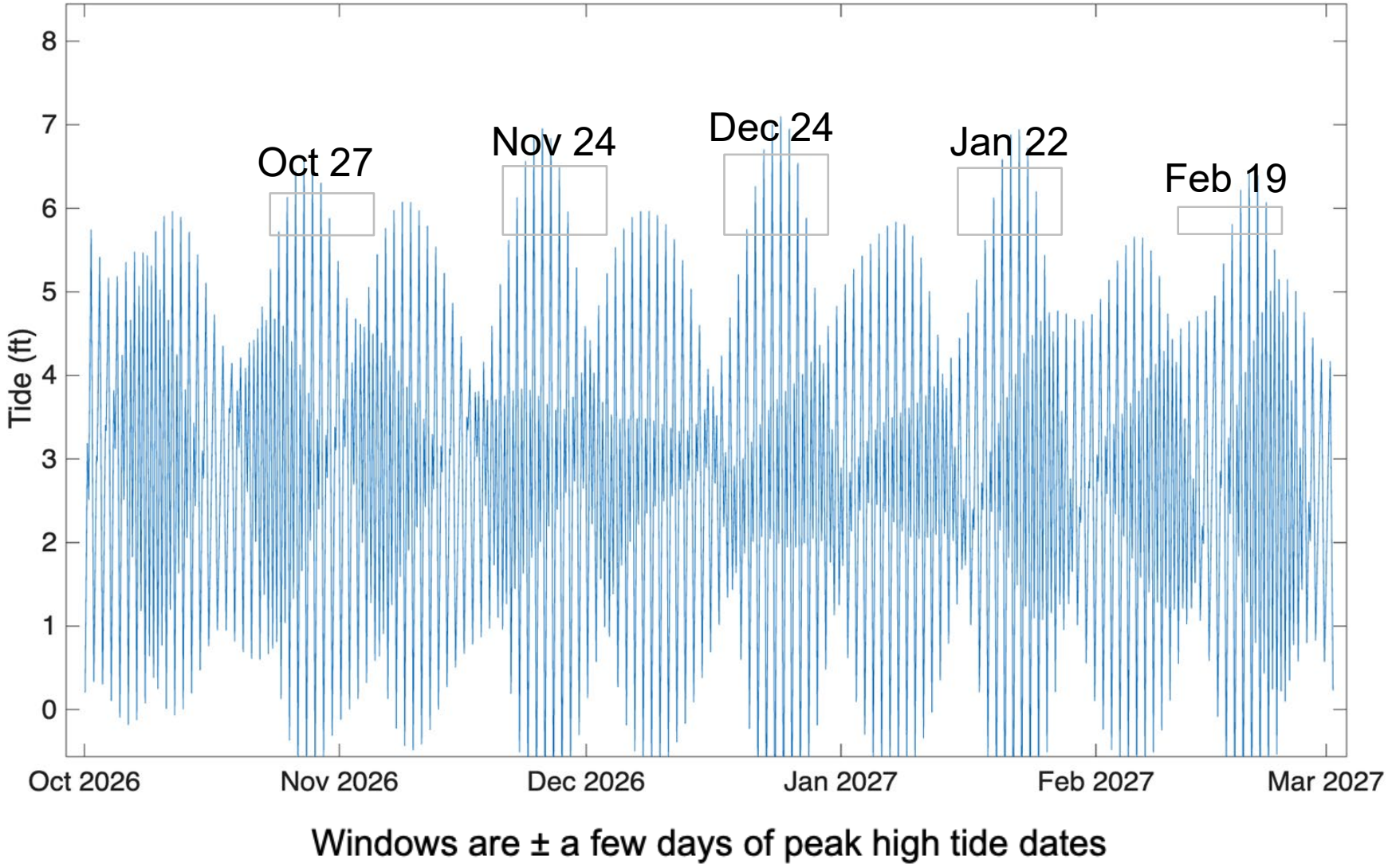
CALIFORNIA'S FIFTH CLIMATE CHANGE ASSESSMENT

Tides & Timing Matters

- Coastal hazards increases when large waves arrive during elevated high tides
- Winter high tides occur in the morning (6-10 am)

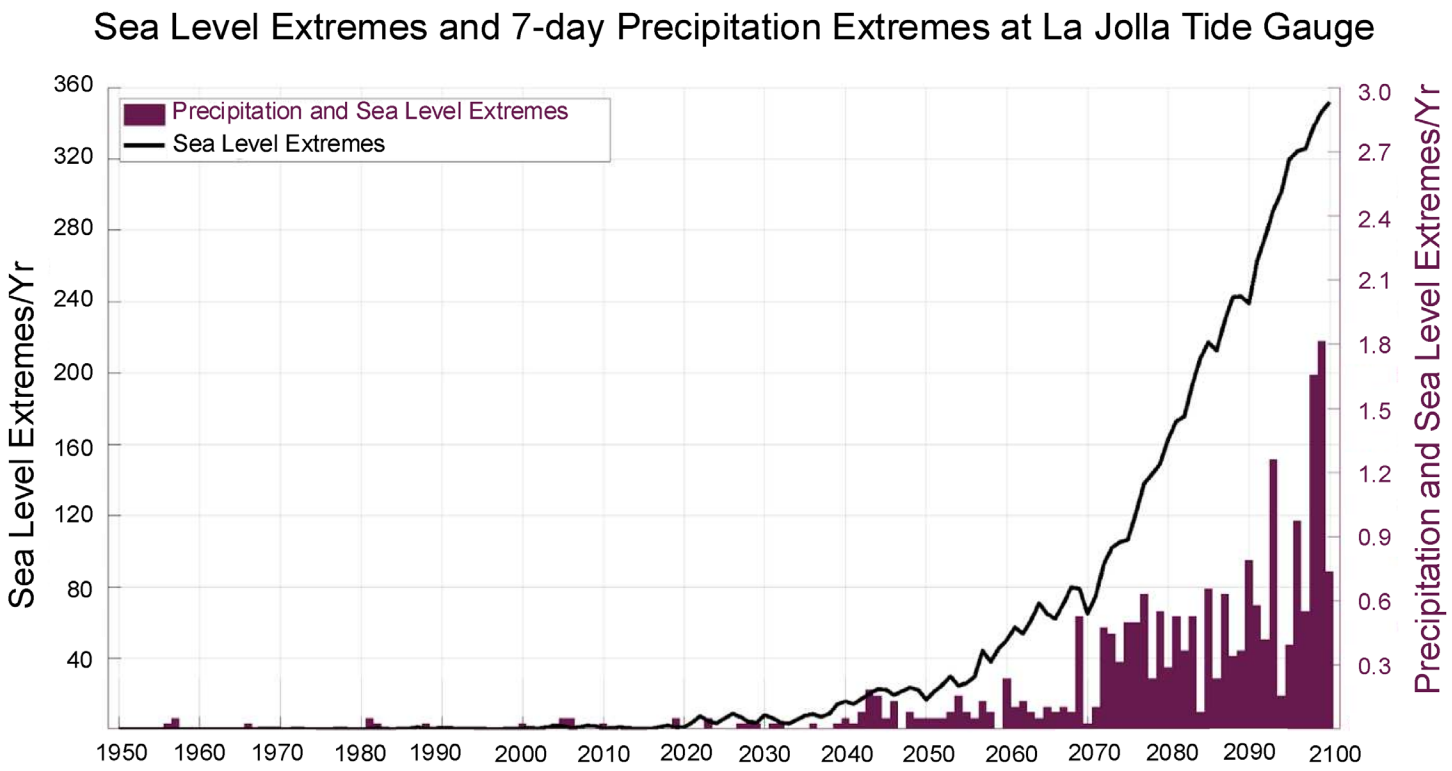


Slide provided by A. Young, SIO



Compound Extremes

Two or more weather/climate events that either co-occur or occur in a certain sequence exacerbating the impact of any one event occurring in isolation



- Coastal flooding and erosion by high tides and big waves compounded by atmospheric river rainfall and runoff along the coast
- Wildfire followed by high intensity precipitation leading to debris flows
- Heatwaves cause by Santa Ana Winds which can cause fires & health impacts from smoke

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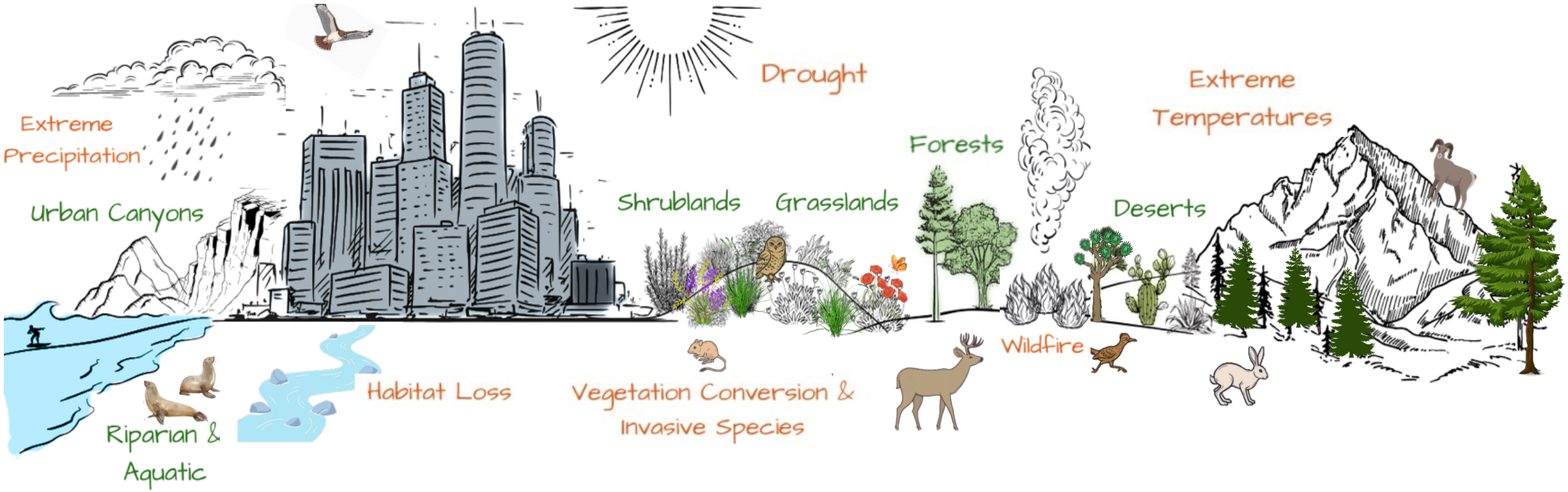
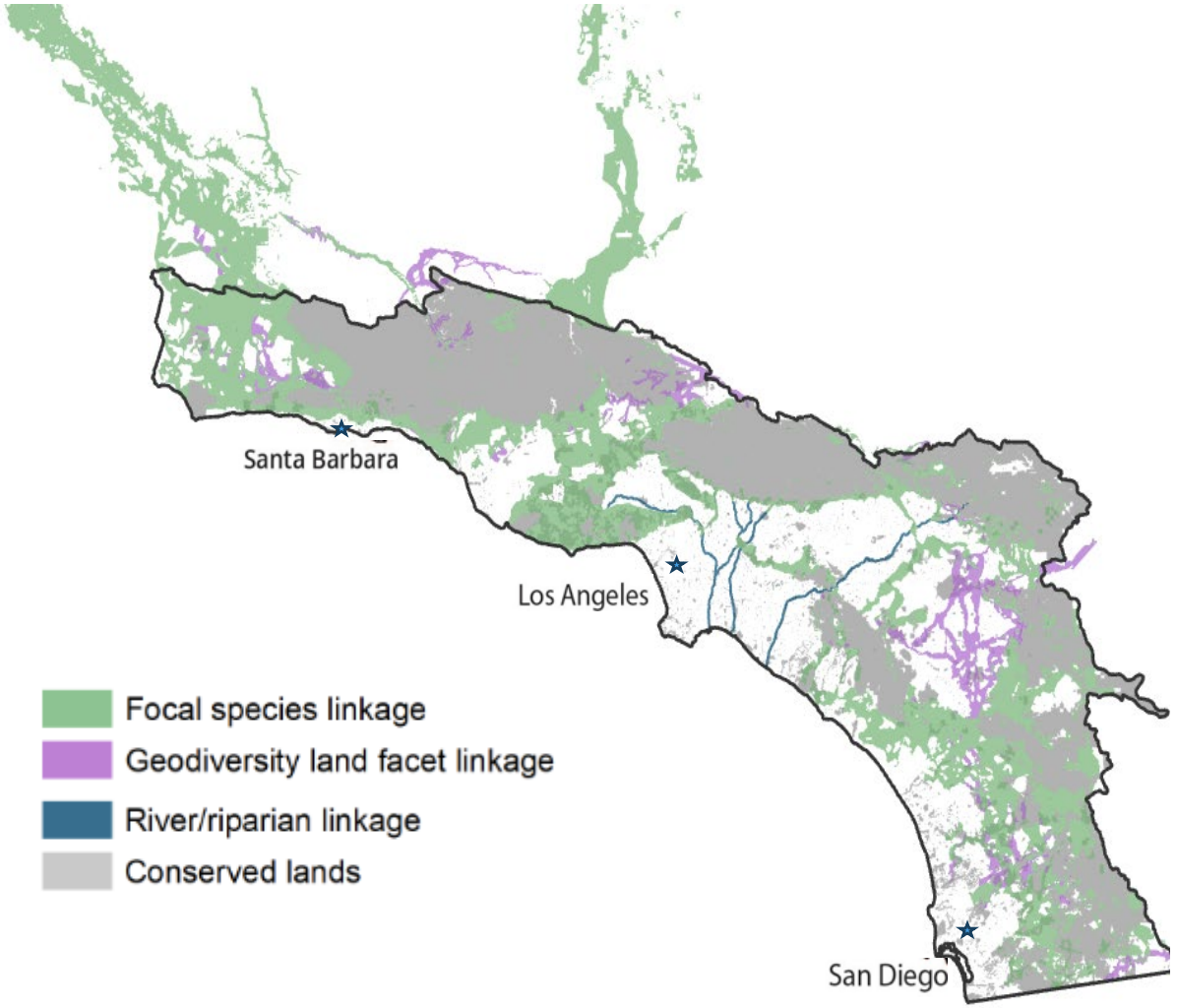
San Diego's Terrestrial Ecosystems and Threats



E. Gay

Climate Adaptation Science

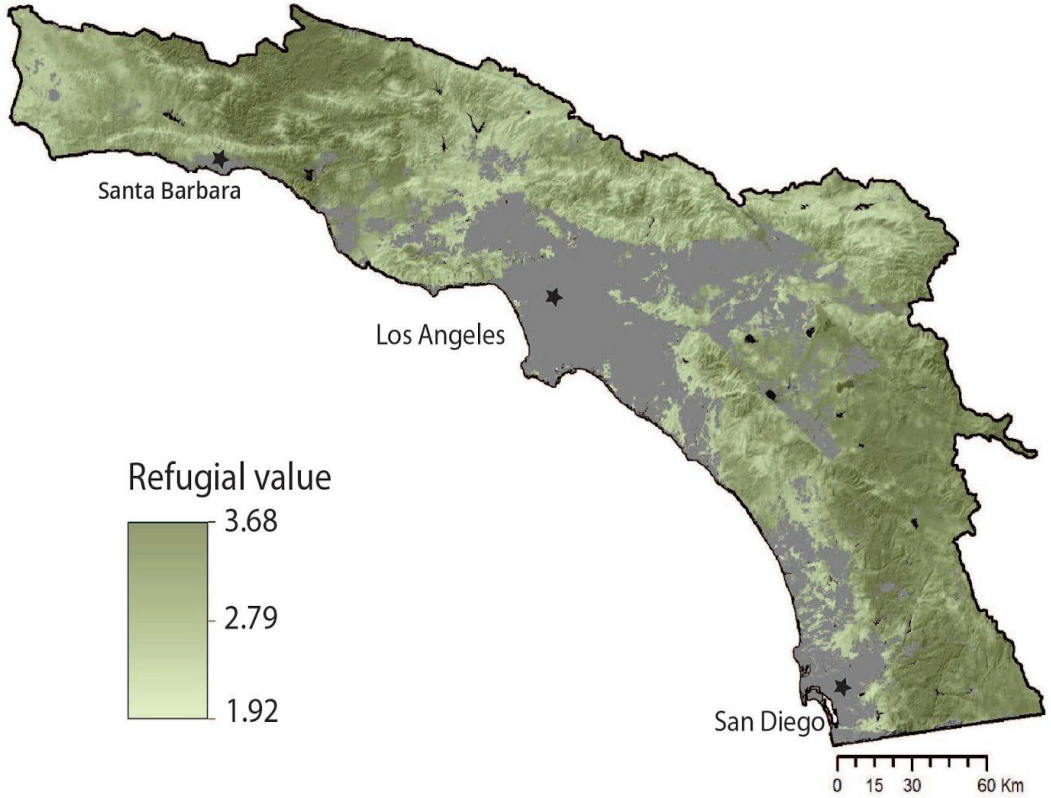


Connectivity

Jennings et al. Land 2020

Refugia

Climate + Fire + Water + Recreation

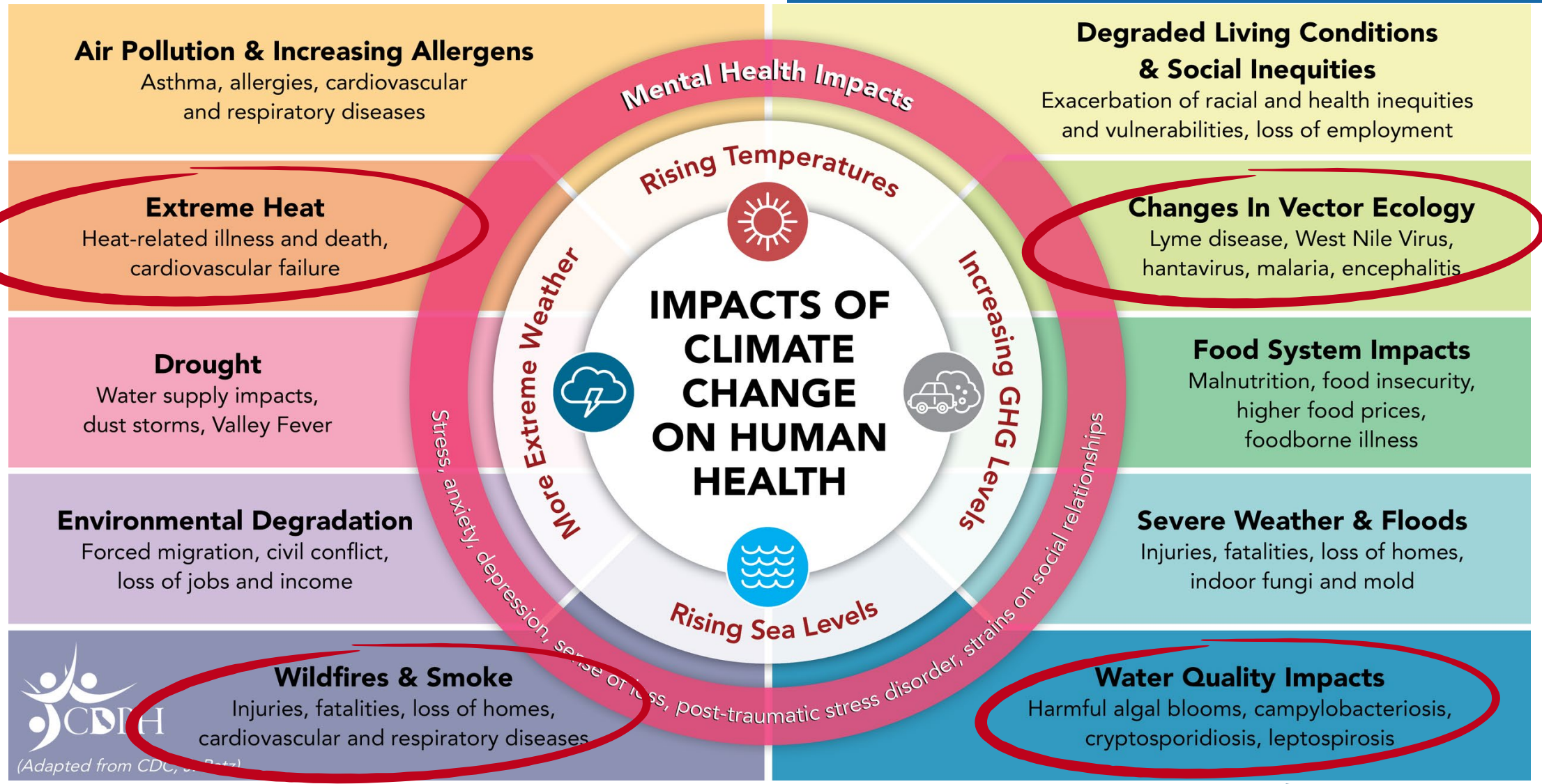


Rojas et al. Cons Bio 2022

M. Jennings

Impacts of Climate Change on Health

Public Health

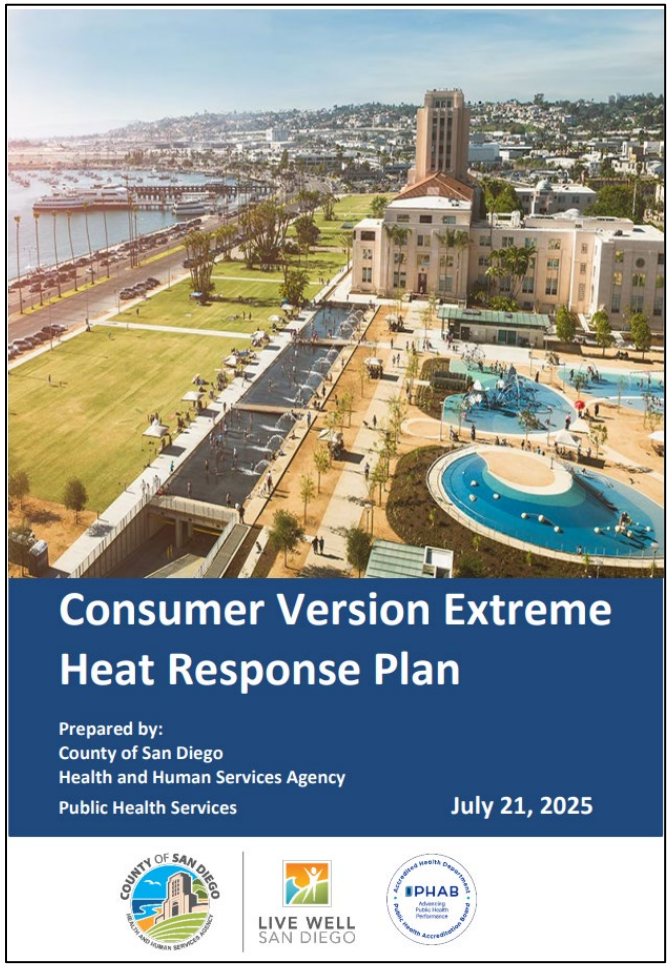


Impacts of Climate Change on Human Health (adapted from the Centers for Disease Control and Prevention (CDC) and J. Patz).

CALIFORNIA'S FIFTH CLIMATE CHANGE ASSESSMENT

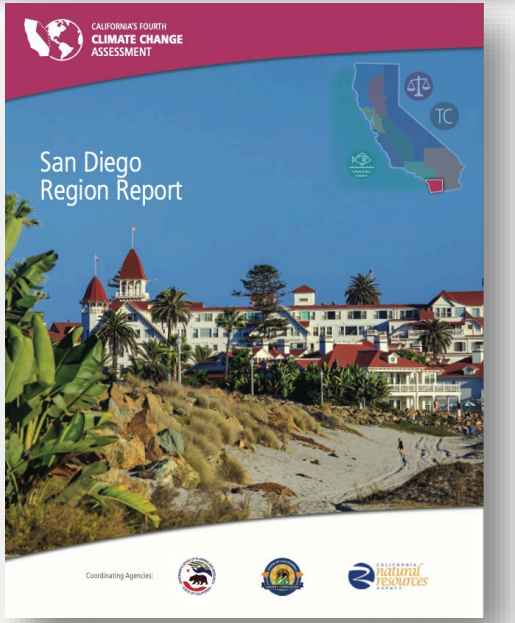
Examples of Local Strategies that Address Health Topics

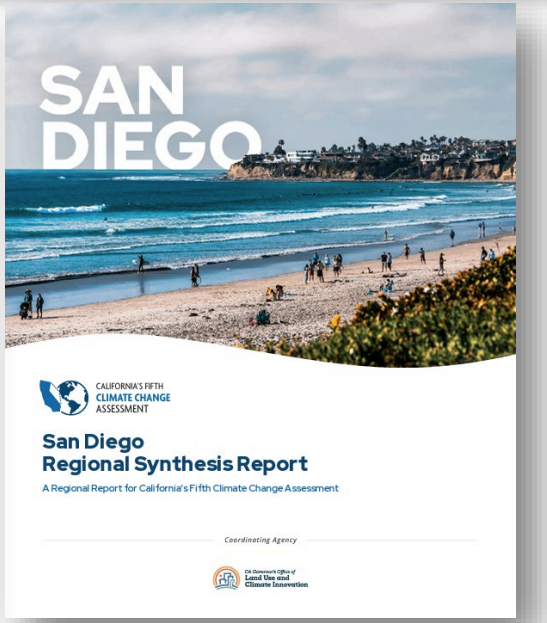
Climate Hazard	Local Climate Adaptation and Resilience Strategies
Extreme Heat	Excessive Heat Response Plan Annual Excessive Heat Report Cool Zone Program
Air Pollution and Wildfire Events	Air Pollution Control District Air Quality Forecast Incident Response Plan Climate Resilient San Diego Plan
Water-borne Diseases	Beach and Bay - Water Quality Program
Infectious and Vector-Borne Diseases	San Diego County Vector Control Program County Reportable Diseases and Conditions by Year One Health Epidemiology Program



Reasons for Optimism

We have accomplished a lot







All of us working together

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ASSESSMENT

Extra Slides



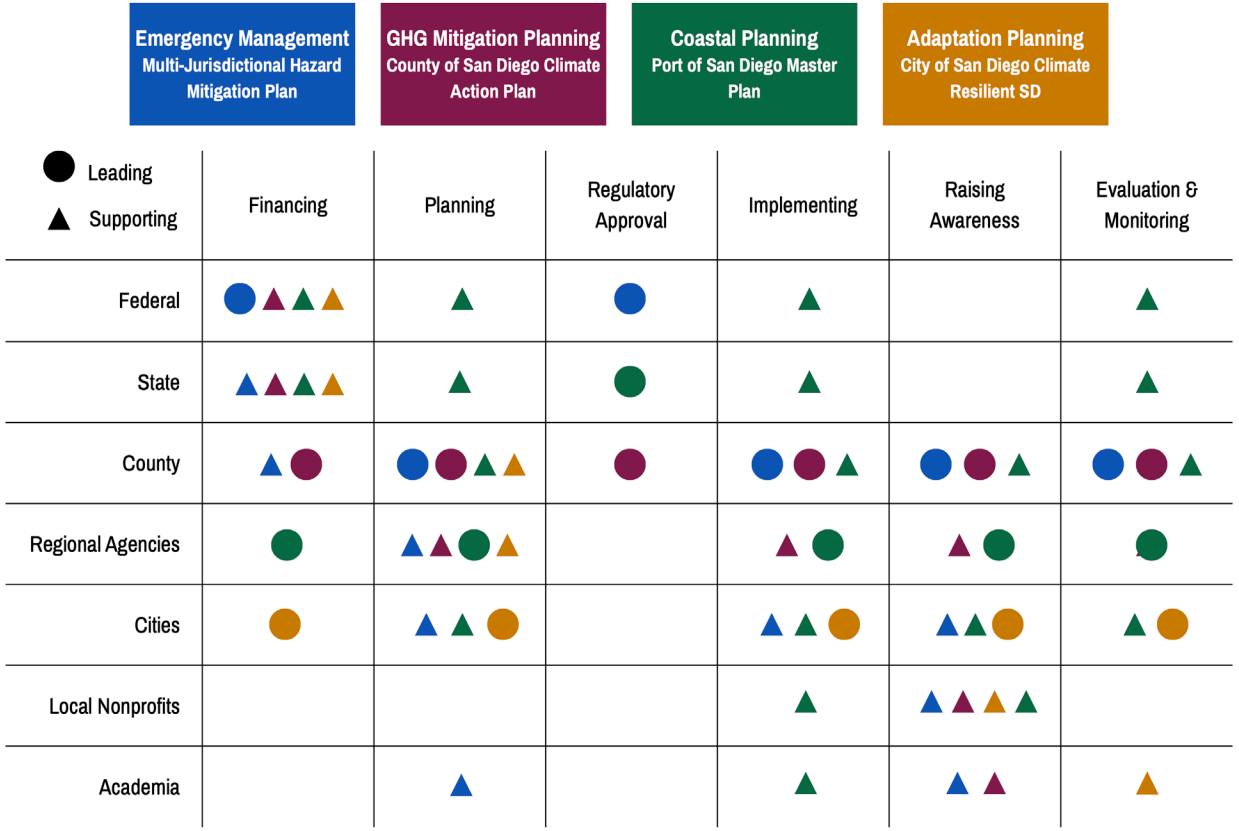
Importance of Governance

A critical component resilience is a strong governance framework that enables cross-jurisdictional and collaborative projects, including securing the necessary funding for implementation.

Regional Roles and Partnership

Streamlined Governance Structure

- San Diego is single county and a single council of governments.
- Facilitates more effective coordination among county, cities and other agencies.



Roles played by different levels of government, regional agencies, community-based organizations, and academia across a set of climate-related plans.

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Moving Forward

- Clearly defined roles and responsibilities
- Increase capacity of local government
- Leverage regional plans to strengthen local adaptation efforts
- Develop standardized metrics to assess resilience, however this can be complex and challenging
- Regional collaboration and strong governance foundational to adaptation success



Key Sectors Driving the Region's Economy



Defense | Healthcare | Biotech | Higher Ed | Agriculture | Tourism | Cross-Border Trade

- The region has evolved into a diverse, innovation-driven economy anchored by high-tech industries, education, healthcare, the military, and tourism.
- There are strong cross-border ties to Baja California which have been shaped by military investment, higher education, and cross-border advanced manufacturing.
- The high cost of living and housing affordability strain residents, with disproportionate impacts on low-income communities. Rising temperatures, sea level rise, wildfires, and shifting precipitation increase costs across sectors, disrupt infrastructure, and deepen inequities.
- Both market-driven responses (insurance adjustments, technological innovation) and public interventions (climate-smart housing, resilient infrastructure) are needed. Strategic investment in adaptive infrastructure, equitable workforce participation, and energy transition can turn climate risk into long-term opportunity.

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Looking Ahead



INSURANCE & RESILIENCE MARKETS

- Insurers are shifting to risk-based pricing — rewarding mitigation (e.g., wildfire home-hardening) with lower premiums. That payoff creates real, paying demand for resilience retrofit contractors, resilient materials, and mitigation-assessment services.
- Insurers retreating from the highest-risk areas (leaving the FAIR Plan as backstop) leaves a coverage gap — room for new entrants (parametric insurance, state programs, insurtech) to build products that didn't exist before.



PUBLIC INVESTMENT OPPORTUNITIES

- Hardening the grid, water systems, and transportation network means sustained public construction, engineering, and workforce spending — the same kind of investment that built San Diego's military-tech and education economy in the first place.
- Smart-growth housing and transit investment can cut costs and climate exposure for lower-income residents while expanding the tax base — resilience and equity paying off together, not traded off.
- Rebates and incentives (efficiency retrofits, undergrounding, EV infrastructure) pull private capital into new local industries built around meeting them.

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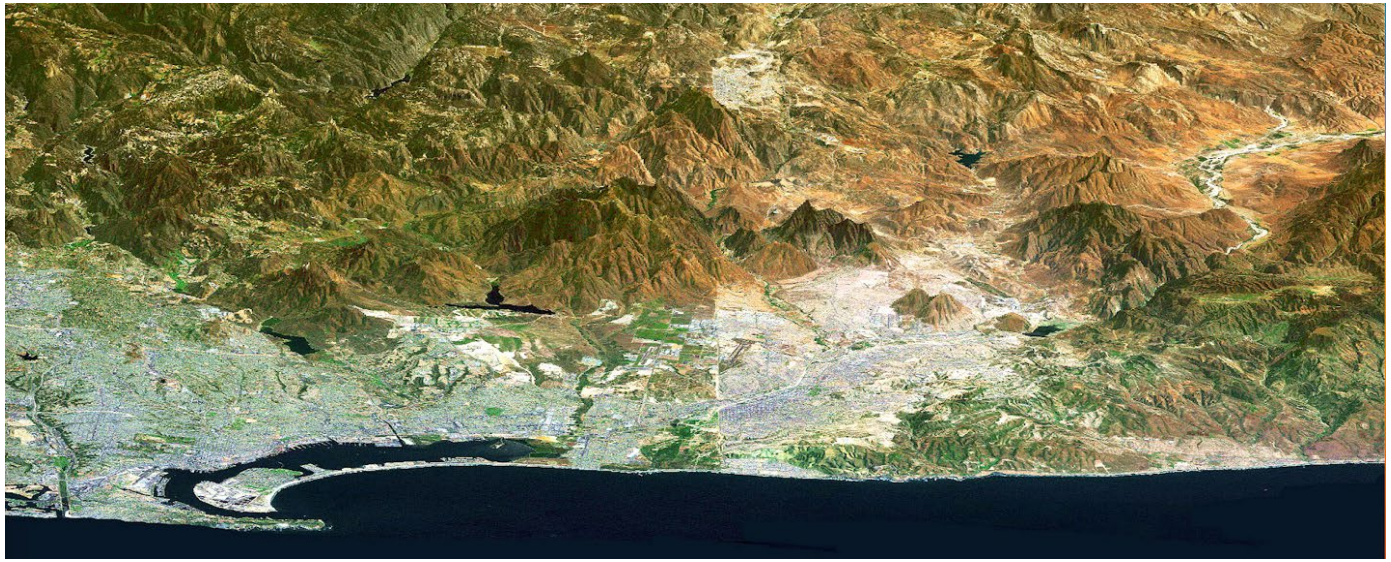
San Diego and Baja California Cross-Border Resilience

- Strengthening plurinational resilience to climate extremes depends on binational cooperation across shared watersheds, ecosystems, and cultural ties.
- Expansion of real-time data sharing and integration of ecological, hydrodynamic, and socioeconomic models to guide adaptation across the Cali-Baja
- Funding and collaboration are central to moving resilience forward though often require different structures and mechanisms than in San Diego alone, and must include Indigenous Stewardship.



- Largest integrated economic zone on the US-Mexico border
- 7 million people and a GDP of $250 billion
- One the most pressing issues are wastewater treatment systems operate beyond capacity producing contaminant levels that exceed water quality standards

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Climate Risk Is Already Hitting the Economy



WATER: Drought raises dependence on expensive imported water; heavy precipitation causes flash flooding that damages homes, roads, and utilities.



SEA LEVEL RISE: Coastal assets and property face damage and rising insurance premiums. Airport, port, and wastewater infrastructure need costly adaptation — maritime and tourism generate ~$14B in combined economic activity and are particularly exposed.



HEAT: Extreme temperatures reduce labor productivity and strain electrical grids. Low-income residents lacking cooling access face elevated illness risk and cost.



WILDFIRE: 15 of California's 20 most destructive fires have occurred since 2015. Insurers are retreating from fire-prone areas — prompting a $1B FAIR Plan bailout and a $2B SDG&E rate increase for mitigation.

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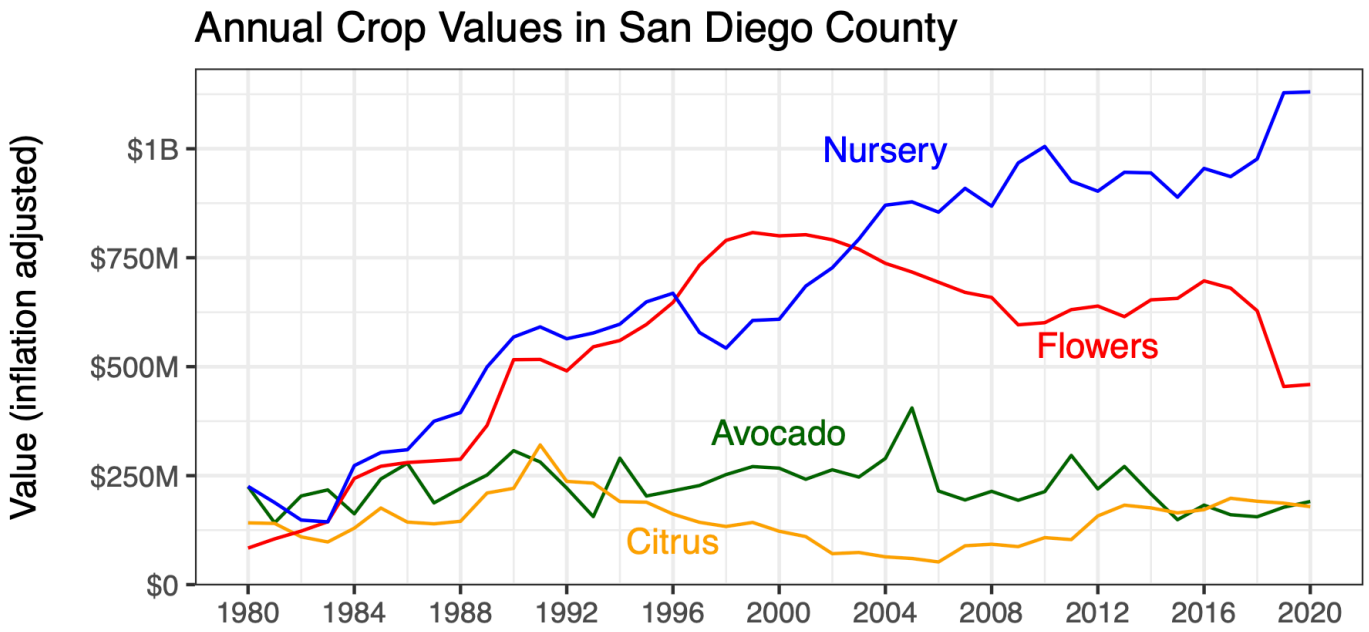
Agriculture in San Diego

- In 2023, agricultural production totaled $1.7 billion across 210,732 acres (County of San Diego, 2023a)
- More small farms than any other county in the U.S. (San Diego County Farm Bureau, 2025)
- Fishing industry - over 60 species - annual value exceeding $10 million (County of San Diego, 2019b)
- 842 school gardens, at least 78 community gardens



Inflation-adjusted annual crop values in San Diego County for major agricultural commodities. Figure provided by Tom Corringham.

A. Quandt

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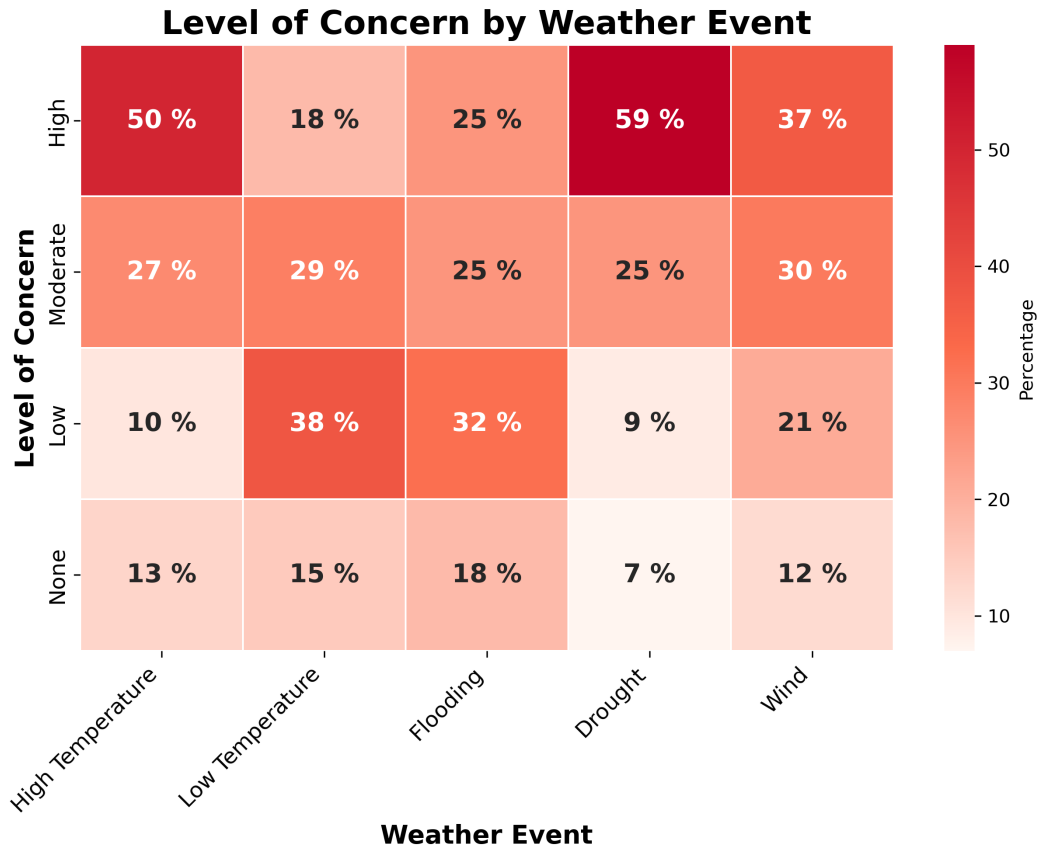
Impacts on Agriculture and Food Systems



Description of farmer concern levels for five extreme weather events in San Diego County. Figure provided by Bross, 2024.

- Water scarcity and cost
- Interrupted indigenous food systems
- Reduced urban food security
- Aquatic food systems – species range shifts, marine heatwaves, harmful algal blooms, increasingly severe storms

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Adaptation Strategies

- Irrigation system efficiency
- Improved soil management
- Diversifying crops
- Agroforestry
- Revitalization of indigenous-led agriculture
- Food sovereignty and traditional ecological knowledge
- Community and school gardens
- 35% tree cover by 2035





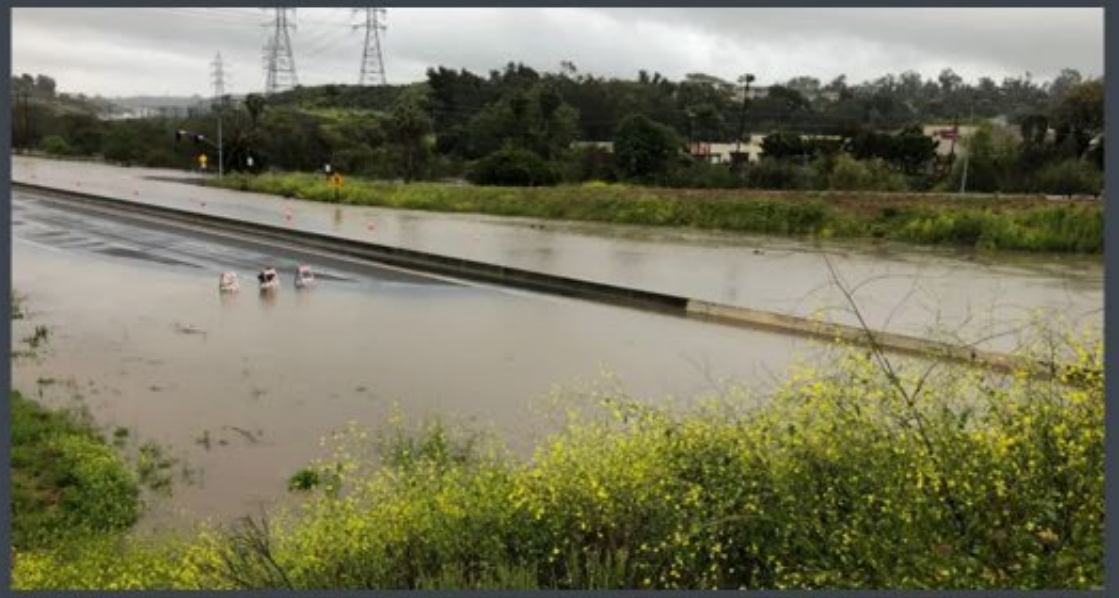
A. Quandt

Transportation: Vulnerability

The San Diego Regional Transportation System is vulnerable to climate stressors that impact all modes of transportation. Key threats include changes in temperature and precipitation, wildfires, sea level rise, cliff erosion, and storm surge









R. Allen

Transportation: Adaptation



Since the Fourth California Climate Assessment, state, regional, tribal, and local entities have invested significant resources towards assessing their region and transportation systems' specific climate vulnerabilities and adaptation strategies.

R. Allen