

The Disproportionate Effects of Drought on Drinking Water Quality

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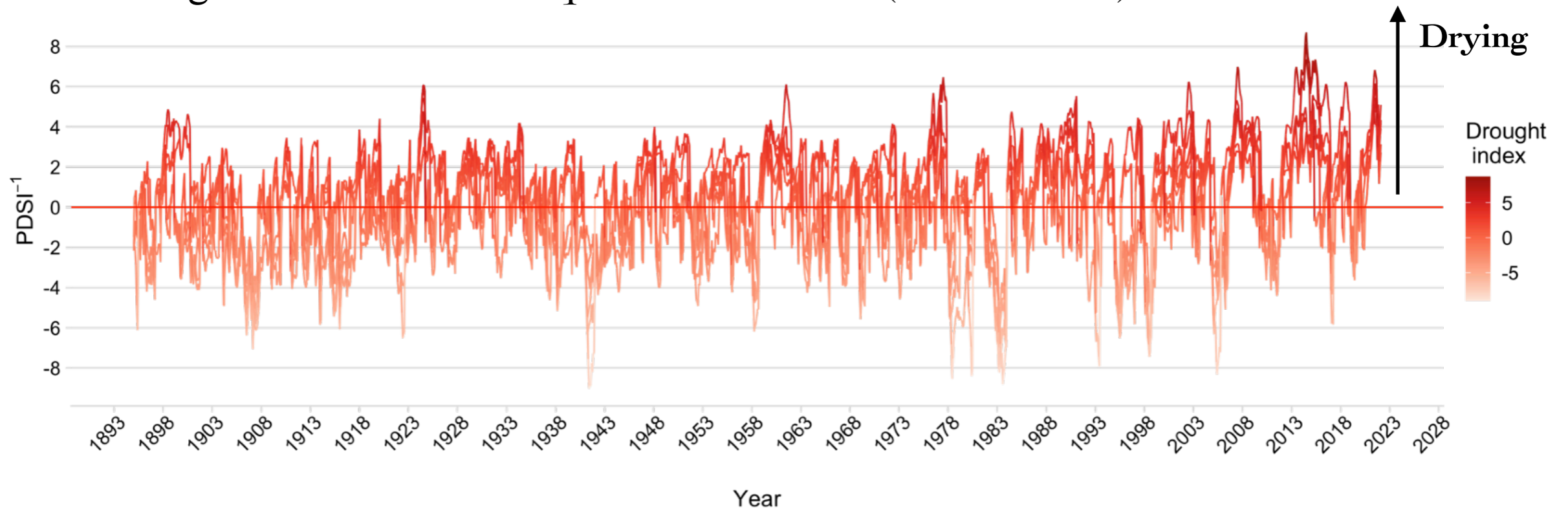
May 22, 2023

A Central Coast Regional Equity Initiative project



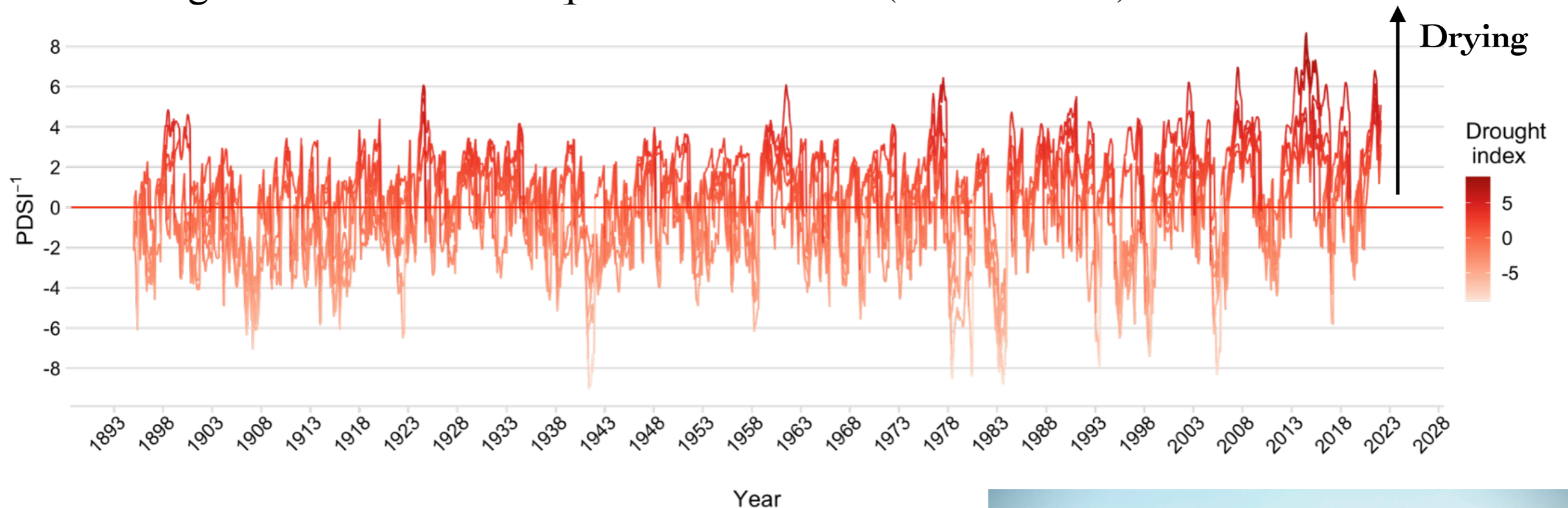
Motivation

- ▶ Drought is a prolonged period of abnormally low rainfall, frequently compounded by high temperature
- ▶ Drought will be more frequent and severe (IPCC, 2021)



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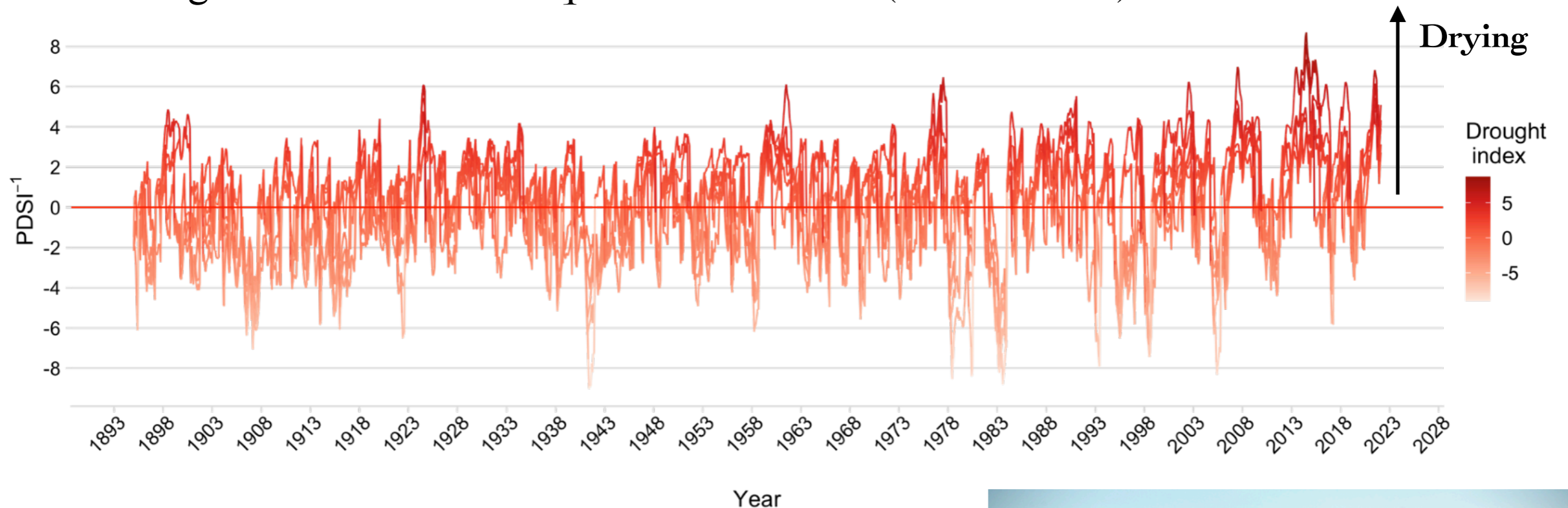
- ▶ Economic costs of drought
 - Water shortages → agricultural losses and domestic water supply disruptions
 - Heat related health and socioeconomic costs



Credit: Gregory Urquiaga/UC Davis

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 - Heat related health and socioeconomic costs
 - **Changes in drinking water quality**



Defining drinking water quality

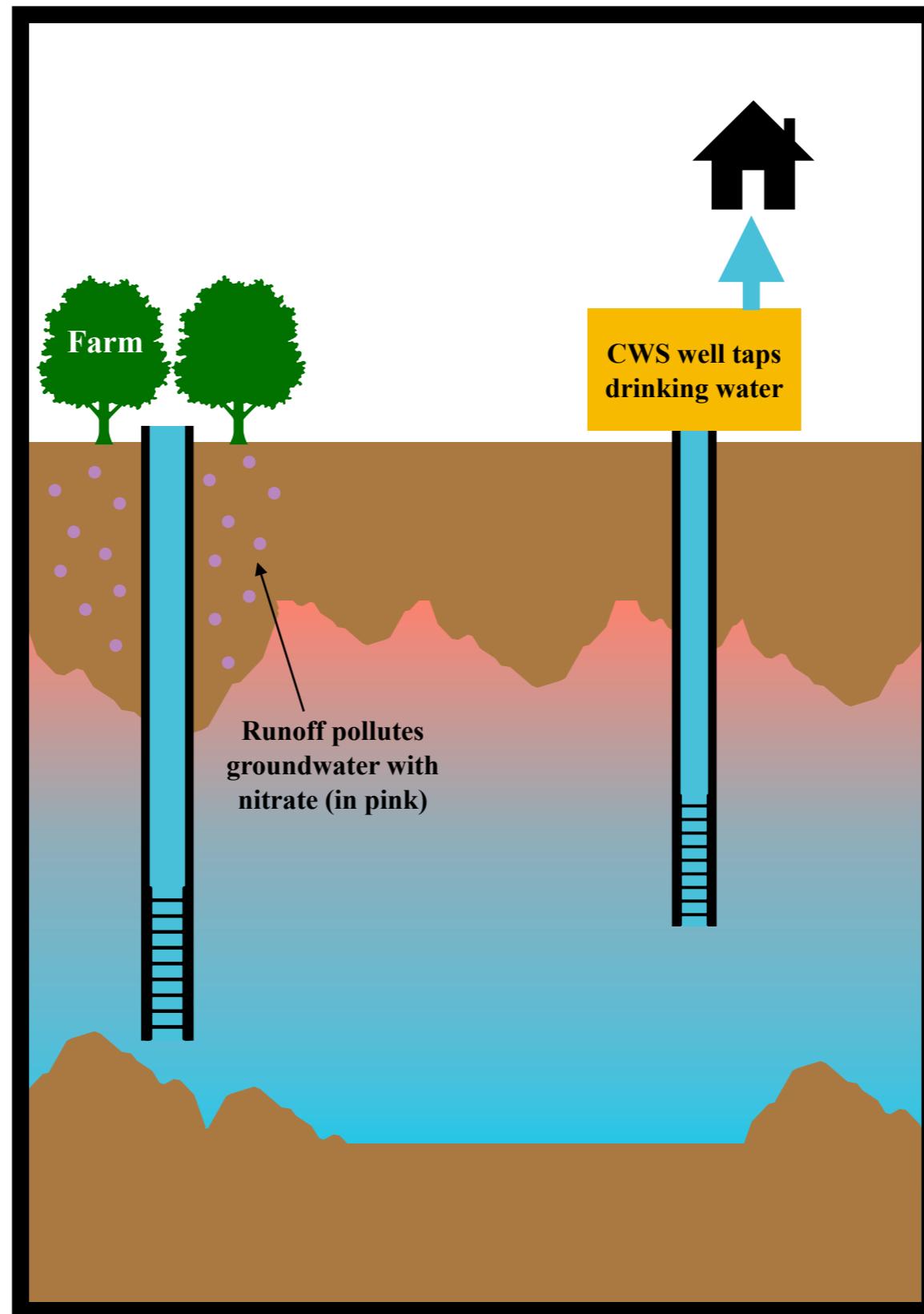


Source: Community Water Center

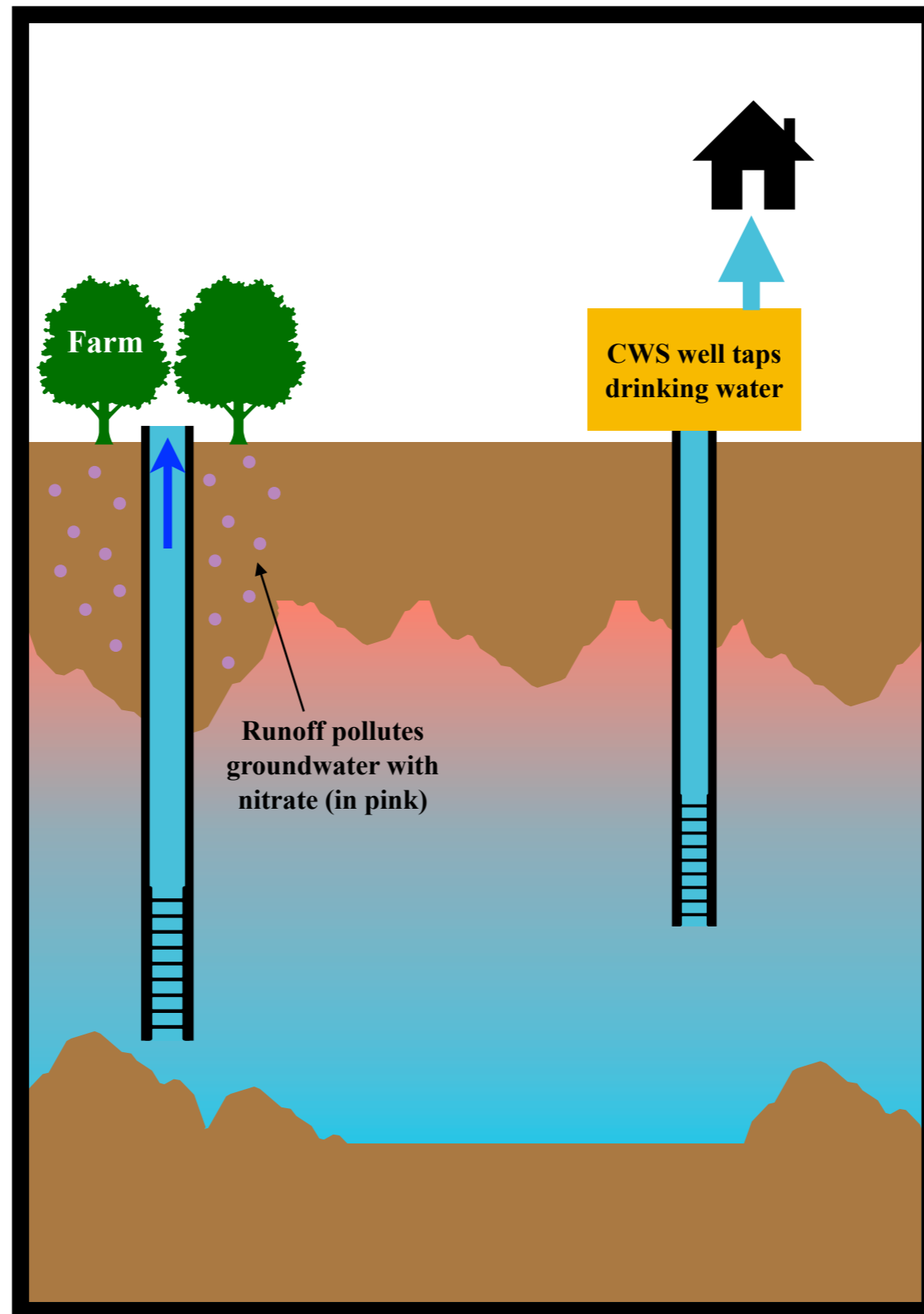
Nitrates (MCL: 10mg/l)

- ▶ Anthropogenic: 90% from agricultural and waste systems
- ▶ Infant methemoglobinemia; birth defects and developmental outcomes in children; cardiovascular diseases

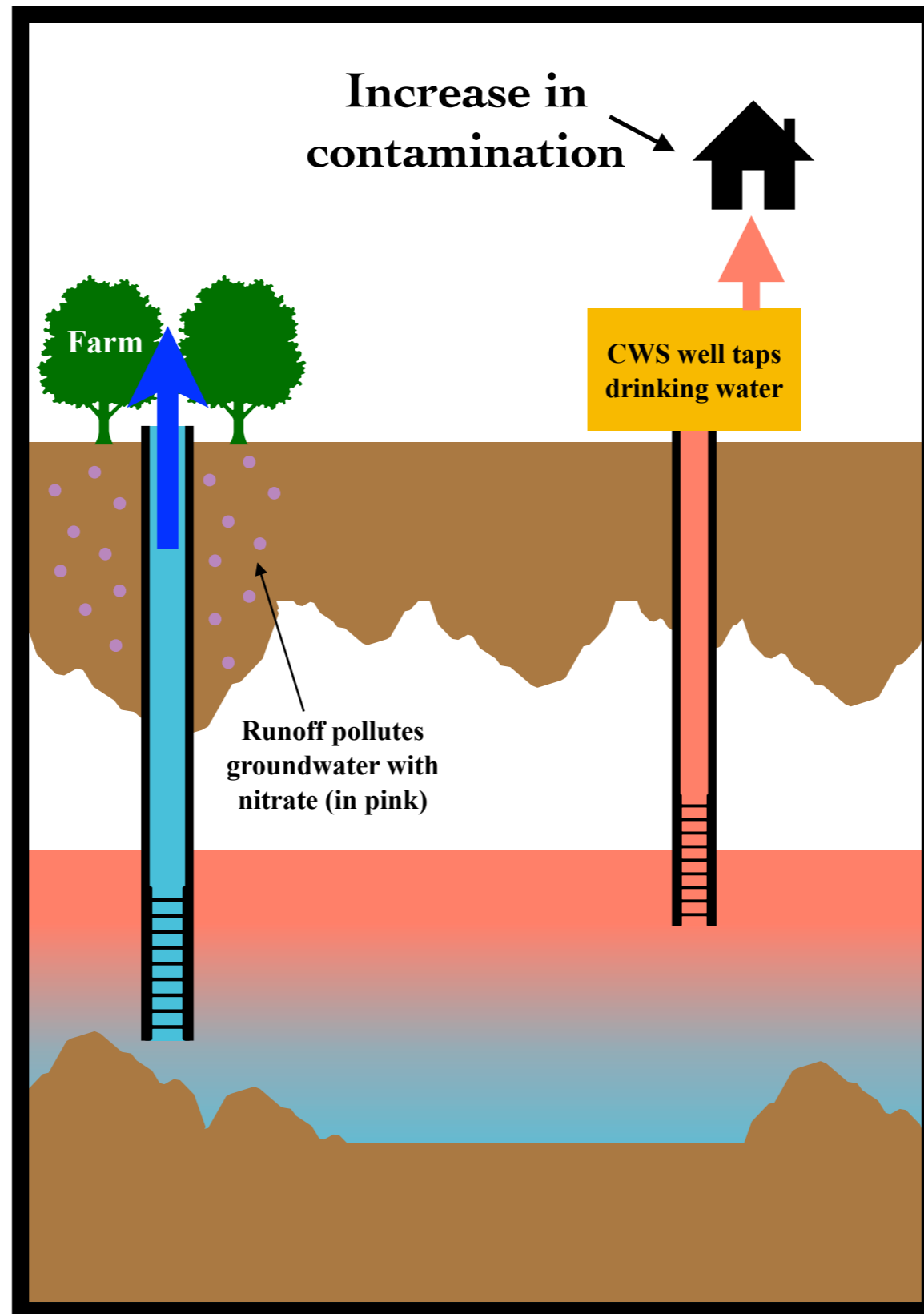
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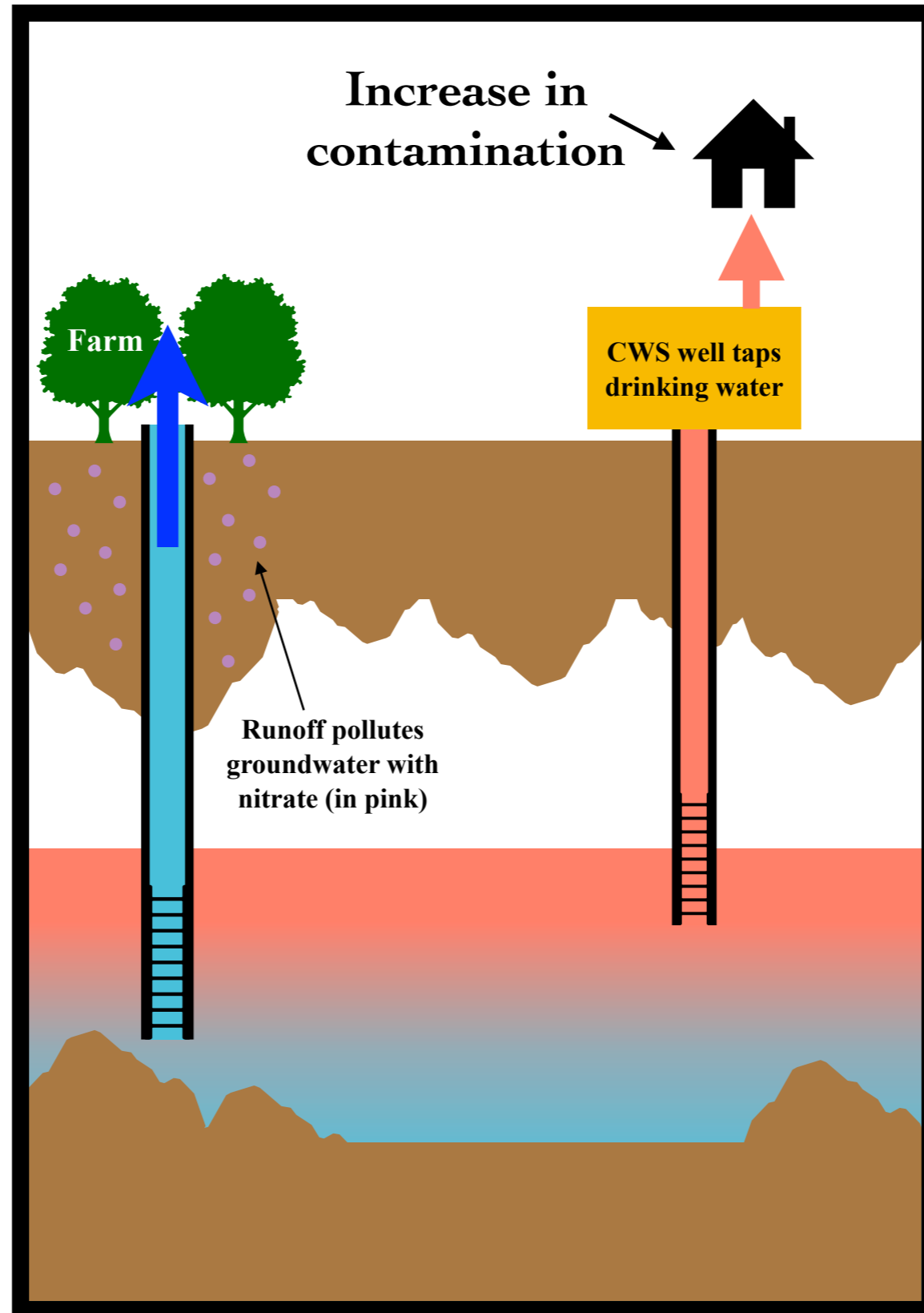


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Common pool resource:
Pumping not only depletes amount of water for everyone else, it also worsens the quality for users who drink it



Mechanisms for drought's impact on surface water quality

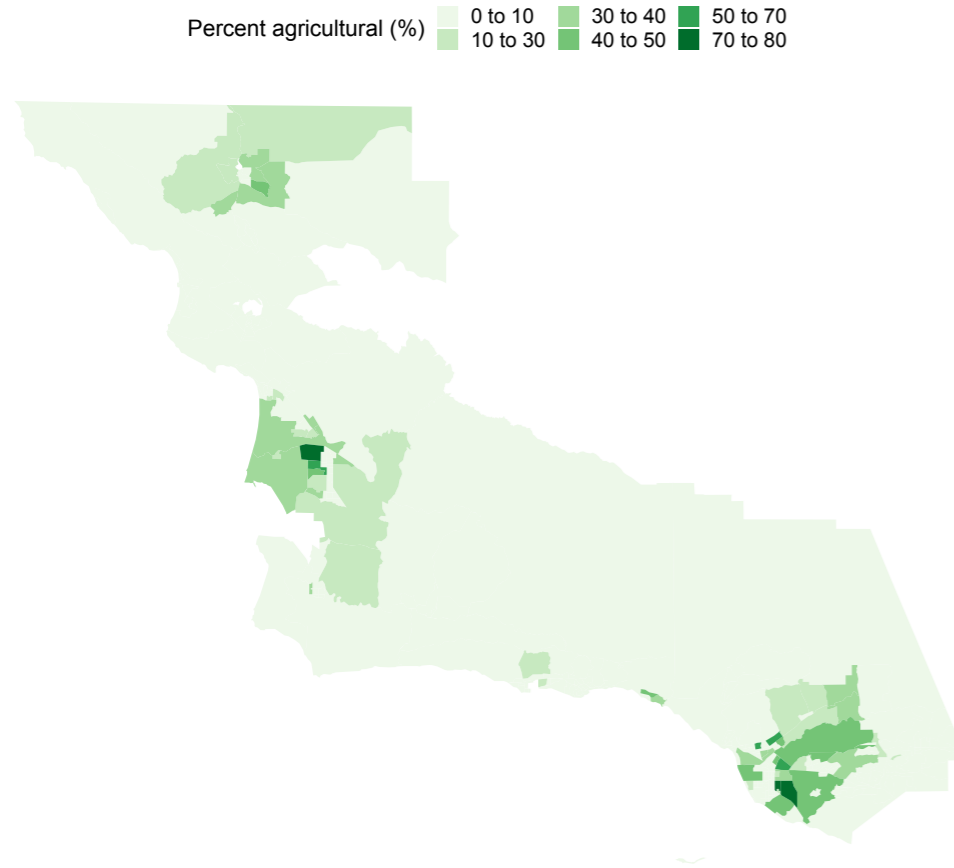


Mechanisms for drought's impact on surface water quality



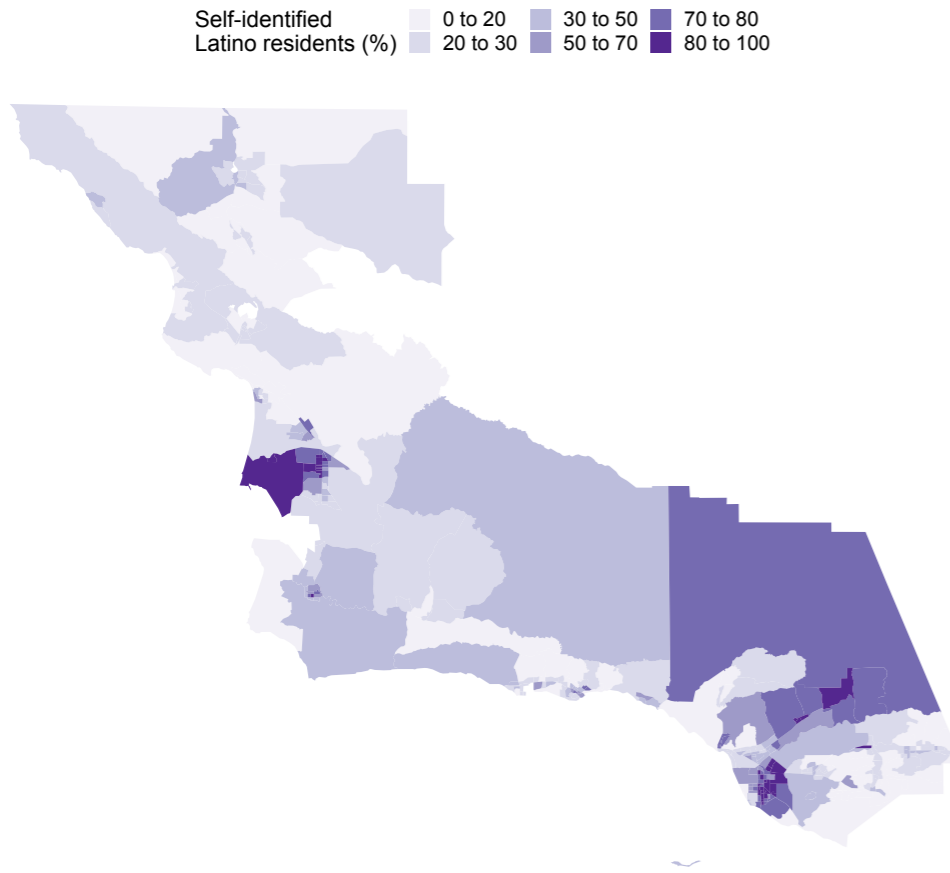
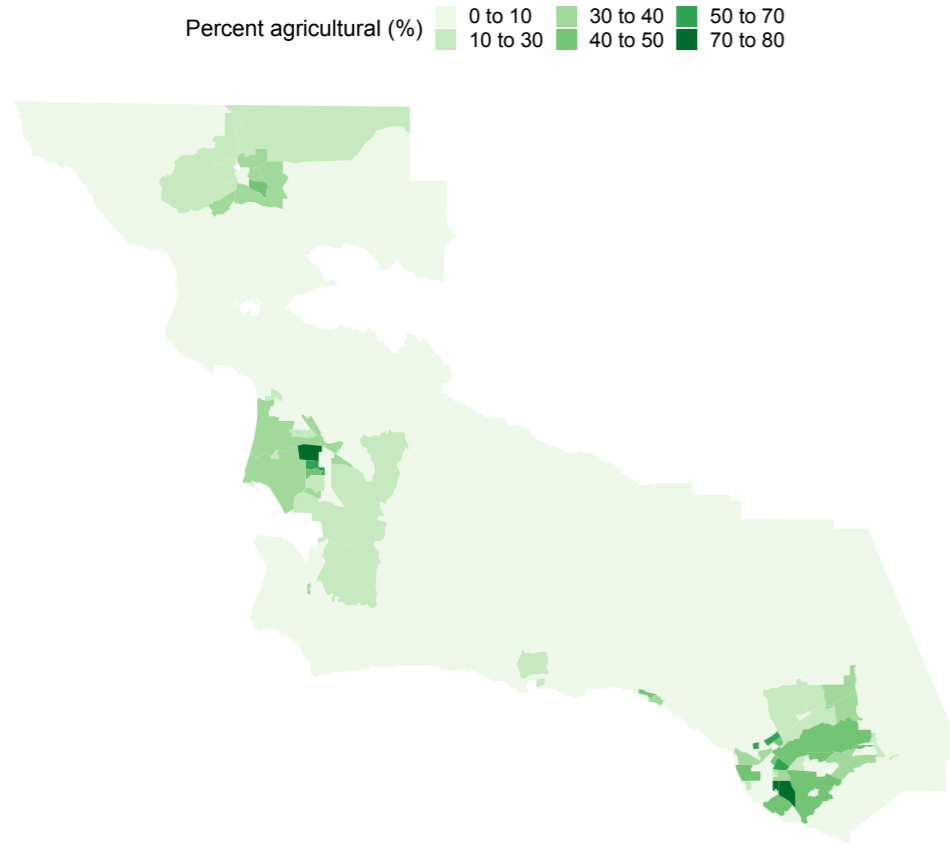
**Drop in precipitation leads to
increasing concentration of
contaminants**

Central Coast and drinking water contamination



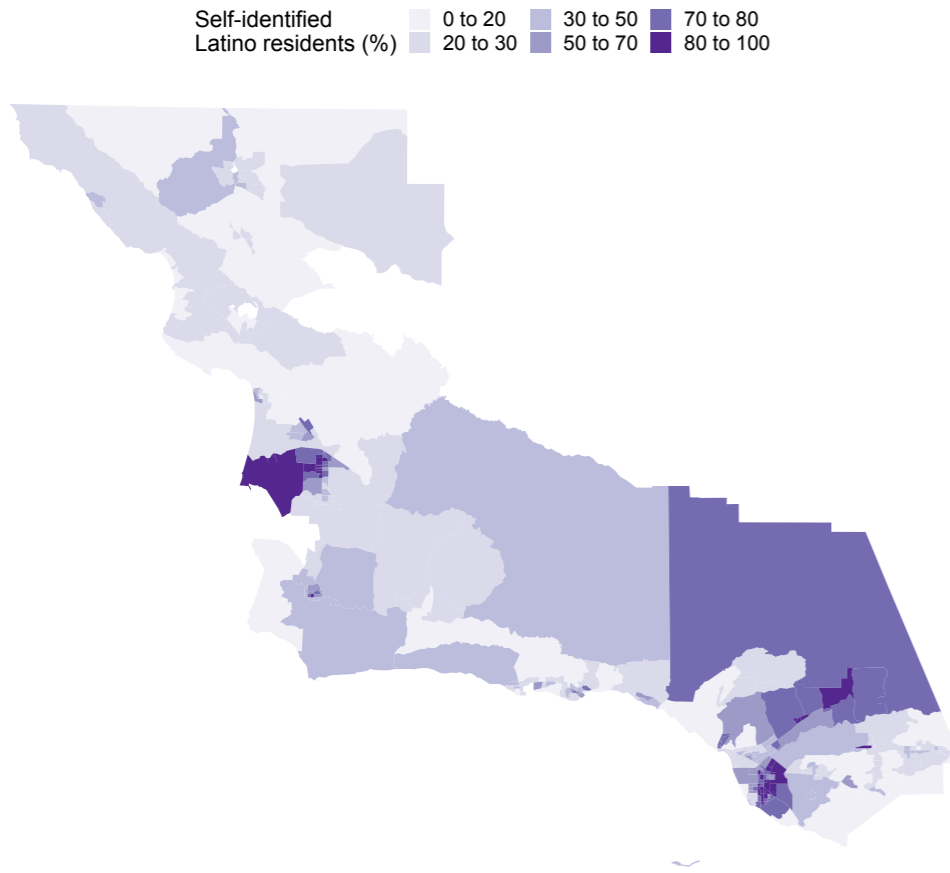
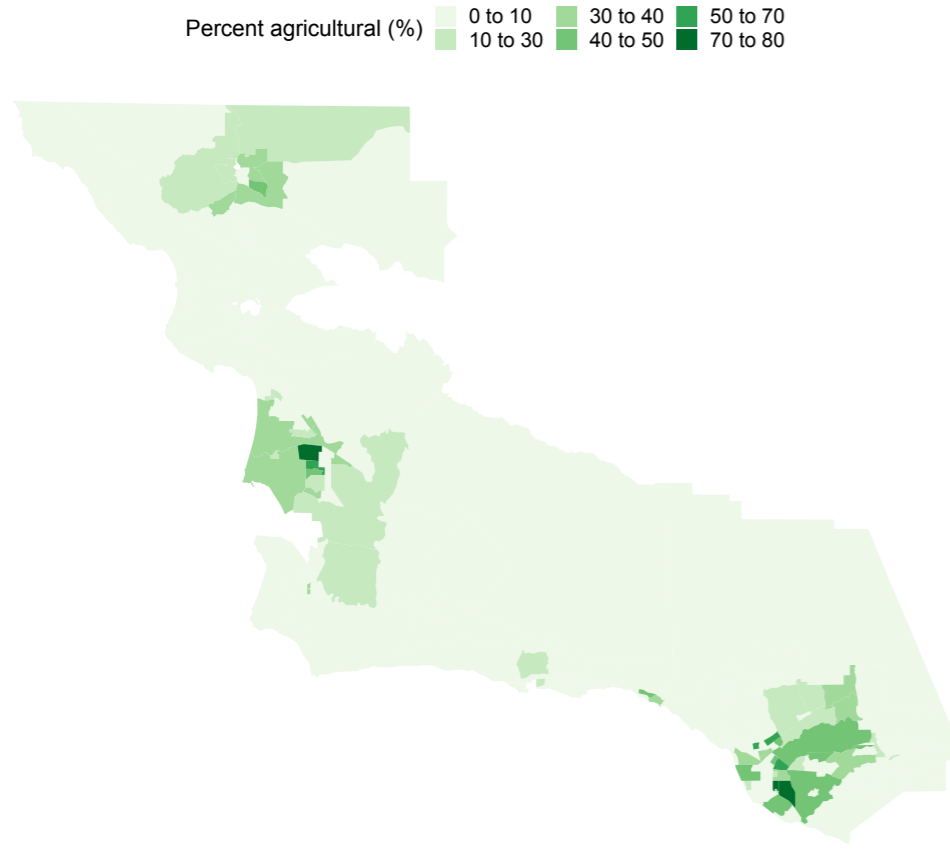
- ▶ CC is an agricultural powerhouse
- ▶ Strawberries, wine grapes, and citrus — 10% of CA's agricultural value
 - ▶ Legacy nitrate pollution
 - ▶ Drought → groundwater pumping (3.4k wells since 1977)

Central Coast and drinking water contamination



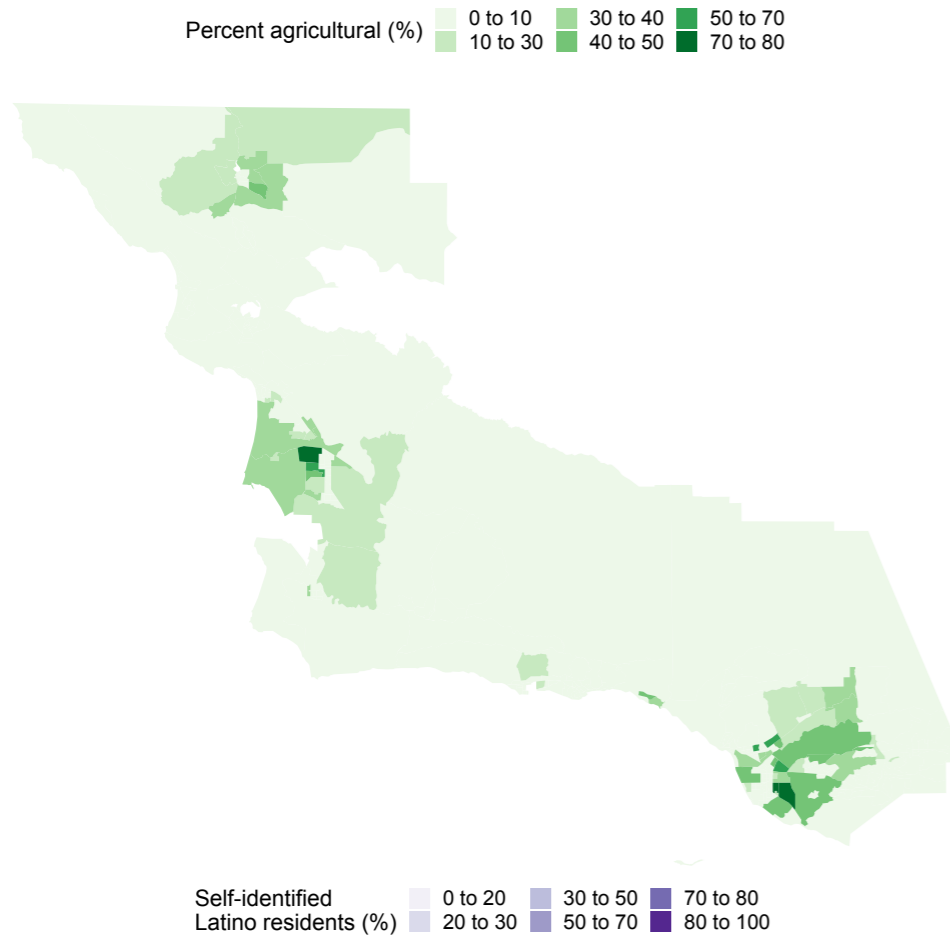
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 - ▶ Rural majority-Latino farmworker communities

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- ▶ Agriculture + drought + patterns of spatial segregation = Equity implications

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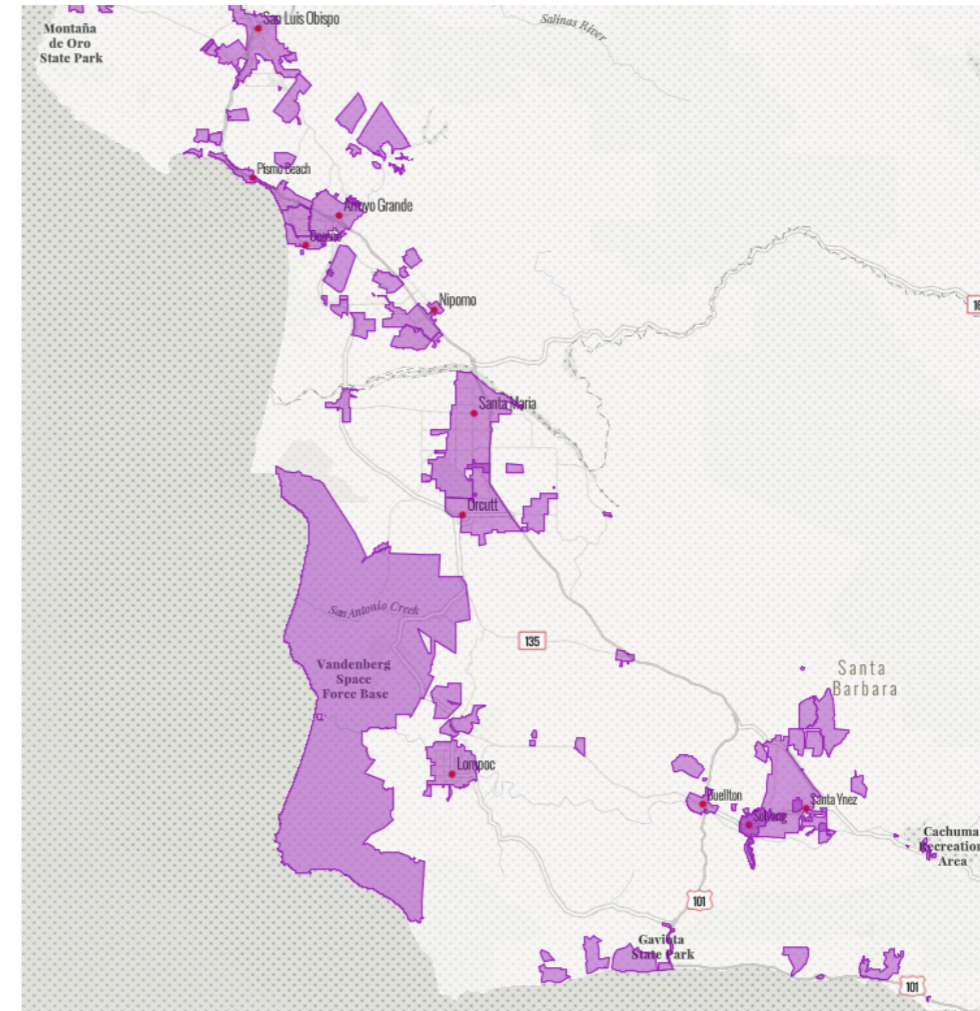
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- ▶ “They Grow the Nation’s Food, but They Can’t Drink the Water” — The New York Times, 2019

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Data

- ▶ Regulatory drinking water quality panel data of >3,000 locations across 15 years
- ▶ + drought, land use, agricultural, sociodemographic, soil characteristics

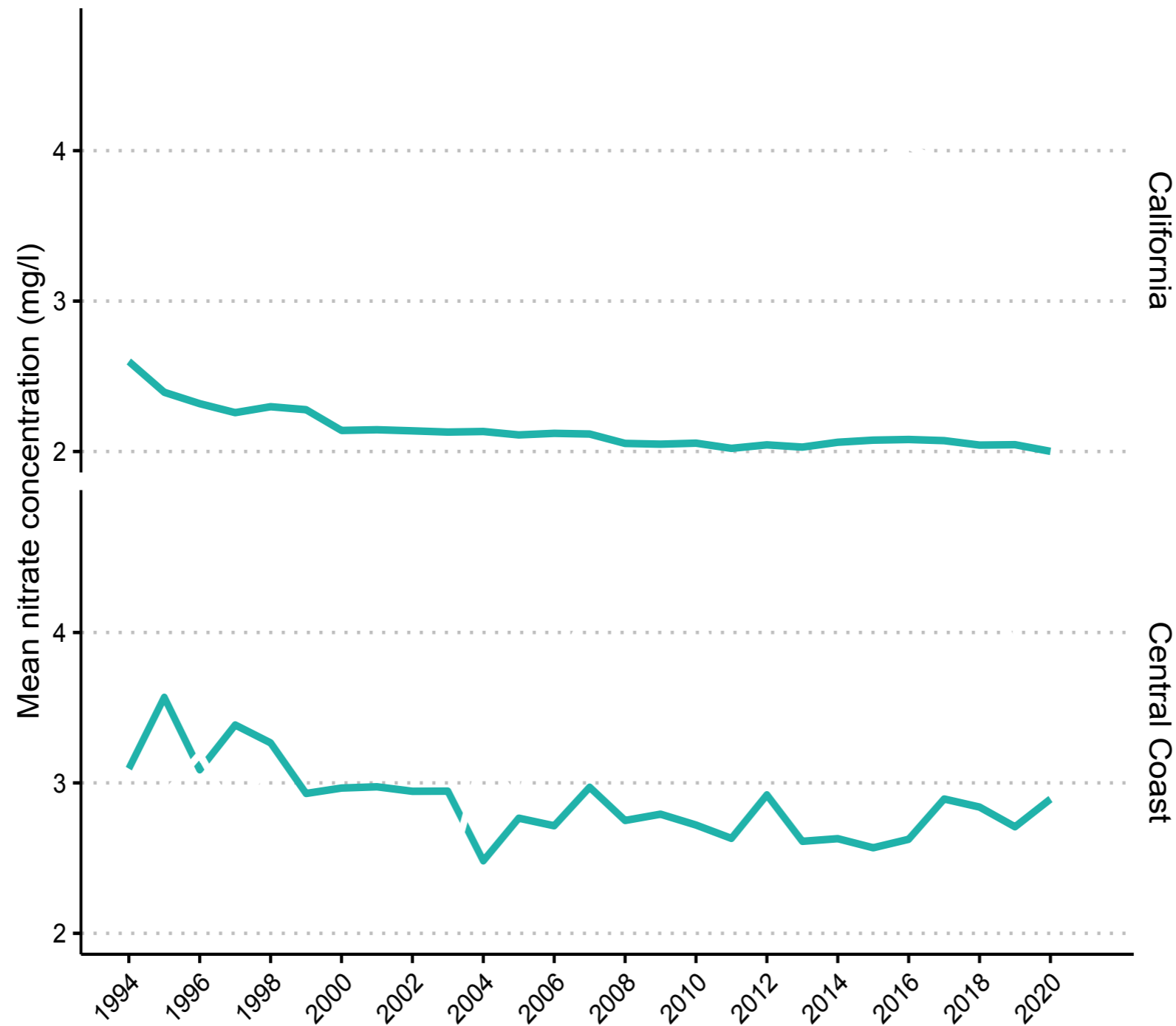


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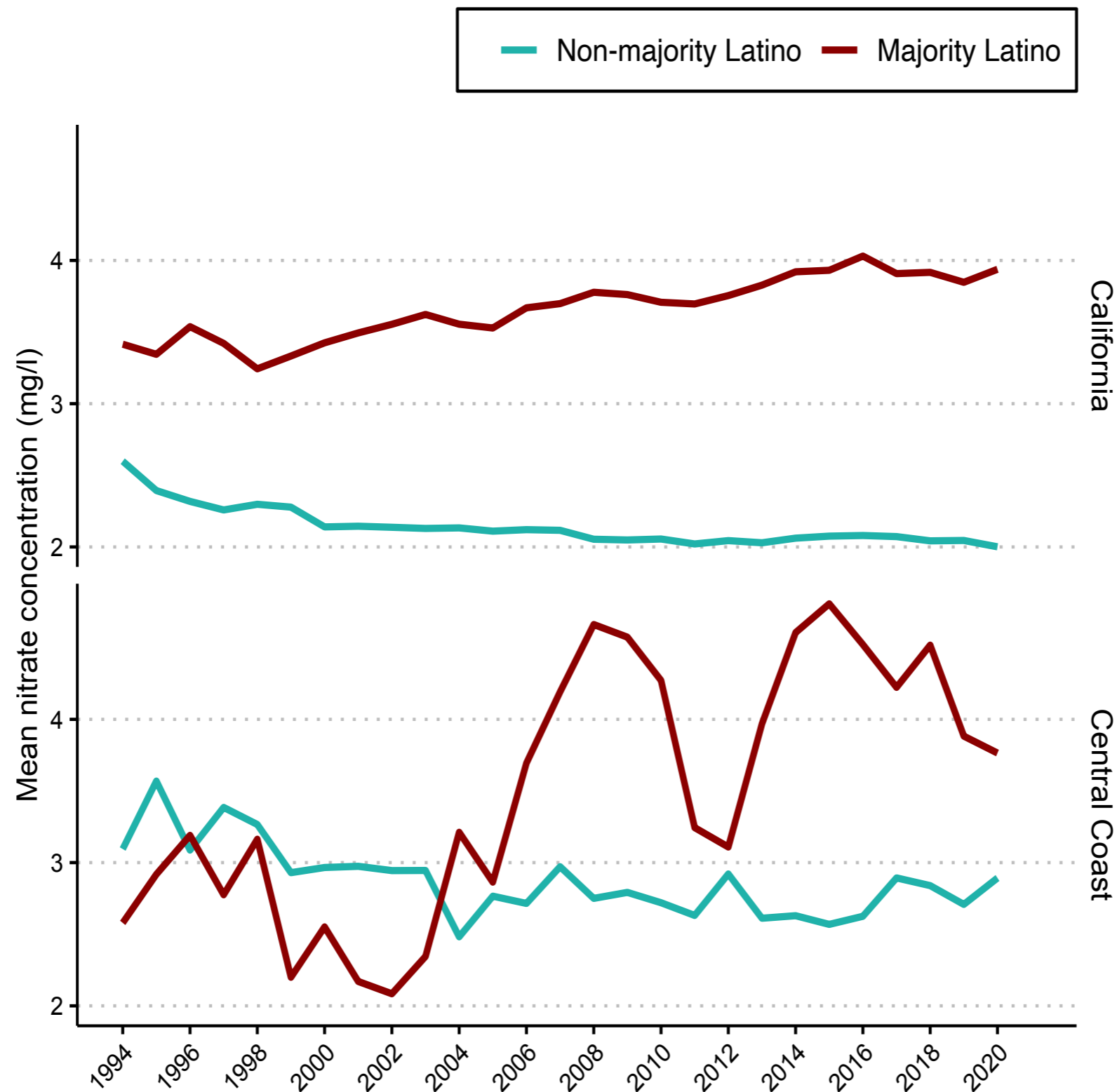
Results: California

- ▶ A widening gap in drinking water quality between Latino and non-Latino communities.
- ▶ Drought widens this gap by up to 10%.
- ▶ Mostly driven by small and private water operators.

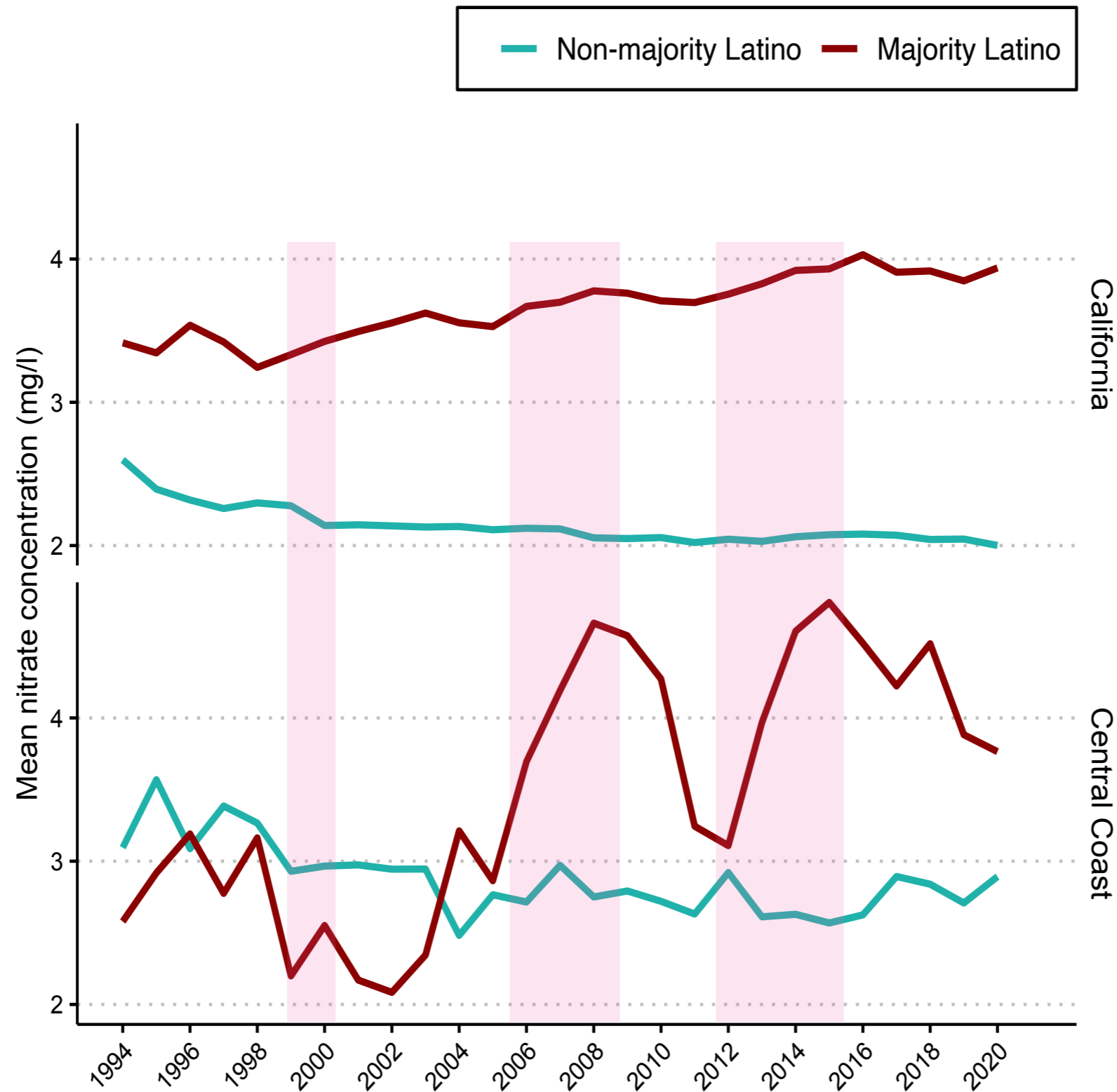
Drinking water nitrate trends

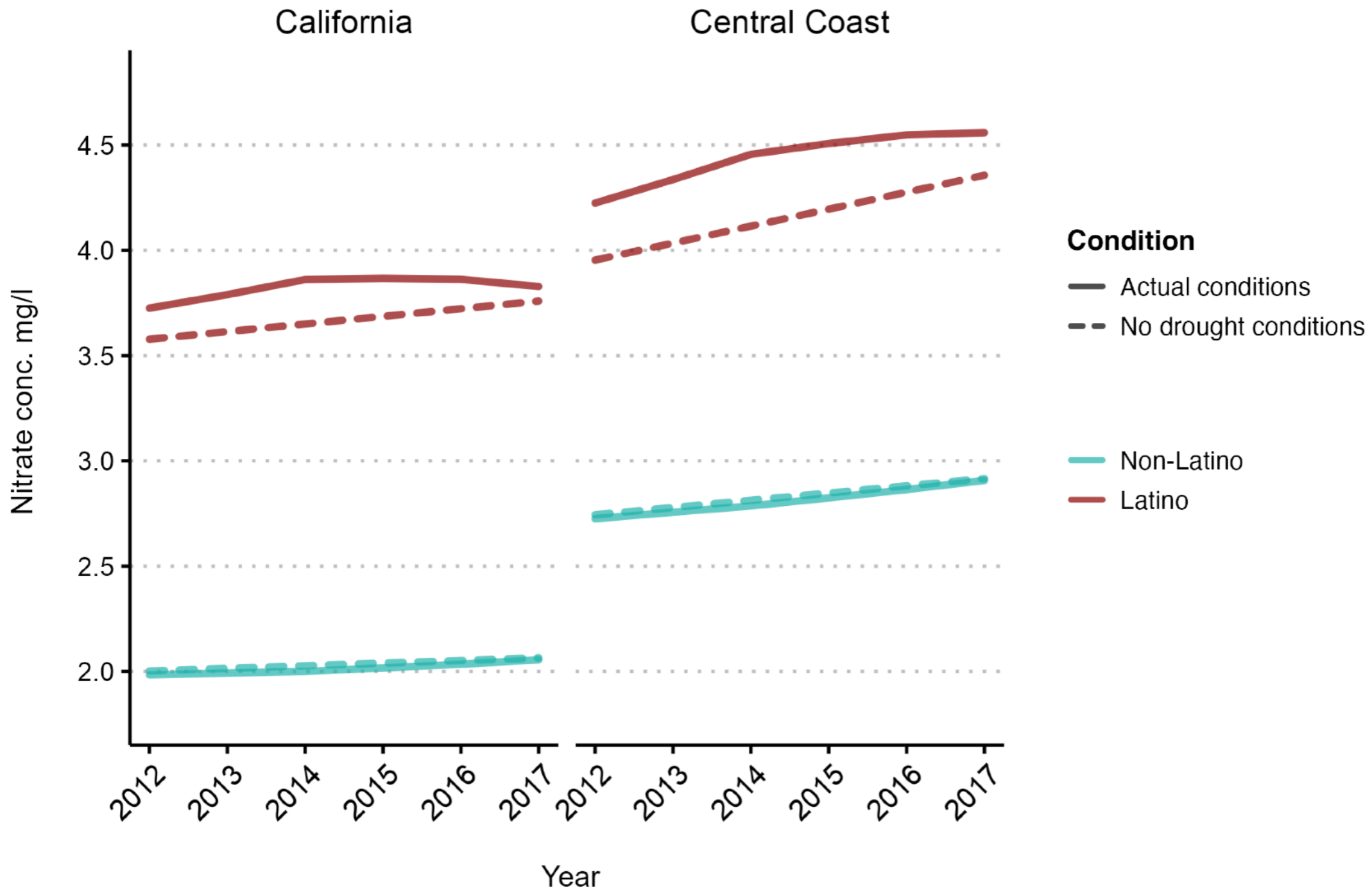


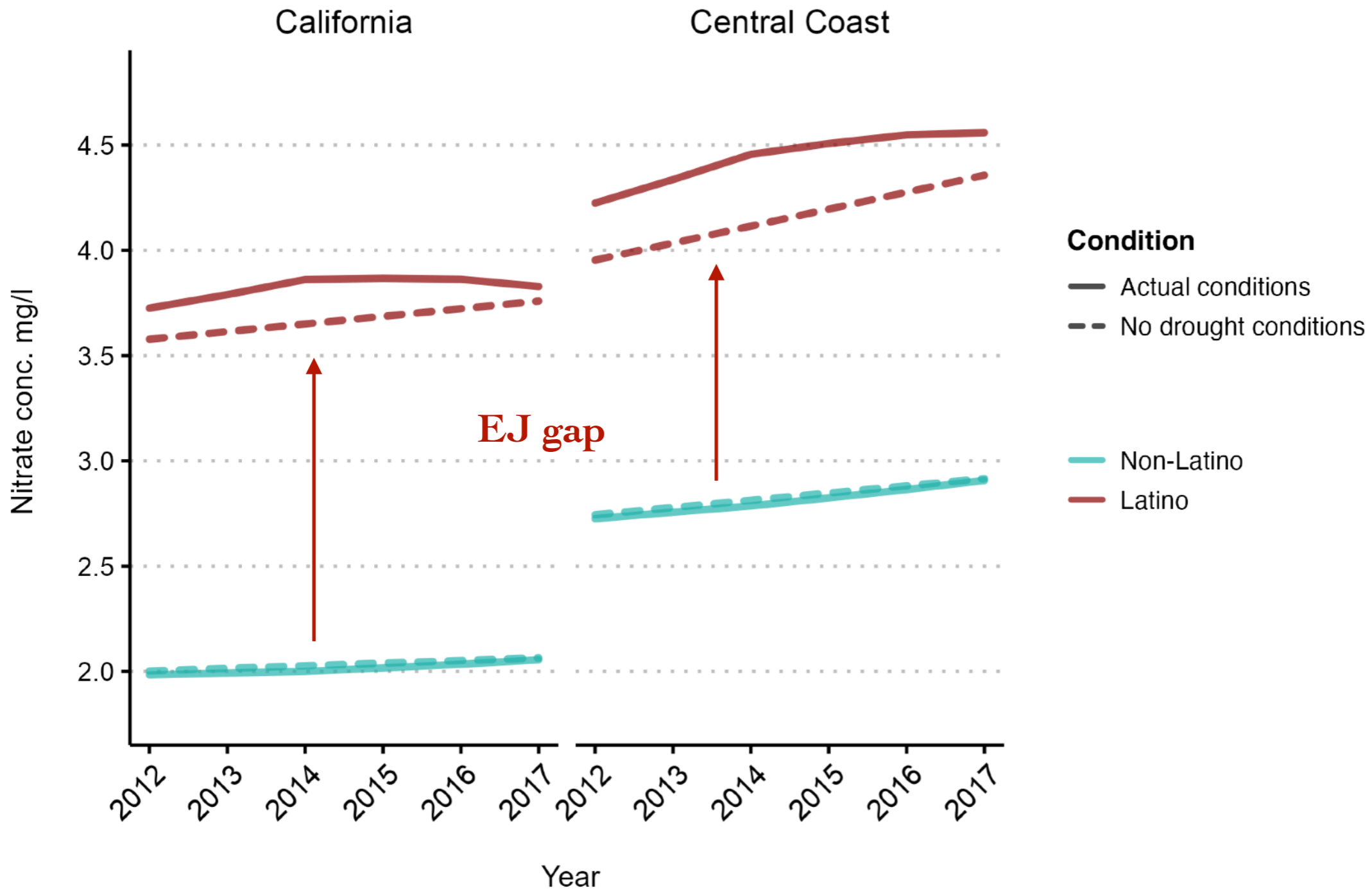
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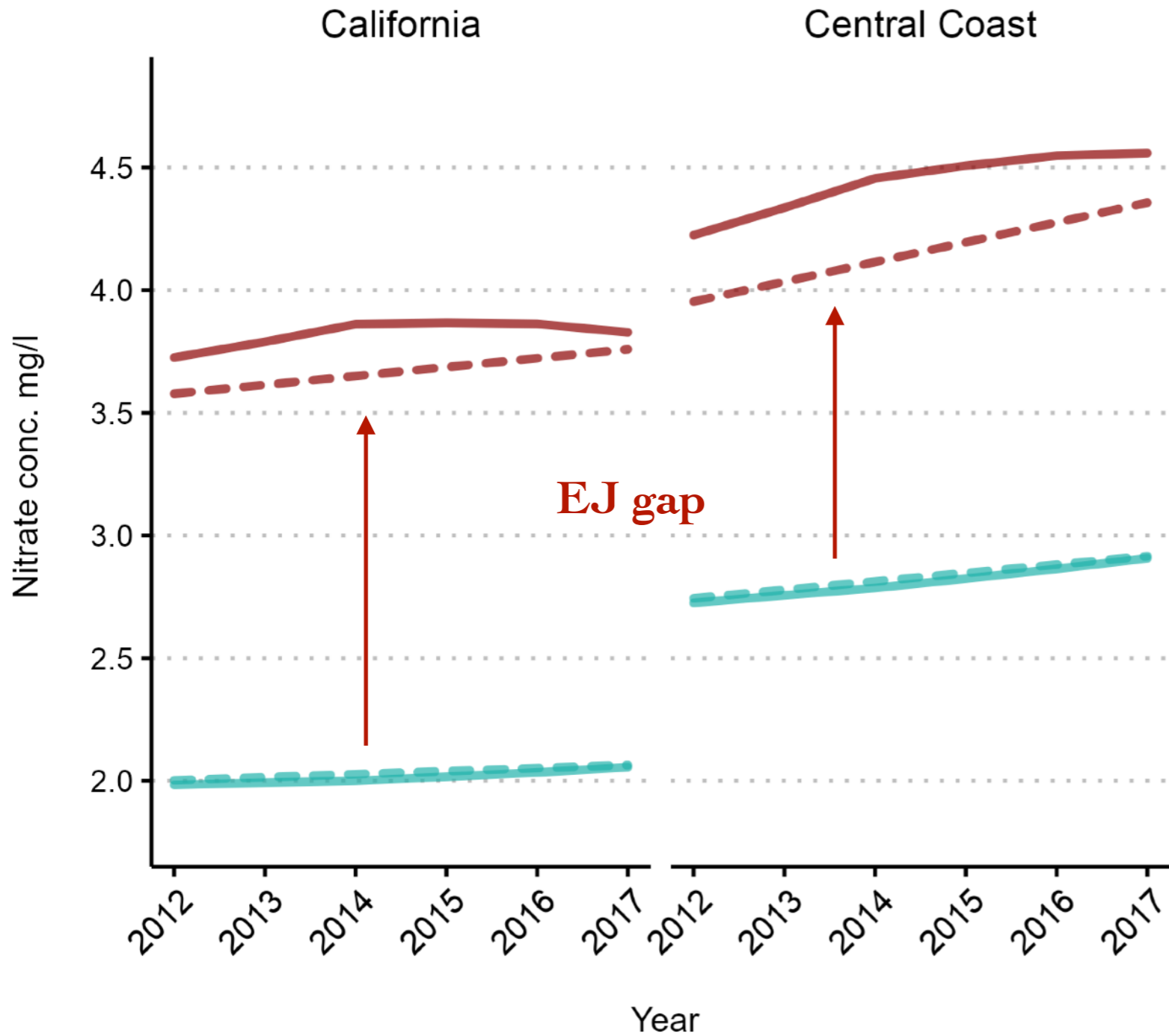


Drinking water nitrate trends









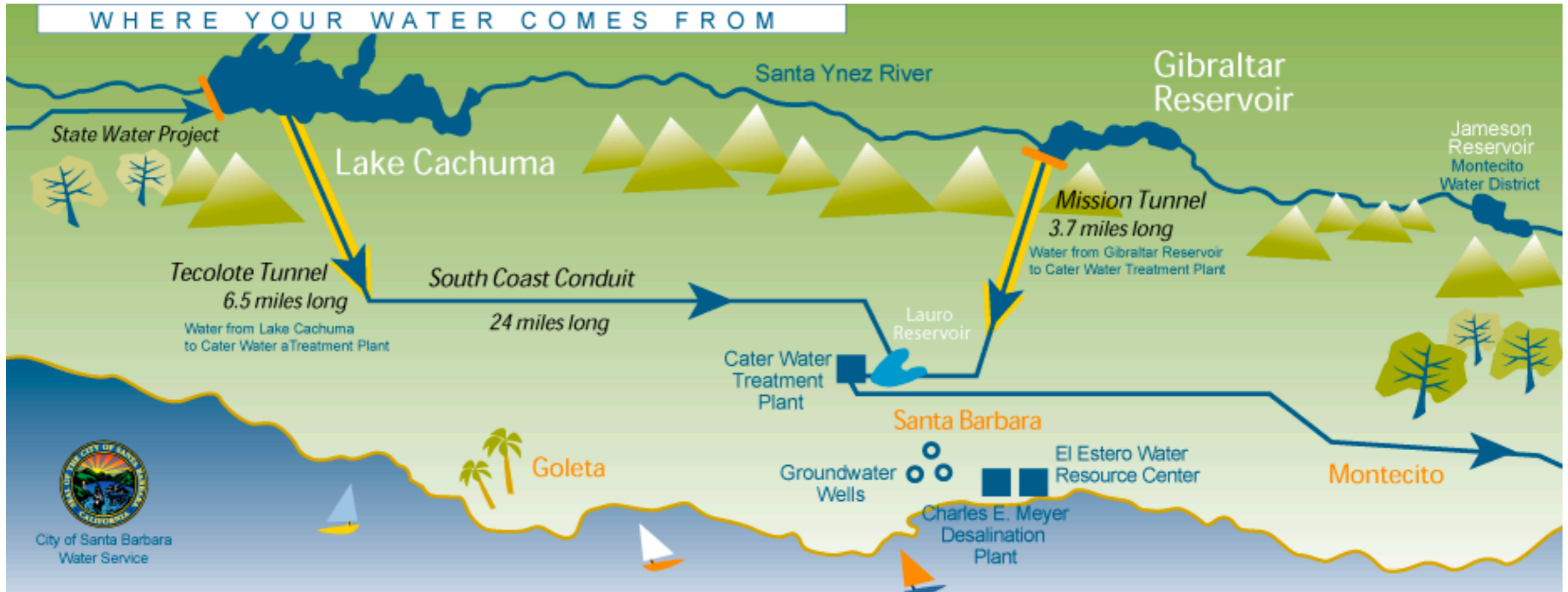
Condition

- Actual conditions
- - No drought conditions

- Non-Latino
- Latino

- ▶ Drought increases nitrate by **0.4mg/l (10%)** only for Latino communities
- ▶ CC's nitrate problem is slowly worsening for all groups (↑20% over last decade)

- ▶ Larger and city-owned water systems have diversity in water sources and are resilient to drought-induced worsening water quality



Key takeaways

- ▶ Increasing nitrate trends in drinking water
- ▶ Existing drinking water disparity
- ▶ Drought widen this “gap”
- ▶ Disproportionate effects driven by numerous **small** and **private** water providers in the CC valleys
- ▶ How do we design equitable and resilient water systems?
 - ▶ April 2023: **\$270m** to New York and **\$391m** to California for water infrastructure upgrades