Environmental justice & the human right to water

Community-engaged research to advance clean drinking water access in California

Lara Cushing, Ph.D., M.P.H.

Assistant Professor
Environmental Health Sciences

UCLA | **Fielding**
School of Public Health

Rushing Waters mural, Pacoima, CA | Lead artist: Levi Ponce | Photo: Justin Cram

California's Human Right to Water Law
(AB 685, 2012)

- First U.S. state to legislatively recognize universal access to safe, clean, affordable, and accessible water as a human right

- ~1 million Californians served by a water system in violation of at least one regulatory standard

- Small water systems in rural, Latinx communities are among the most impacted

- Risks among domestic well households are poorly characterized

SWRCB 2019 Annual Compliance Report; Balazs et al. 2011; Bangia et al. 2020

Water Equity Science Shop (WESS)

Community-driven research and policy engagement to advance water justice in California and reduce exposure to hazardous substances in drinking water
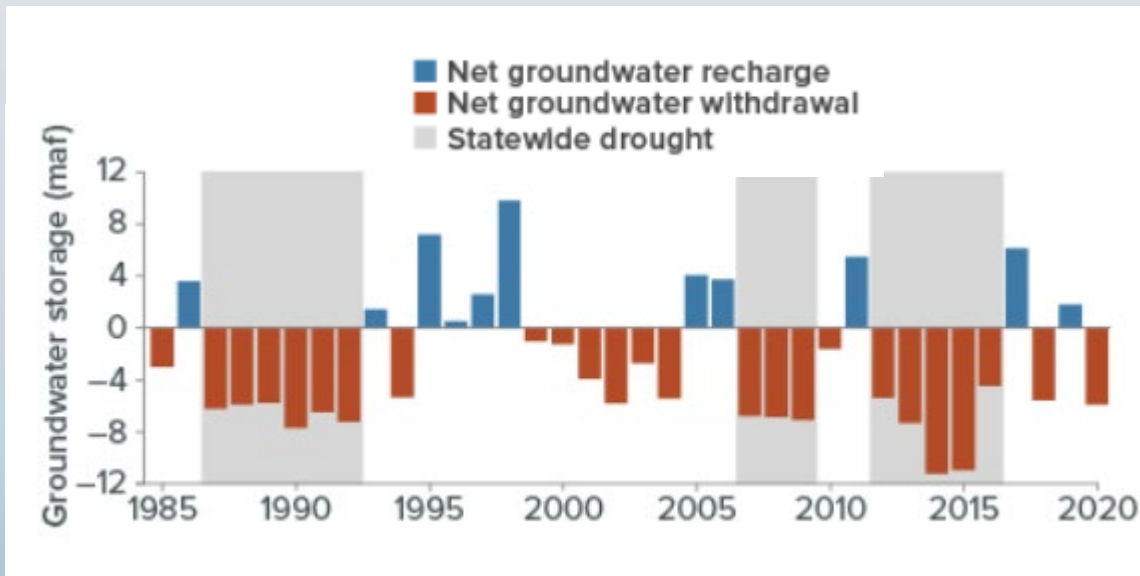
Research goals

1. Identify domestic well communities and estimate groundwater quality in those areas

2. Assess whether communities of color are at a higher risk of poor water quality

3. Provide accessible data tools to inform policy implementation

Demographics

Water quality

Domestic well communities & community water system service area boundaries
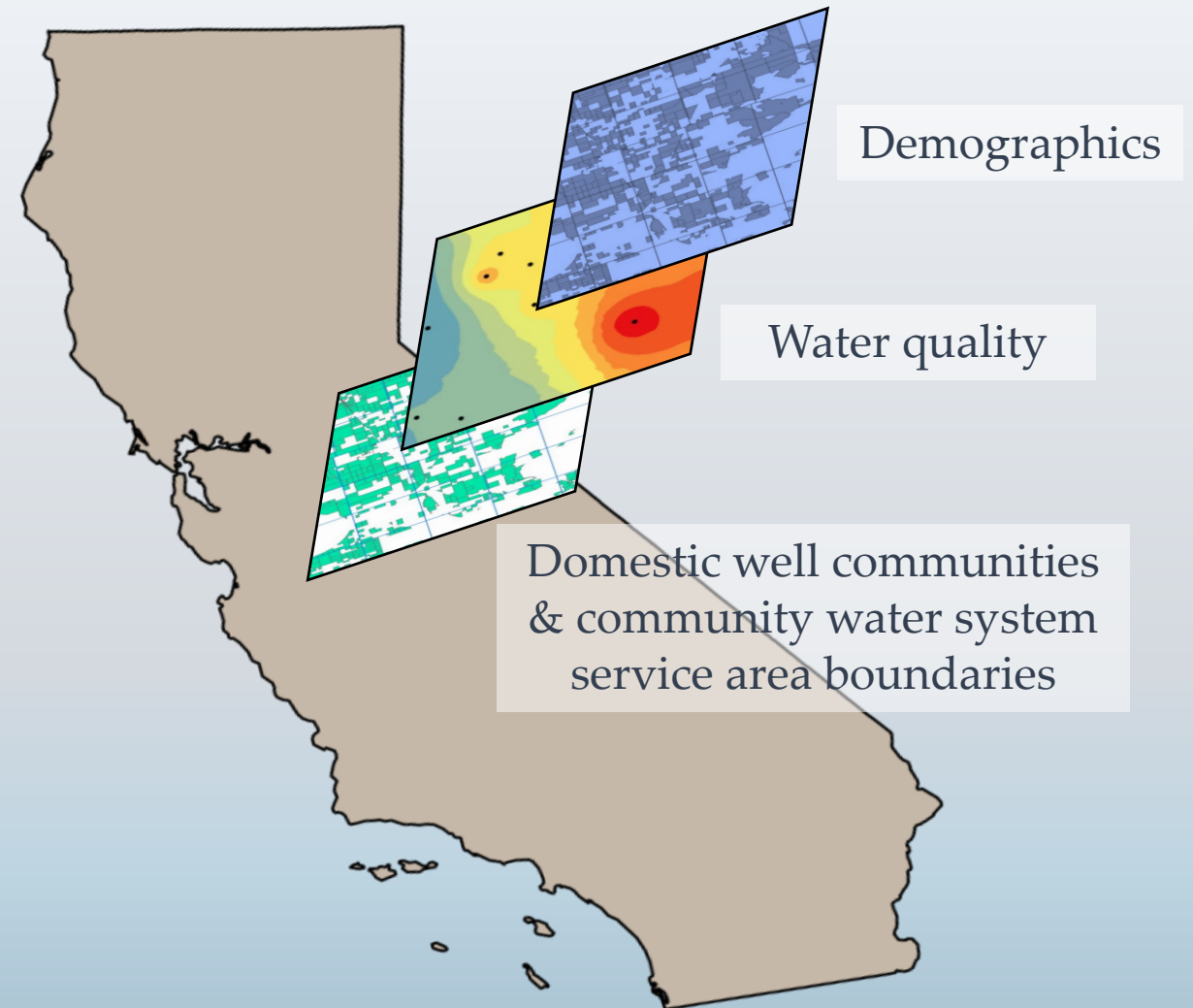
California is the U.S.'s most populous state

- 39.5 million people
- Highly diverse
- Mediterranean climate
- Heavy agricultural water use
- Significant water resources challenges

SCIENTIFIC AMERICAN
Ongoing Megadrought Puts the West in 'Uncharted Waters'

PBS NEWS HOUR
In California's agricultural heartland, thousands of wells could soon run dry

KCRA 3
Audit says nearly 1 million in CA face long-term health issues due to unsafe drinking water

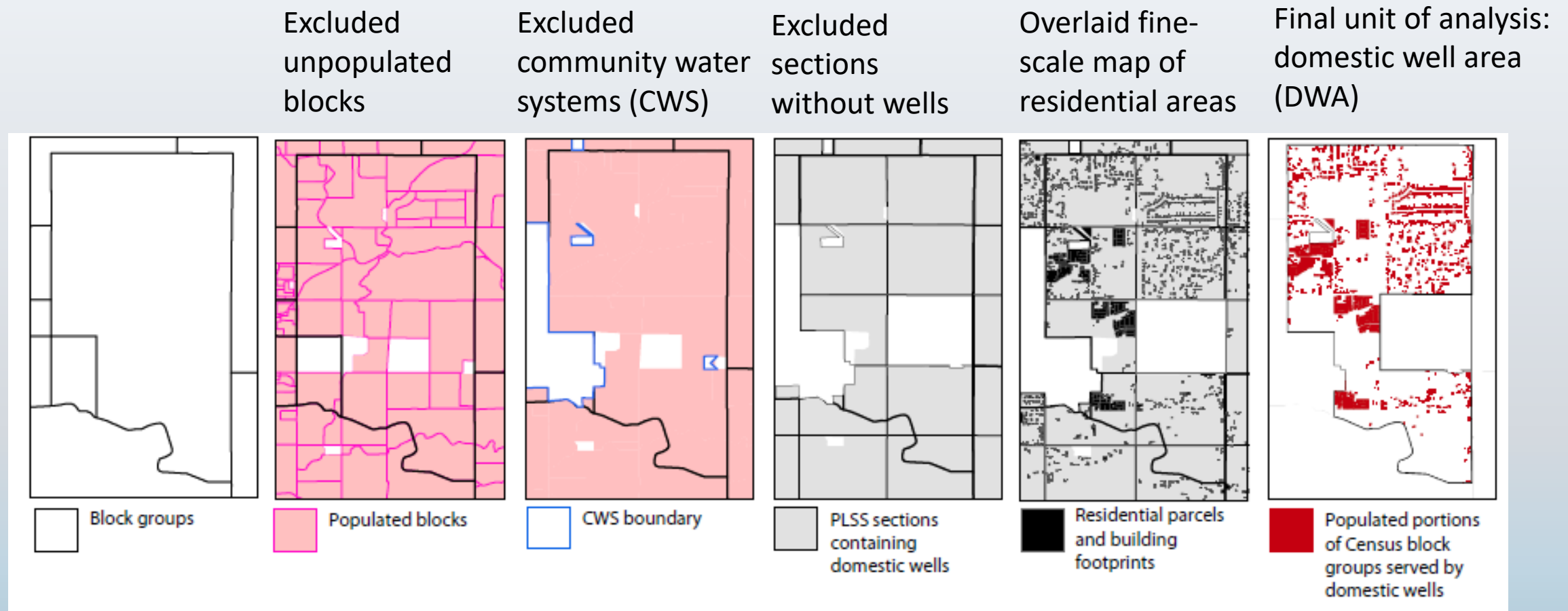The New York Times
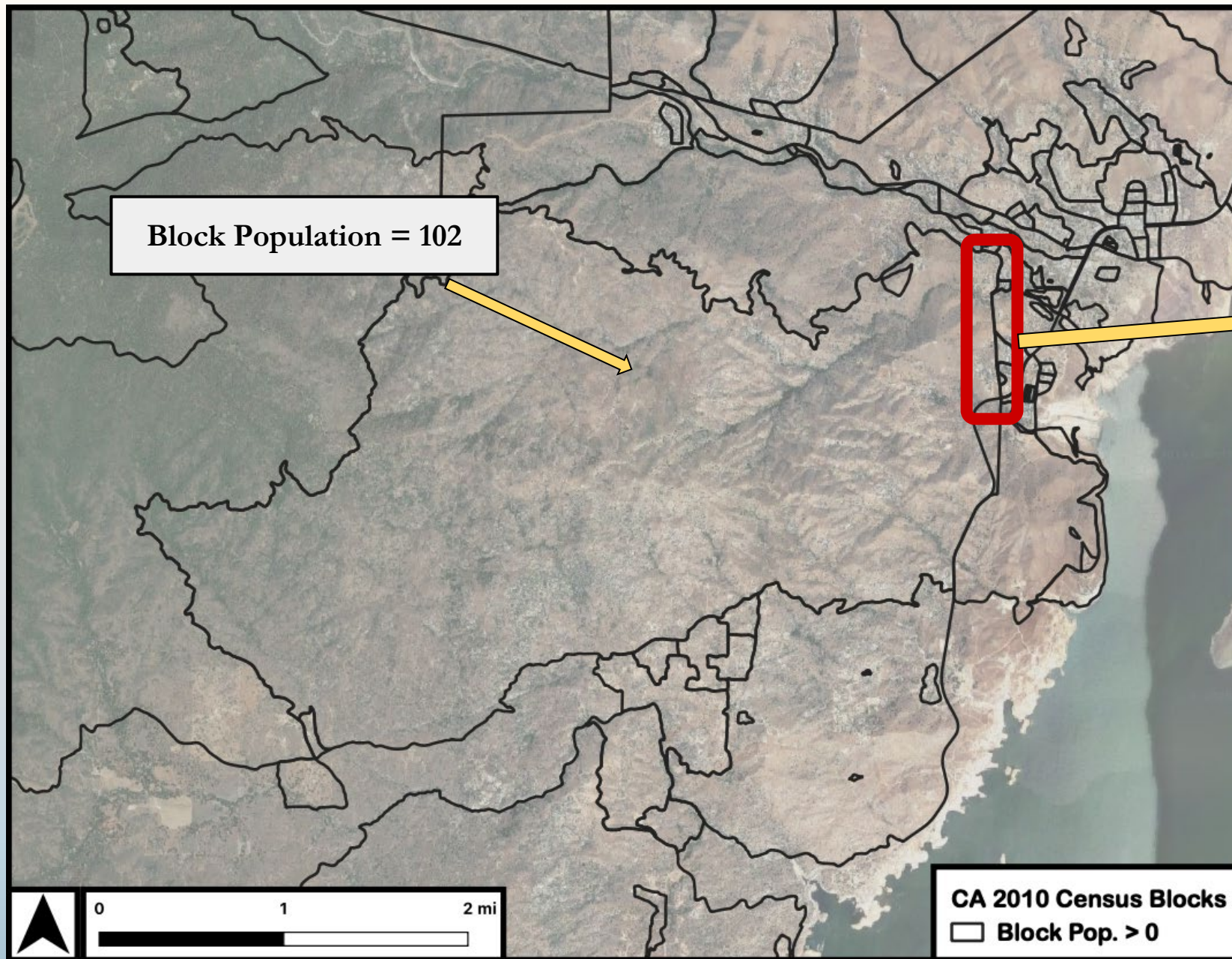## They Grow the Nation's Food, but They Can't Drink the Water

Los Angeles Times
Dirty water, drying wells: Central Californians shoulder drought's inequities

2020 US Census, Public Policy Institute of California

Identifying communities served by domestic wells

Excluded unpopulated blocks

Excluded community water systems (CWS)

Excluded sections without wells

Overlaid fine-scale map of residential areas

Final unit of analysis: domestic well area (DWA)

Block groups

Populated blocks

CWS boundary

PLSS sections containing domestic wells

Residential parcels and building footprints

Populated portions of Census block groups served by domestic wells

A-B https://www.census.gov/geo/maps-data/data/tiger-data.html; C CWS Boundaries https://trackingcalifornia.org/water/map-viewer;
D https://civicnet.resources.ca.gov/DWR_WELLS/; E https://www.digmap.com/platform/landvision/

Block Population = 102

CA 2010 Census Blocks
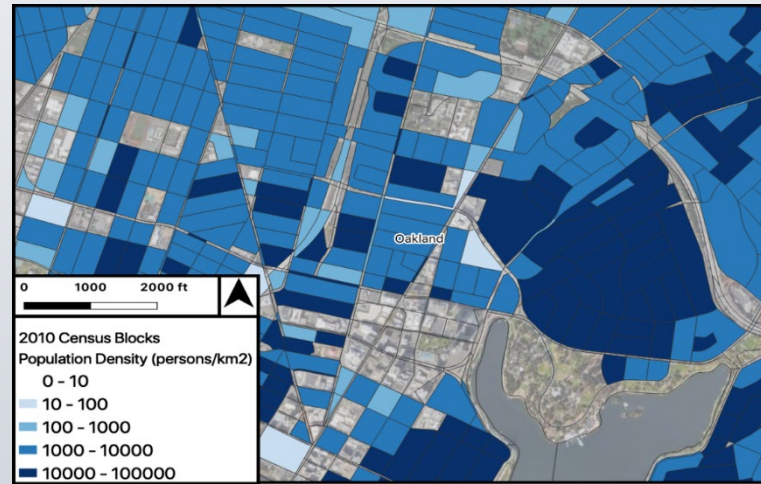☐ Block Pop. > 0

Populated Area

Forested area NE of Bakersfield, CA

Dasymetric mapping to estimate community demographics
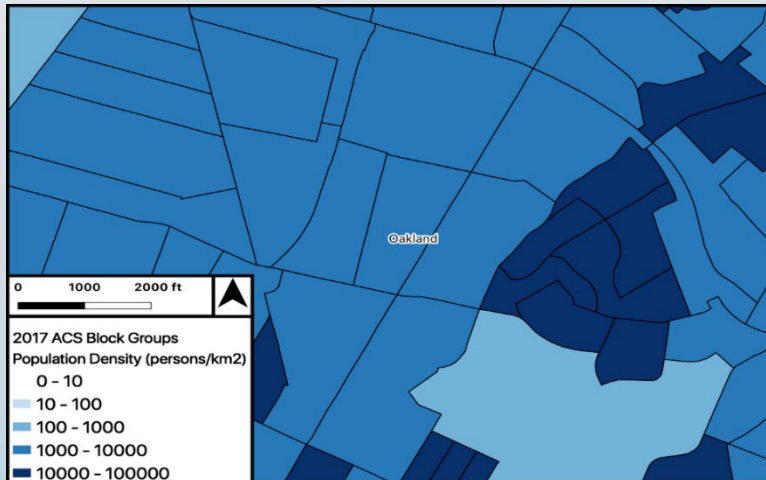
1. 2013-2017 block group population from the American Community Survey

2. Apportioned to 2010 census blocks

3. Assigned to building footprints and residential parcels and used to derive weighted averages for each CWS and DWA:

- *Racial/ethnic composition*
- *Poverty rates*
- *Linguistic isolation*
- *Housing tenure*

Estimating water quality among community water systems & domestic well communities

Measure: Time-weighted average (mean) over most recent 9-year compliance cycle (2011-2019)

Contaminant	Health Risks	Data sources		Maximum Contaminant Level (MCL)
Arsenic	Carcinogen, pulmonary and CV disease, diabetes, developmental effects	Community water systems: Drinking water samples, State Water Resources Control Board (SWRCB) EDT Library	Domestic well areas: Groundwater samples, SWRCB Groundwater Ambient Monitoring and Assessment (GAMA) program	10 µg/L
Nitrate	Hematotoxin, blue baby syndrome, thyroid disease, birth defects			10 µg/L
Hexavalent chromium	Carcinogen			10 µg/L (most recent, no current MCL)

2011-19 mean drinking water concentrations across community water systems (CWSs) & domestic well areas

	Domestic well areas (n=1,914)	Small CWSs (n=1,773)	Medium CWSs (n=859)	Large CWS (n=219)
Total population	1,300,193	253,098	6,030,628	30,784,197
Arsenic, μg/L				
Median (95th percentile)	1.1 (14.8)	<DL (9.6)	0.6 (6.2)	0.5 (3.8)
Nitrate as N, mg/L				
Median (95th percentile)	1.6 (9.7)	0.8 (6.4)	0.6 (5.3)	0.7 (5.1)
Hexavalent chromium, μg/L				
Median (95th percentile)	0.3 (9.3)	<DL (8.5)	<DL (6.2)	0.2 (4.6)
% of population ≥ MCL for 1 or more contaminant	12.1%	8.8%	2.6%	0.1%

MCL = Maximum Contaminant Level. The is MCL is 10 μg/L for all contaminants.
Chromium does not have a current MCL; We used the most recent MCL of 10 μg/L.

Communities of color face higher risks of chemical contaminants ≥ 1/2 MCL

Prevalence ratios & 95% confidence intervals
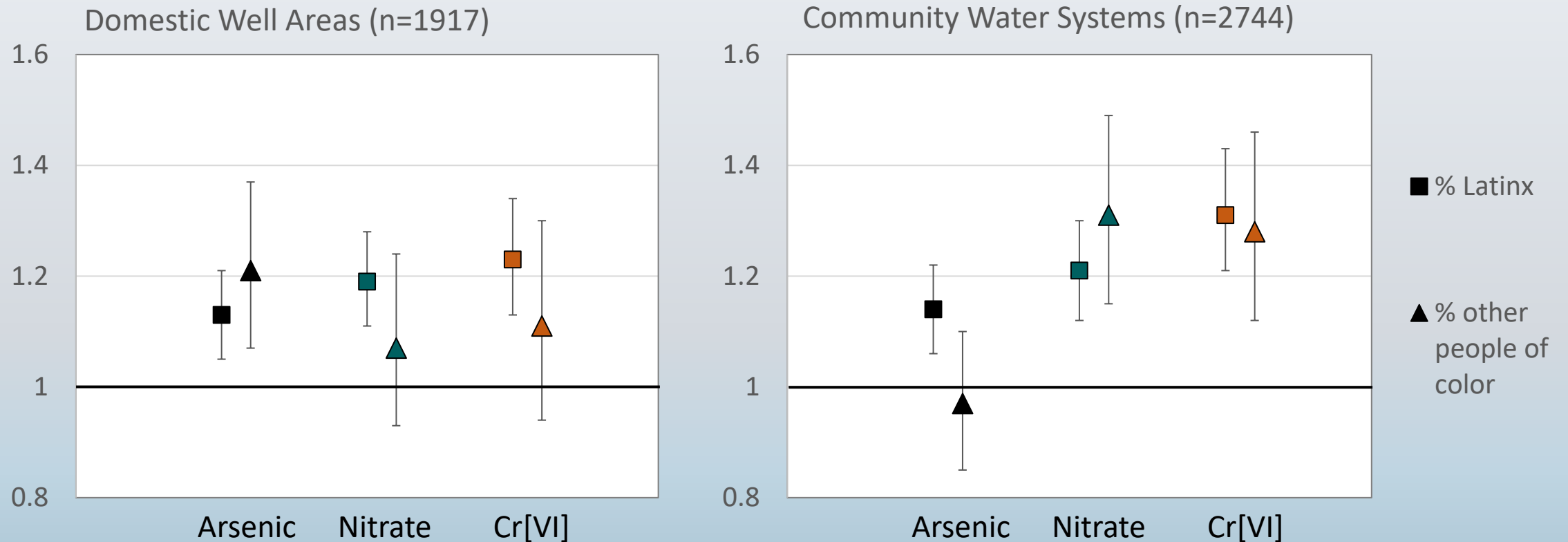
MCL = 10 µg/L for all contaminants. Chromium does not have a current MCL; We used the most recent MCL for chromium (VI).
GAM models control for % renters, region, spatial autocorrelation, and (for CWSs) system size and ground vs. surface water source.

Drinking Water Tool
drinkingwatertool.communitywatercenter.org

Drinking Water Tool
drinkingwatertool.communitywatercenter.org

Drinking Water Tool
drinkingwatertool.communitywatercenter.org

Likely domestic well communities

Domestic Well Population
- Up to 250
- 251 - 1,500
- 1,500 - 4,250
- More than 4,250
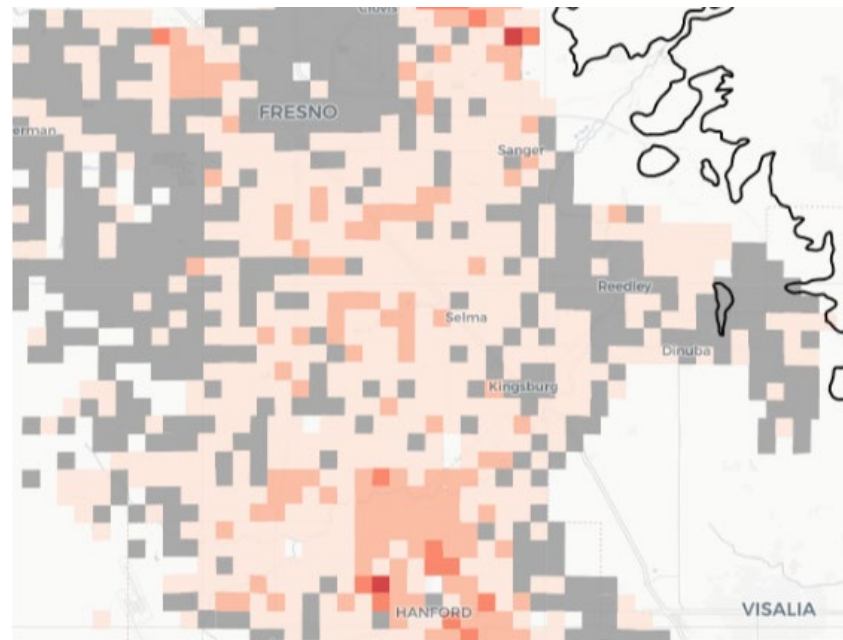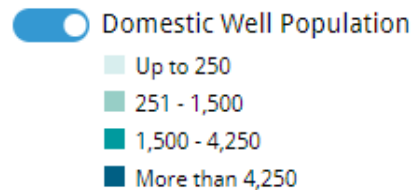
Projected well failures under projected drought conditions

Number of Impacted Domestic Wells
- 0
- 1 - 4
- 5 - 12
- 13 - 26
- More than 26
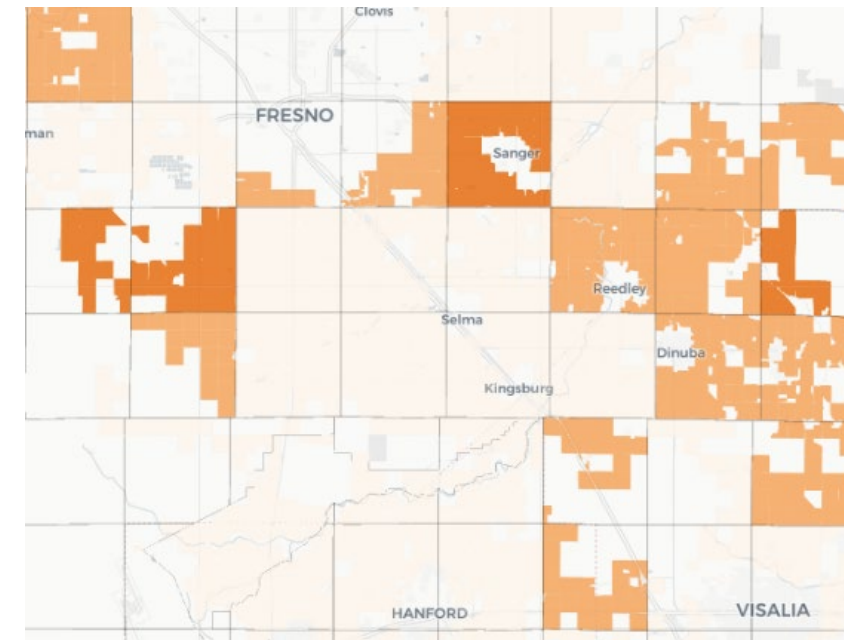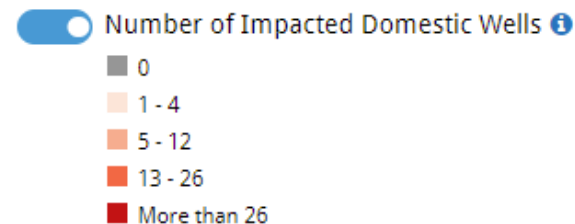
Estimated groundwater contaminant concentrations

Arsenic
Nitrates
- 0 - 50% MCL (MCL = 10 mg/L)
- 50 - 100% MCL
- 100 - 200% MCL
- > 200% MCL
- No Data
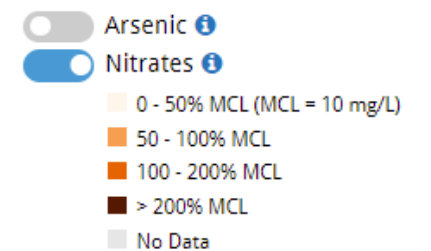
Drinking Water Tool
drinkingwatertool.communitywatercenter.org

- Leveraged to ensure domestic well communities were accounted for in groundwater management plans
  - >220 attendees at the public launch
  - >200 visitors/month in first year
- Process over product
  - Increased scientific rigor
  - Improved communication between agencies and community groups
  - Accelerated parallel efforts
- CWC ownership
  - Greater trust of the data among communities
  - Hesitancy of agencies to adopt an outside tool

AJPH NEW FRONTIERS OF ENVIRONMENTAL JUSTICE

Inequities in Drinking Water Quality Among Domestic Well Communities and Community Water Systems, California, 2011–2019

Clare Pace, PhD, MPH, Carolina Balazs, PhD, Komal Bangia, MPH, Nicholas Depsky, MS, Adriana Renteria, BA, Rachel Morello-Frosch, PhD, MPH, and Lara J. Cushing, PhD, MPH

International Journal of
Environmental Research and Public Health

Article

The Drinking Water Tool: A Community-Driven Data Visualization Tool for Policy Implementation

Clare Pace [1,*], Amanda Fencl [2], Lauren Baehner [1], Heather Lukacs [3], Lara J. Cushing [4,†] and Rachel Morello-Frosch [1,5,†]

Drinking Water Tool – future additions
drinkingwatertool.communitywatercenter.org

- Refined domestic well community locations
  - Well permits joined to tax parcel data
  - Addition of select state small water systems
- Drinking water quality threats
  - Polyfluoroalkyl substances (PFAS)
  - Pesticide applications
  - Concentrated animal feeding operations and dairies
  - Industrial clean up sites (Superfund)
  - Oil and gas wells
- Targeted and non-targeted analysis of tap water

AJPH NEW FRONTIERS OF ENVIRONMENTAL JUSTICE

Inequities in Drinking Water Quality Among Domestic Well Communities and Community Water Systems, California, 2011–2019

Clare Pace, PhD, MPH, Carolina Balazs, PhD, Komal Bangia, MPH, Nicholas Depsky, MS, Adriana Renteria, BA, Rachel Morello-Frosch, PhD, MPH, and Lara J. Cushing, PhD, MPH

International Journal of *Environmental Research and Public Health*

Article

The Drinking Water Tool: A Community-Driven Data Visualization Tool for Policy Implementation

Clare Pace [1,*], Amanda Fencl [2], Lauren Baehner [1], Heather Lukacs [3], Lara J. Cushing [4,†] and Rachel Morello-Frosch [1,5,†]

Contact: lcushing@ucla.edu

Contributors:
Clare Pace
Rachel Morello-Frosch
Carolina Balazs
Komal Bangia
Nicholas Depsky
Adriana Renteria
Amanda Fencl
Lauren Baener
Heather Lukacs
Rob Gailey

NIH> National Institute of Environmental Health Sciences

Rushing Waters mural, Pacoima, CA | Lead artist: Levi Ponce | Photo: Justin Cram