Climate Change & Health

Linda Rudolph, MD, MPH
California Department of Public Health
March 23, 2011

Climate Change Webinar Series

- **Communicating Climate Change as a Critical Public Health Issue** (April 27 11am – noon)
  - Dr. Ed Maibach, Director of George Mason University's Center for Climate Change Communication
  - BreAnda Northcutt, Vice-President, Cater Communications, former Communications Director, Cal EPA
- **Integrating Health and Equity into SB 375 and Sustainable Community Planning (**May 18 11 – 12:30_
  - Robin Salsburg, Sr Attny, Public Health Law and Policy
  - Carl Anthony, Equity and Env Justice Advocate, co-founder, Breakthrough Communities
  - Tracy Delany, San Diego Dept of Public Health, Manager, Chronic Disease and Health Disparities
- **Creating a Health Framework for Climate Action and Adaptation Planning** (June 22 11 – noon)
  - Melissa Stults, Climate Action Director, ICELI/Local Governments for Sustainability.
  - Dr. Ed Moreno, Health Officer and Director of Fresno Co Dept of Public Health and president of the California Conference of Local Health Officers

NOAA, Todd Heitkamp Wikimedia Commons

USEPA, Wikimedia Commons

National Parks Service, Wikimedia Commons

"Climate change is the biggest global health threat of the 21st century… The impacts will be felt all around the world – and not just in some distant future but in our lifetimes and those of our children."

The Lancet

USDA, Wikimedia Commons

NOAA, Wikimedia Commons

Suat Eman, freedigitalphoto.net

Why should we work on climate change?

- Climate change happening now
  - Faster than expected
  - Upper end of IPCC scenarios
  - Risk of tipping points
- Impacts health in many ways, directly & indirectly
  - Heat, extreme weather, floods, drought, wildfires, water & food-borne disease, vector-borne disease
- Affects life systems on which we depend
  - Air, water, food, shelter, security
- Climate gap
  - Vulnerable communities most at risk
- If we act urgently and aggressively we can
  - Prevent the most catastrophic climate scenarios
  - Promote mitigation and adaptation strategies with health co-benefits
  - Build resilient communities to adapt better
- Public health matters

Climate Change is Happening Now

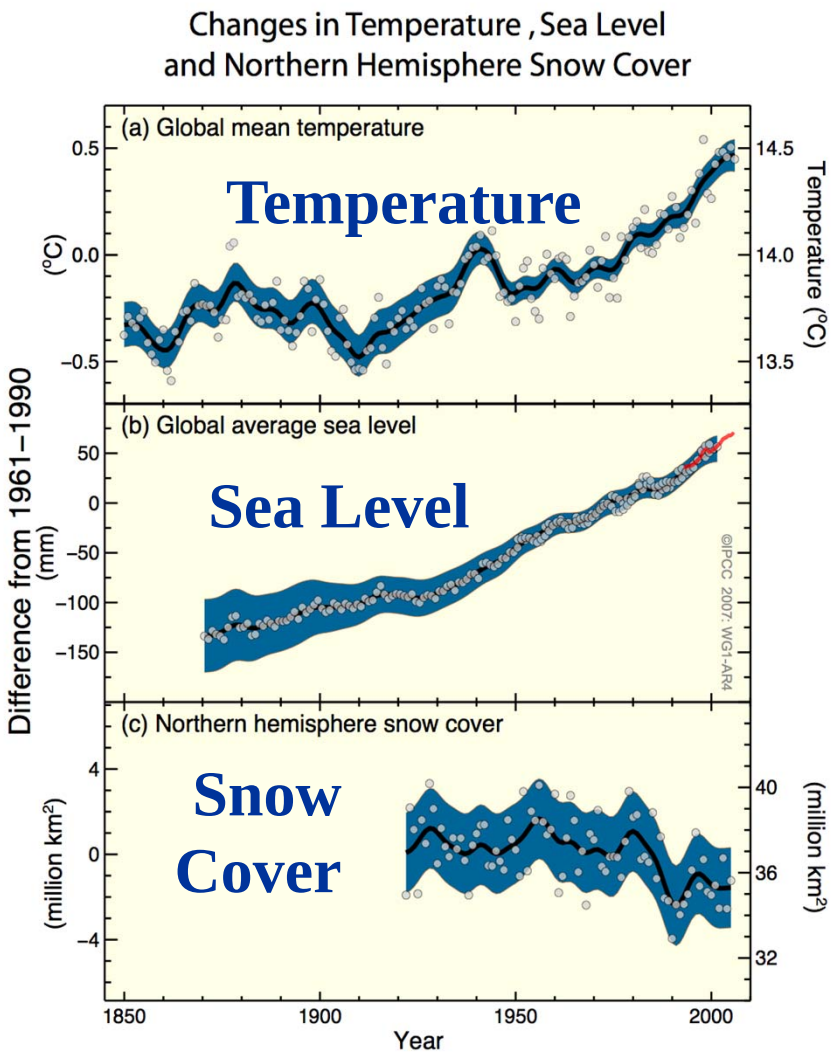
- Warming is unequivocal; most of the warming of the past 50 years is very likely (90%) due to increases in greenhouse gases.
- Warming *plus*: heat waves, wind patterns, drought, & more

- Physical and biological systems on all continents and in most oceans already affected by recent climate changes.

- Greenhouse gases at unprecedented levels, forcing the climate to change.

- Already committed to more warming (next few decades); choices about emissions affect the longer term mor and more.

(IPCC2007)



The Copenhagen Diagnosis

- Surging greenhouse gas emissions
- Recent global temperatures demonstrate human-based warming
- Acceleration of melting of ice-sheets, glaciers and ice-caps
- Rapid Arctic sea-ice decline
- Current sea-level rise underestimated
- Sea-level prediction revised
- Delay in action risks irreversible damage
- The turning point must come soon

Environmental Impacts of Climate Change

- More extreme temperatures
- Sea level increases
- Stronger hurricanes and storm surges
- Increased precipitation and flooding
- Increased droughts and water scarcity
- More frequent wildfires
- Increased ozone concentrations and diminished air quality
- Increased pollen and natural air pollutants
- Increased range for disease vectors

Climate Change:

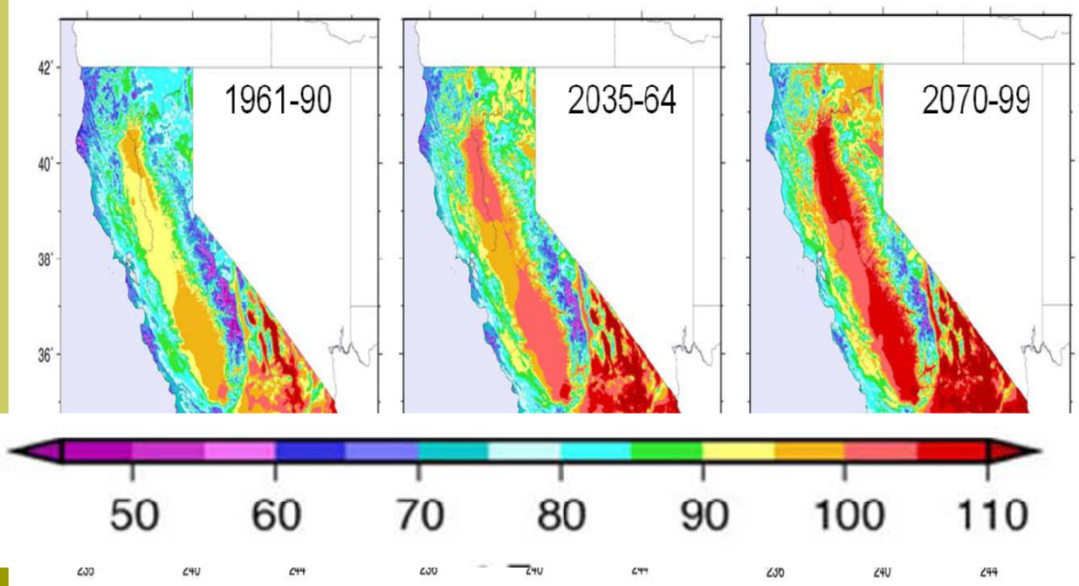
- Temperature rise
- Sea level rise
- Hydrologic extremes

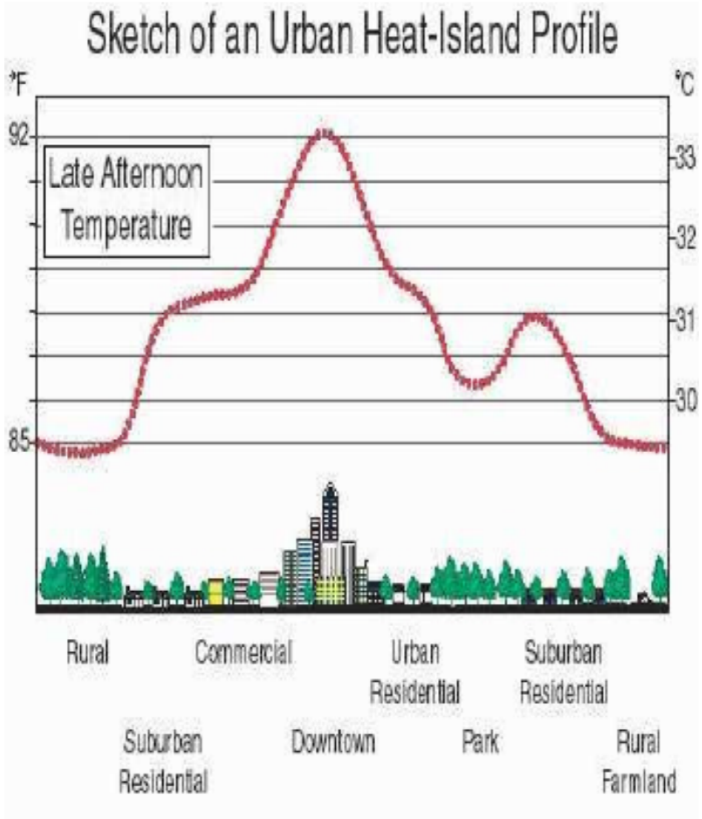
HEAT	→ Heat stress, cardiovascular failure
SEVERE WEATHER	→ Injuries, fatalities
AIR POLLUTION	→ Asthma, cardiovascular disease
ALLERGIES	→ Respiratory allergies, poison ivy
VECTOR-BORNE DISEASES	→ Malaria, dengue, encephalitis, hantavirus, Rift Valley fever
WATER-BORNE DISEASES	→ Cholera, cryptosporidiosis, campylobacter, leptospirosis
WATER AND FOOD SUPPLY	→ Malnutrition, diarrhea, harmful algal blooms
MENTAL HEALTH	→ Anxiety, despair, depression, post-traumatic stress
ENVIRONMENTAL REFUGEES	→ Forced migration, civil conflict

Adapted from J. Patz

Heat

California Historical and Projected July Temperatures



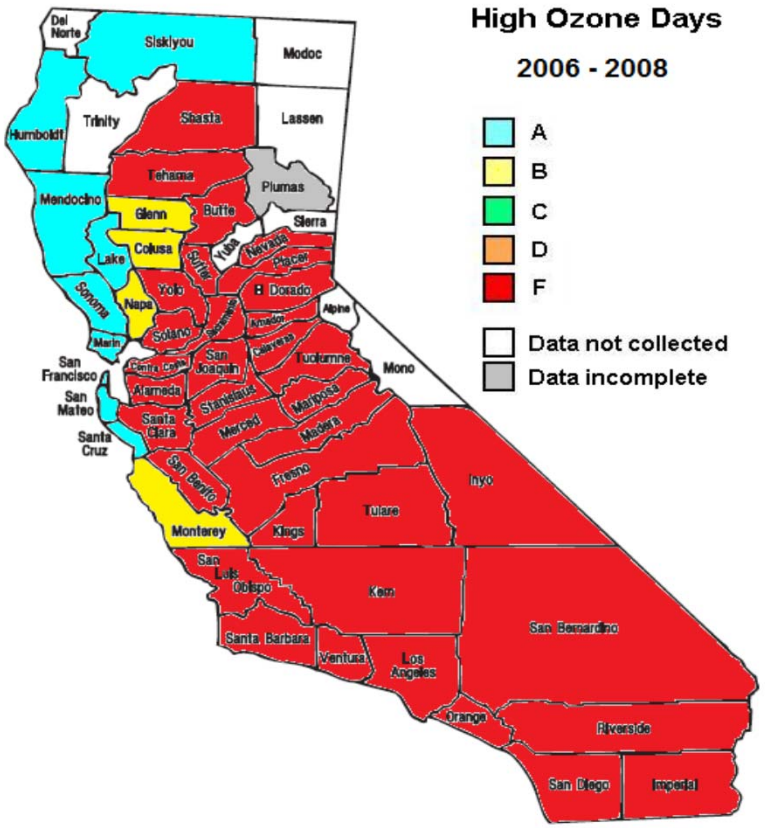


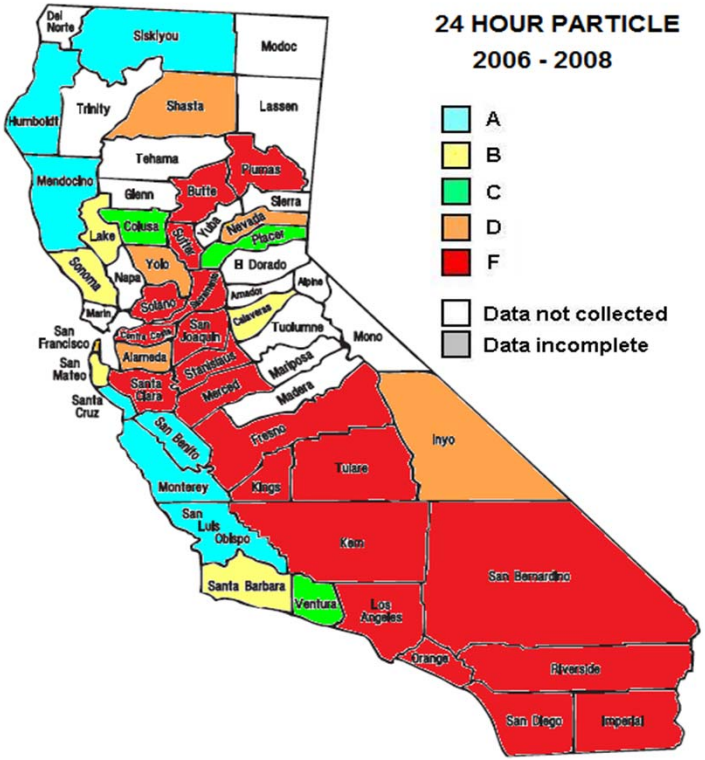
- Urban Heat Island: Can add 7° – 12° F
- Europe 2003: 30,00 confirmed, estimated > 70,000 deaths (check EU report which is even higher)
-

Heat and air pollution

California's unhealthy air quality – climate change will be worse

(ALA-Calif-State of the Air Report, 2010)

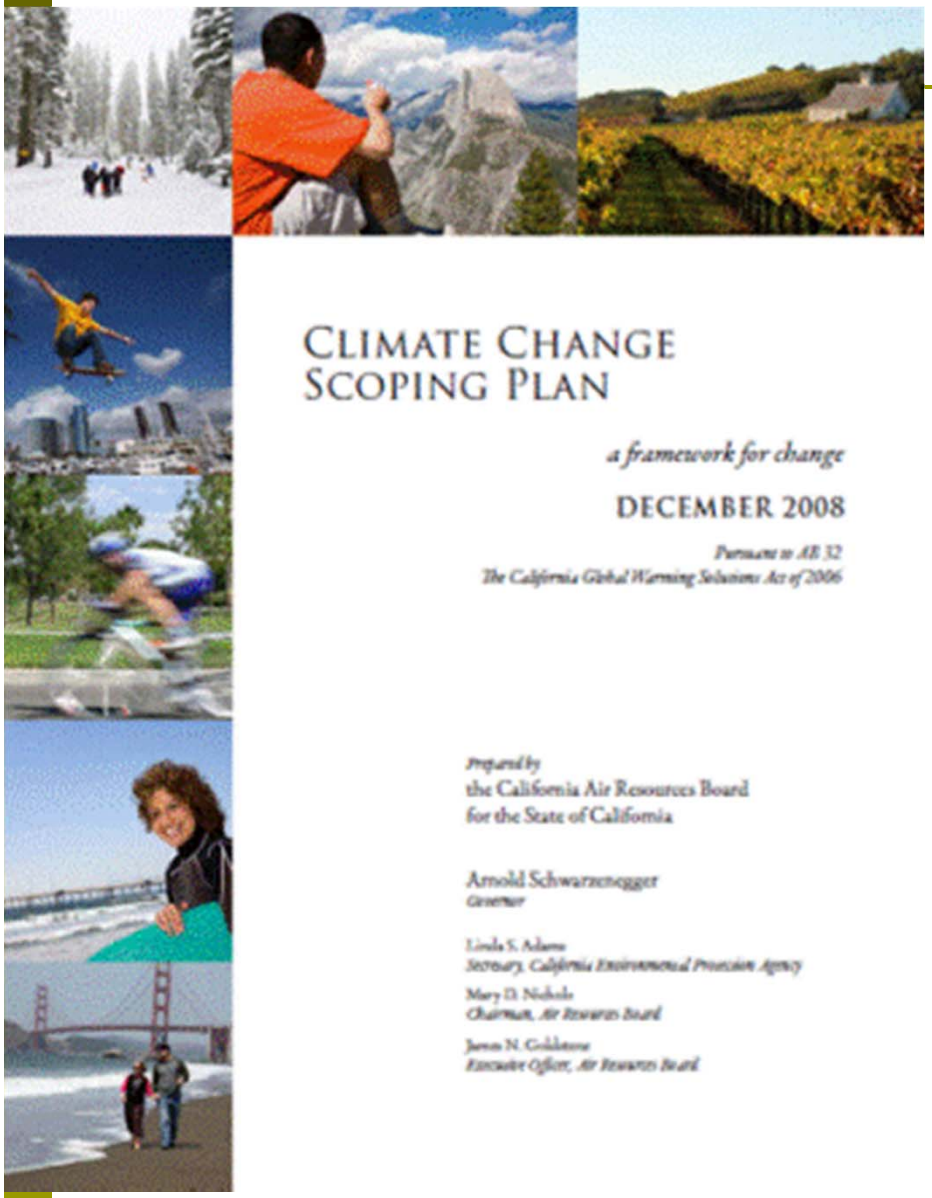




Adaptation and Mitigation: BOTH ARE NECESSARY

- Mitigation involves attempts to slow, stabilize, or reverse the process of global climate change by lowering the level of greenhouse gases in the atmosphere
  - Public health primary and secondary prevention
- Adaptation involves developing ways to protect people and places by reducing their vulnerability to and lessen the impact of climate change
  - Public health preparedness & response, tertiary prevention

We can do something about it



CALIFORNIA natural resources AGENCY

Public Health Adaptation Strategy
Guiding Principles & Core Strategies

- Community resilience
- Equity
- Co-benefits
- Communication, education
- Resources
- Community empowerment and engagement
- Surveillance
- Emergency preparedness
- Research

http://www.climatechange.ca.gov/adaptation/publichealth/index.html

Promote Community Resilience

- Promote built environments that mitigate climate change and/or reduce the impact of climate change on health
  - Location efficient housing
  - Active transportation infrastructure
  - Parks and open space
  - Energy efficiency
  - Fire resistant landscape/materials
  - Urban heat island mitigation
  - Permeable surfaces
- Reduce baseline exposure to toxins (e.g. air pollution)
- Promote strong social support networks
- Promote local sustainable food systems
- Strengthen health and PH infrastructure

Transportation Sector Health Co-Benefits

Reductions

- Greenhouse gas emissions
- Air pollution
- Noise
- Infrastructure costs
- Community Severance

Increases

- Physical Activity
- Social Capital

Reductions

- Respiratory disease
- Traffic injuries
- Heart disease
- Depression
- Osteoporosis
- Diabetes
- Cancer
- Stress

Climate & Health Benefits of Local Sustainable Food Systems

Reductions

- Greenhouse gas emissions
- Pesticide use
- Synthetic fertilizer use
- Food miles
- Antibiotic use
- Water pollution (nitrates)
- Air pollution
- Biodiversity loss
- Soil erosion
- Unsustainable H2O consumption

Increases

- Local food systems
- Rural community strength

Reductions

- Ischemic heart disease
- Obesity
- Colorectal cancer
- Breast & prostate cancers
- Type II Diabetes
- Antibiotic resistance
- Respiratory disease
- Pesticide health effects

Heat Adaptation Co-Benefits

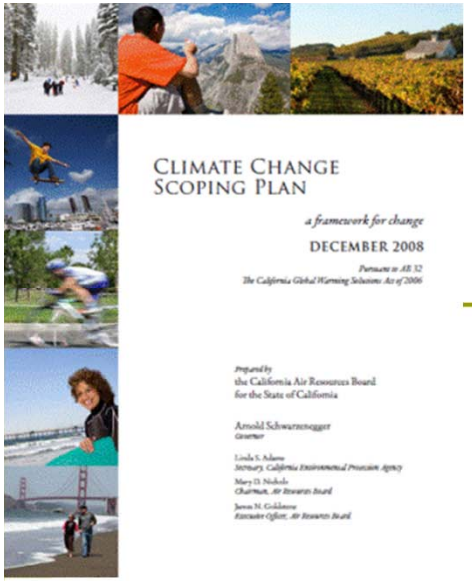
- Urban greening
  - Places to be active
  - Healthy food access
  - Reduce storm water run-off
    - Decrease flooding risk
- Reduce heat island effect
  - Decrease energy consumption
  - Lower energy costs
  - Reduce air pollution
- Improve aesthetics
  - Reduce crime

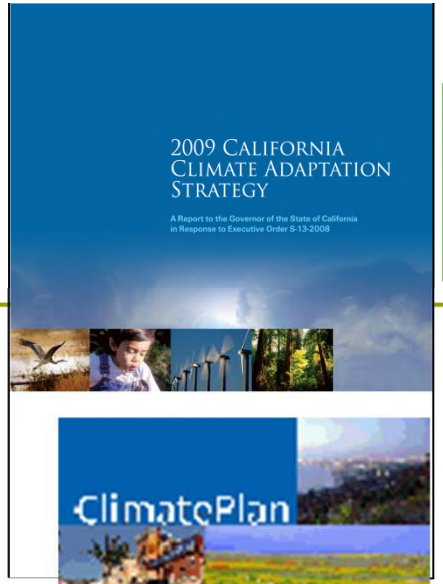
“The health sector must add its voice – loud and clear…we must fight to place health issues at the center of the climate agenda. We have compelling reasons for doing so. Climate change will affect, in profoundly adverse ways, some of the most fundamental determinants of health: food, air, water.”

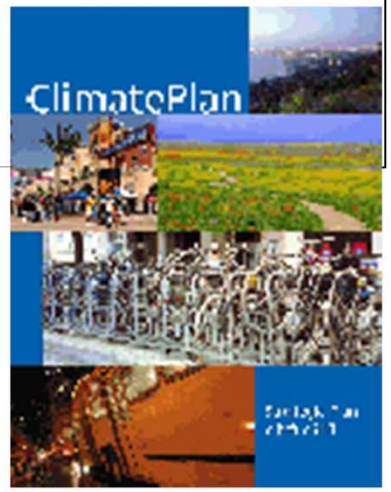
Dr. Margaret Chan, Director General of the World Health Organization, December 2007

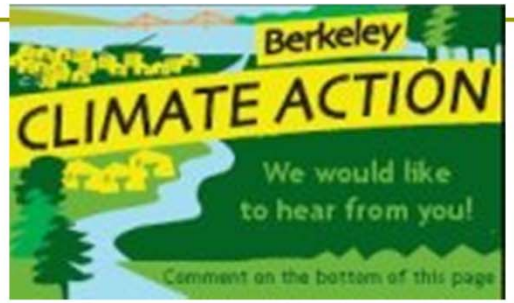
What can public health do?

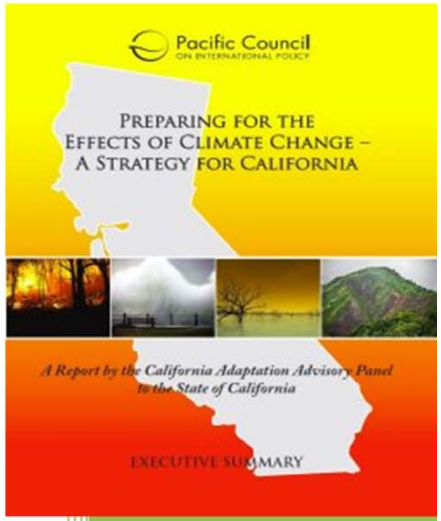
- Define the problem
- Education & messaging
- Community & PH engagement
- Collaboration with other agencies
  - Health lens
- Healthy climate mitigation & adaptation
  - Maximize health benefit
  - Minimize adverse consequences
  - Address the climate gap
- Social norms change











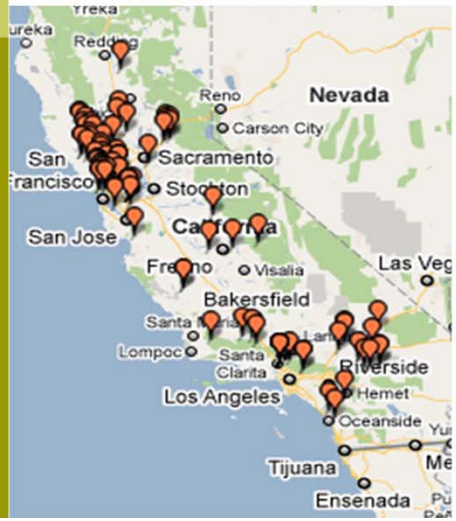
ICLEI
Local Governments for Sustainability
USA

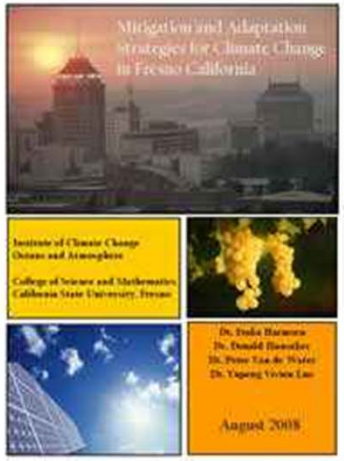
SACRAMENTO COUNTY

DRAFT

Climate Action Plan

California Cool Cities





BENICIA
CLIMATE ACTION PLAN

If we act urgently and aggressively we can

- Prevent the most catastrophic climate scenarios
- Promote climate mitigation and adaptation strategies with health co-benefits
- Reduce health inequities and chronic illness
- Build resilient communities to adapt better
- Promote healthy, equitable, and sustainable communities

For recordings, slides and additional materials for this webinar, and to sign up for other webinars in this climate and health series go to:

http://www.cdph.ca.gov/programs/CCDPHP/Pages/ClimateChange.aspx

Thank you for joining us today!

- Please send questions and comments to Kathy Dervin. CDPH is very interested in your feedback and ideas for other climate and health topics that would be helpful to you.

Kathy.dervin@cdph.ca.gov

Climate Vulnerability In California

Rachel Morello-Frosch
University of California, Berkeley
School of Public Health &
Department of Environmental Science, Policy and Management

THE CLIMATE GAP

Inequalities in How Climate Change Hurts Americans & How to Close the Gap

Rachel Morello-Frosch, Ph.D., MPH | Manuel Pastor, Ph.D. | James Sadd, Ph.D. | Seth B. Shonkoff, MPH

Available at: http://college.usc.edu/pere/publications/index.cfm

The Climate Gap: People of color and the poor will...

- Suffer higher mortality and health impacts
  - More frequent and intense heat waves
- Be exposed to higher air pollution levels
  - Current pattern of pollution exposure and health inequality could become even worse
- See the “spending gap” widen
  - Pay a greater cost for basic necessities
- Experience reduced economic opportunities
  - Shifting job opportunities, greater job losses

Disparate Impact of Climate Change– Heat-related Mortality

Disparate Impact of Heat-Related Mortality by Race/Ethnicity–California, 1999-2003

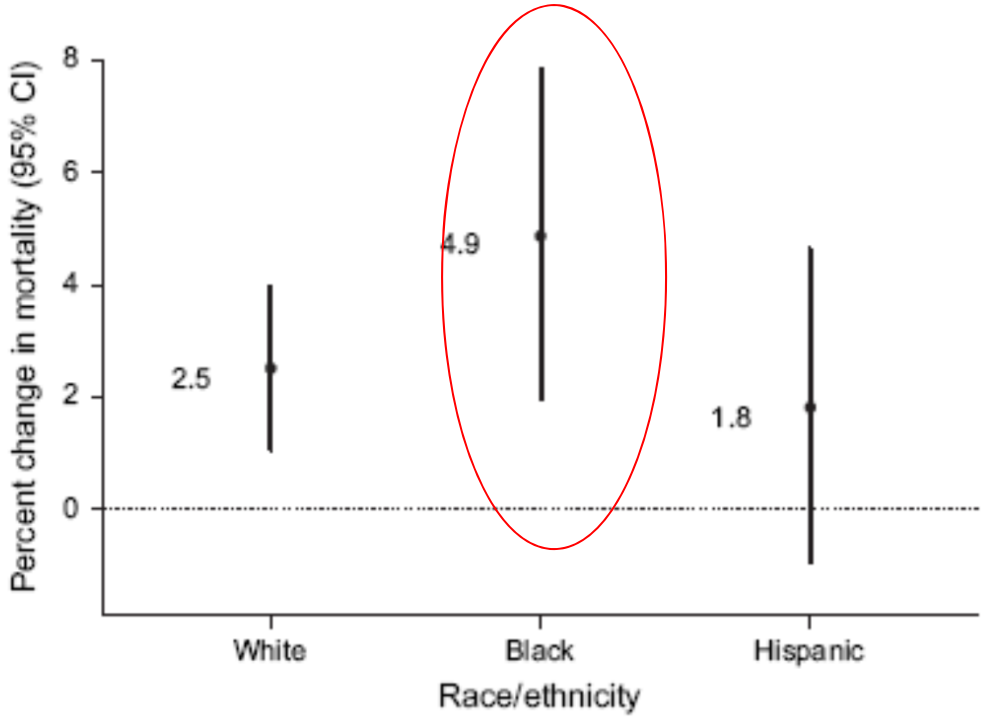


FIGURE 3. Estimated percent change associated with a 10°F (4.7°C) increase in mean daily apparent temperature and nonaccidental mortality by race/ethnic group in nine counties, California, May through September, 1999–2003. CI, confidence interval.

Basu R, Ostro BD (2008) A Multicounty Analysis Identifying the Populations Vulnerable to Mortality Associated with High Ambient Temperature in California, AJE 168(6): 632-637.

Air Conditioning Prevalence, Mortality and Race– 4 U.S. Cities

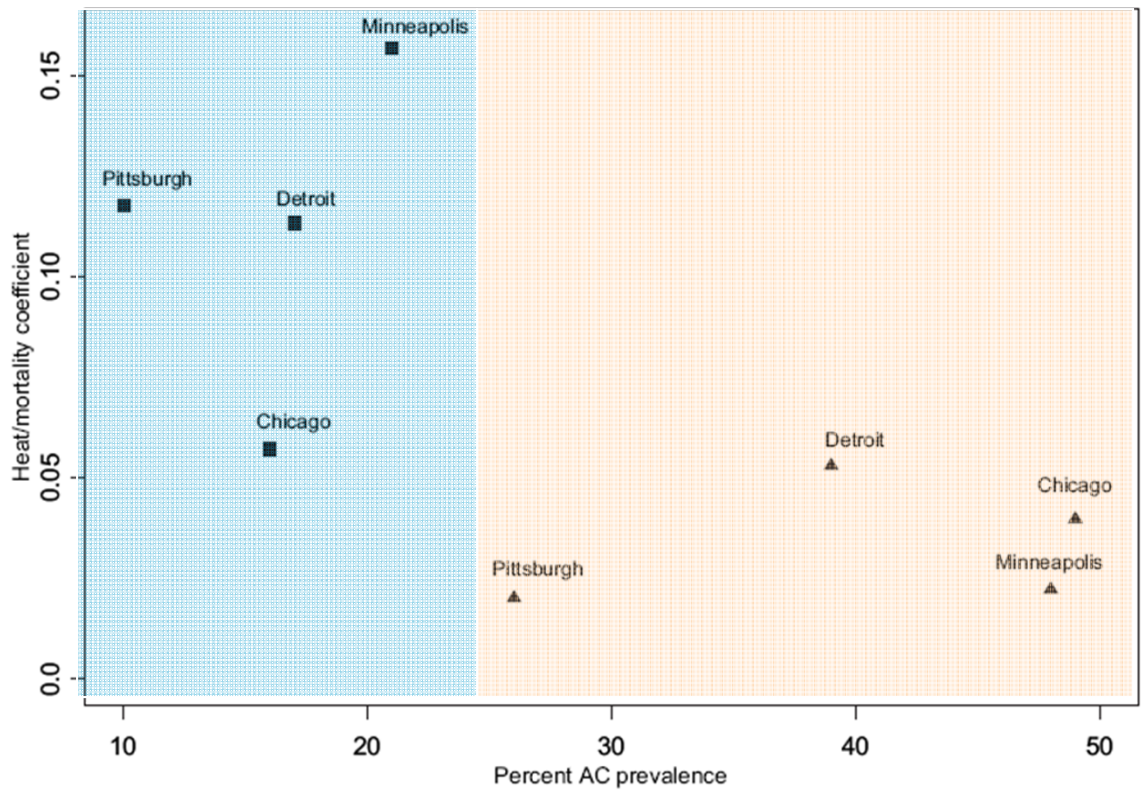


FIGURE. Coefficients for the relative risk of mortality on days at 29 °C apparent temperature compared with days at 15 °C, by prevalence of central air conditioning (AC), race, and city. ▲, Whites (and Whites/Others, for AC prevalence); ■, Blacks. Coefficients are from Poisson regression models with covariates including barometric pressure, PM_{10}, time trend, day of week, and apparent temperature averaged over lags 1, 2, and 3 (heat effect is expressed for apparent temperature lag 0). Data cover the period 1986–1993.

O'Neill, MS, Zanobetti A, Schwartz, J (2005) Disparities by Race in Heat-Related Mortality in Four US Cities: The Role of Air Conditioning Prevalence. *Journal of Urban Health*. 82: 191-197.

Equity, Adaptation Capacity, and the Built Environment

Photo: Climate Change Public Health Impacts Assessment and Response Collaborative California Department of Public Health and the Public Health Institute

Heat Island Effects

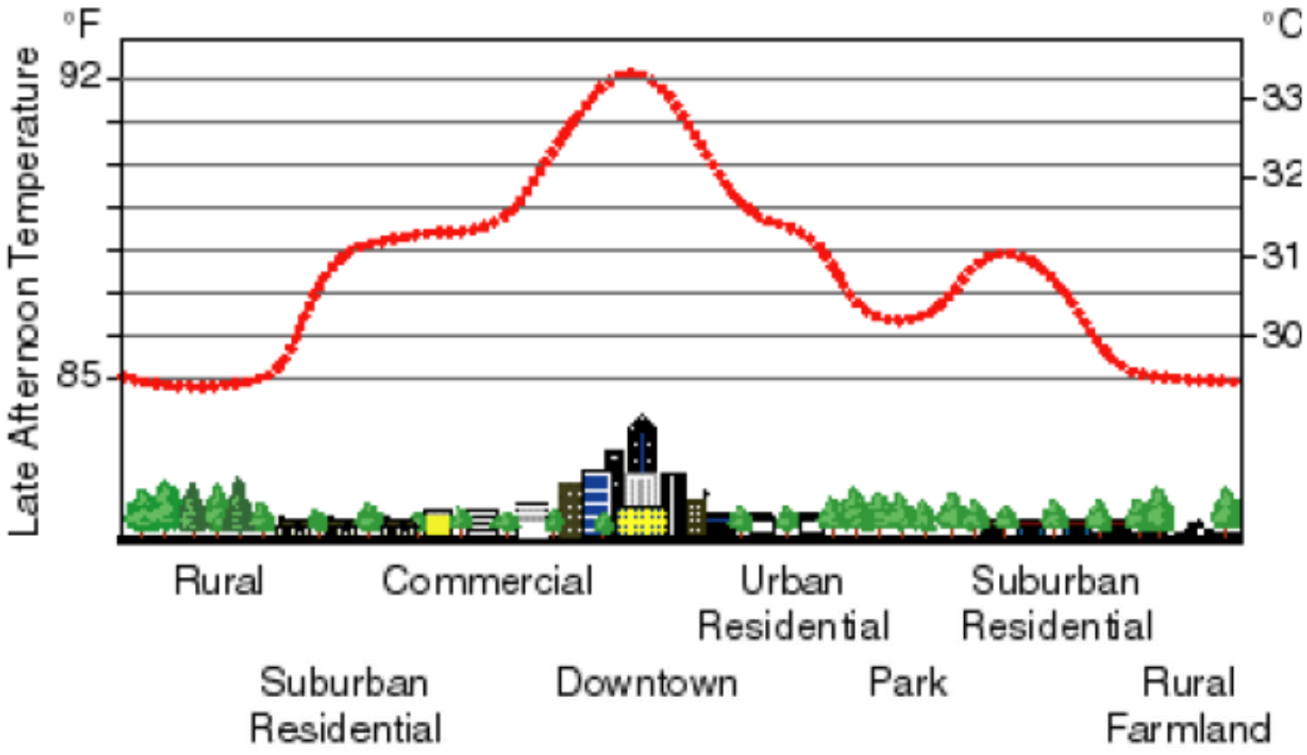
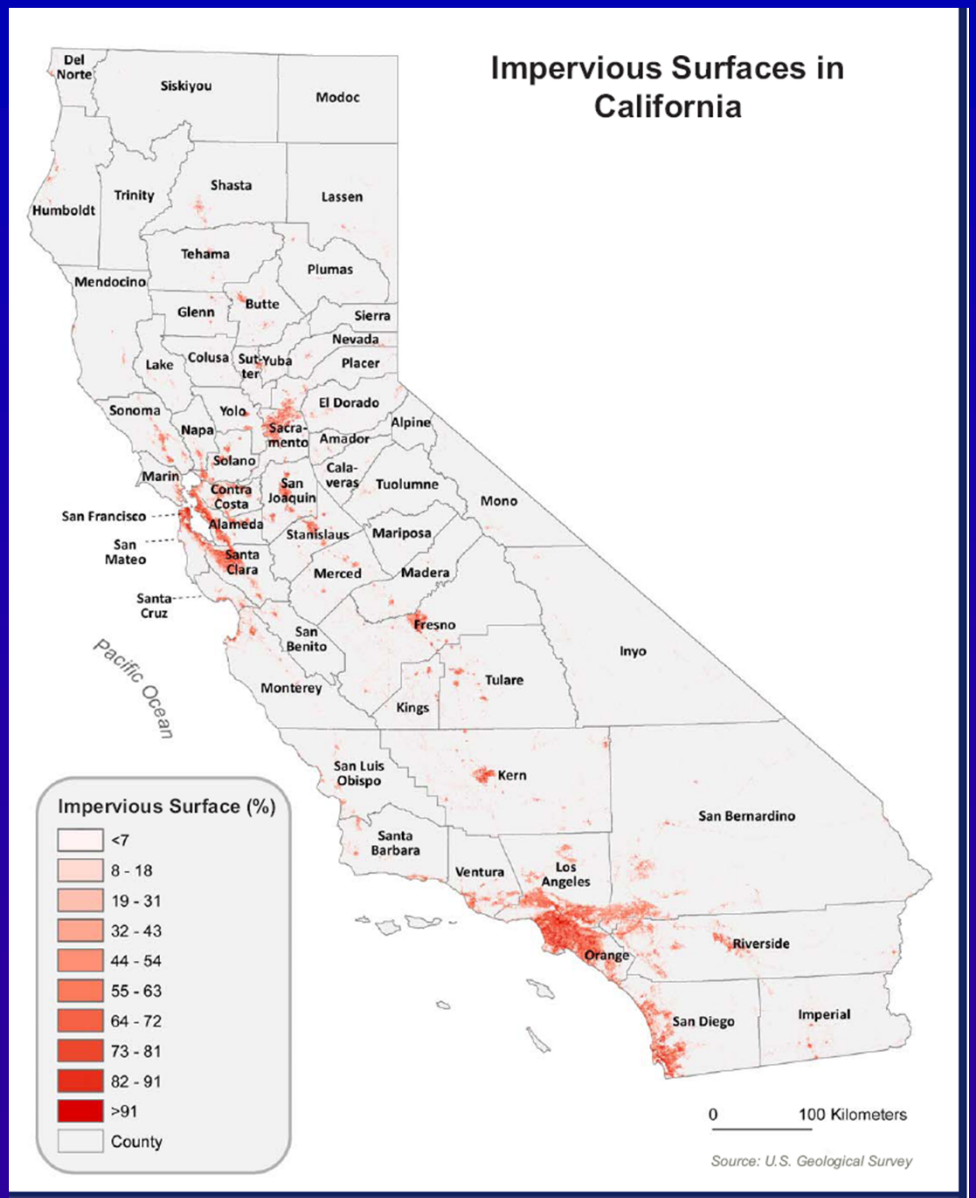


Figure 2.4: Temperature profile of an urban heat island.
(http://www.epa.gov/globalwarming/greenhouse/greenhouse14/reduction.html)

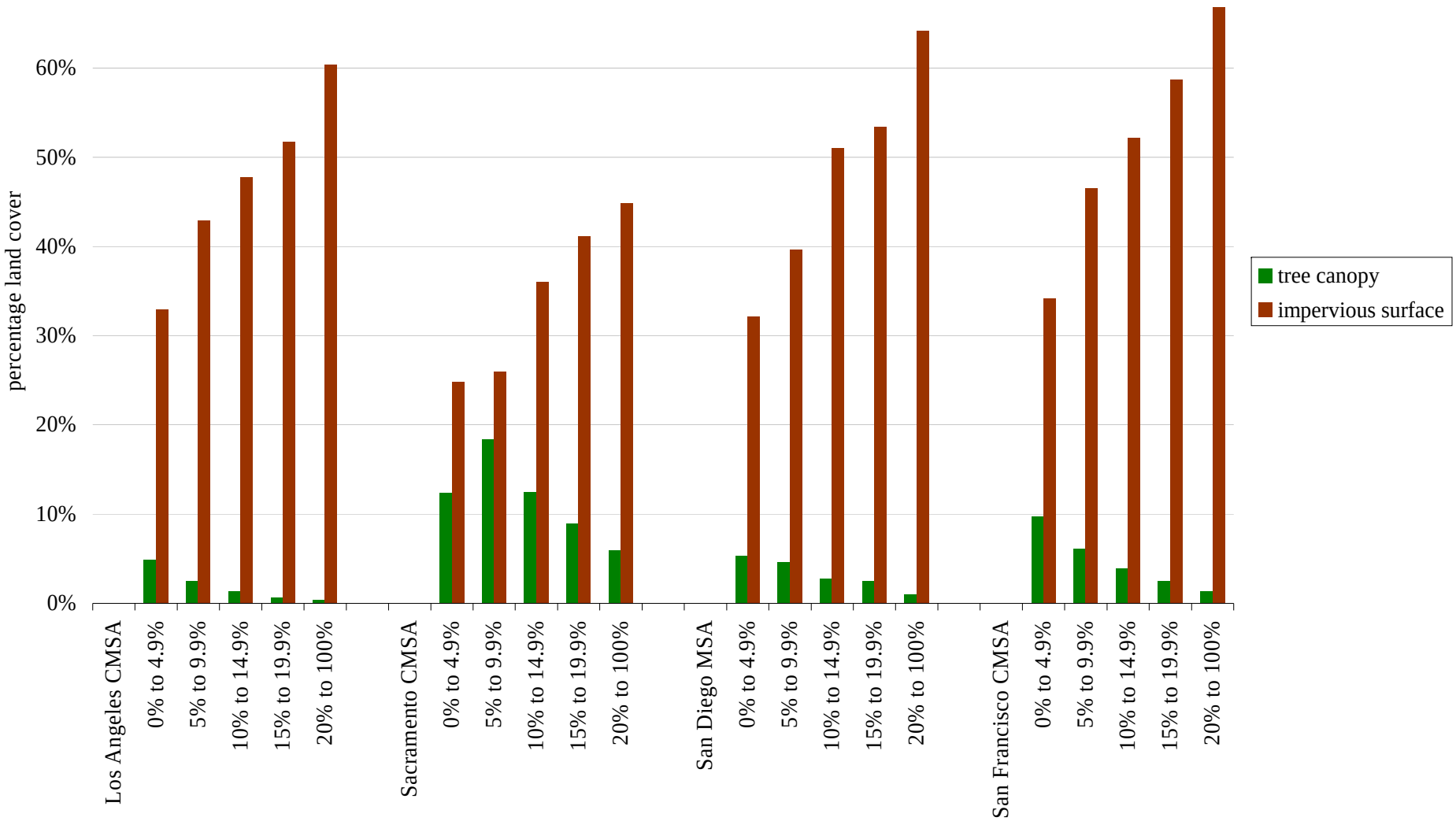
Impervious Surfaces in CA



Climate Change Public Health Impacts Assessment and Response Collaborative
California Department of Public Health and the Public Health Institute

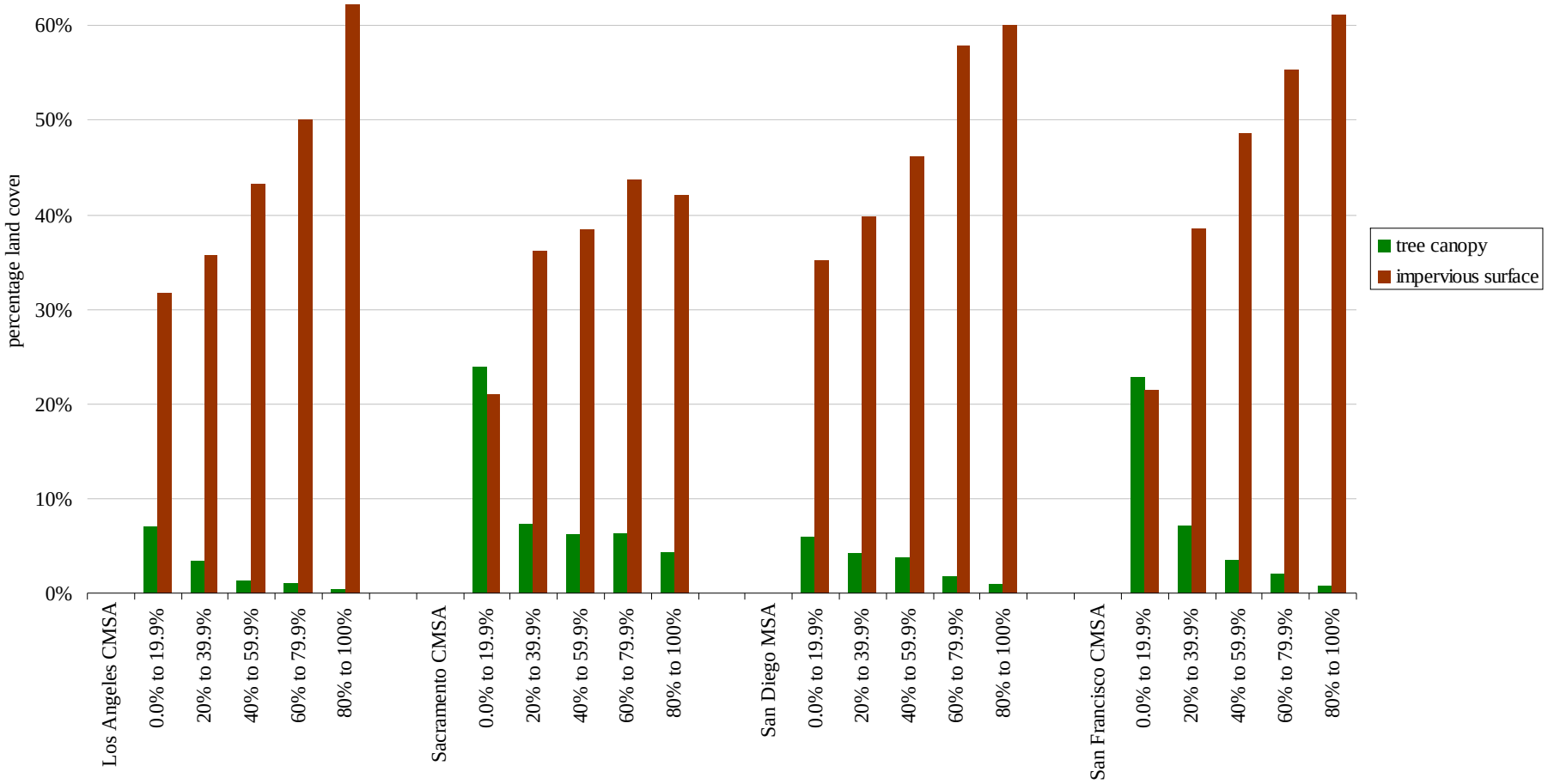
Equity, Adaptation Capacity, and the Built Environment

land cover characteristics
across comparable neighborhood poverty groups



Equity, Adaptation Capacity, and the Built Environment

land cover characteristics
across comparable neighborhood racial/ethnic minority groups



Transportation Justice:
Proportion of households with no vehicle by race/ethnicity,

Los Angeles County

Race/Ethnicity	% of households with no vehicle
White	7.9%
Hispanic or Latino (of any race)	17.1%
Black or African American	20.0%
American Indian and Alaska Native	16.0%
Asian	9.8%
Total Population	12.6%

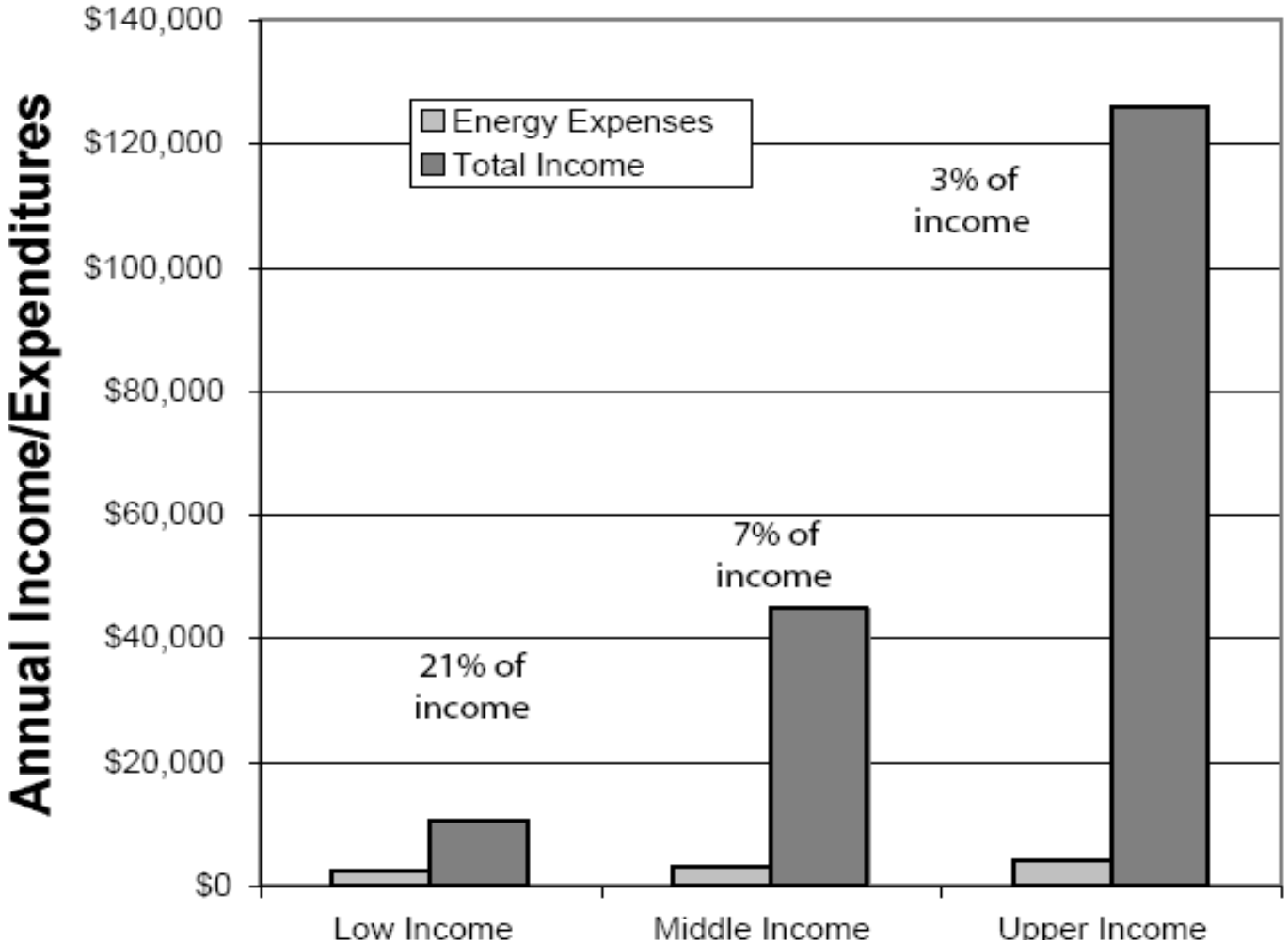
Adapted From: *Census 2000 Summary File 4 (SF 4) - Sample Data*

Racial categories are for non-Hispanics only

•Higher proportions of African American, Latino, and Asian households do not have access to a car, compared to Whites;
•Restricts capacity to move to cooler areas during extreme heat events

Economic Impacts

Share of US Household Income Spent on Energy, 2004

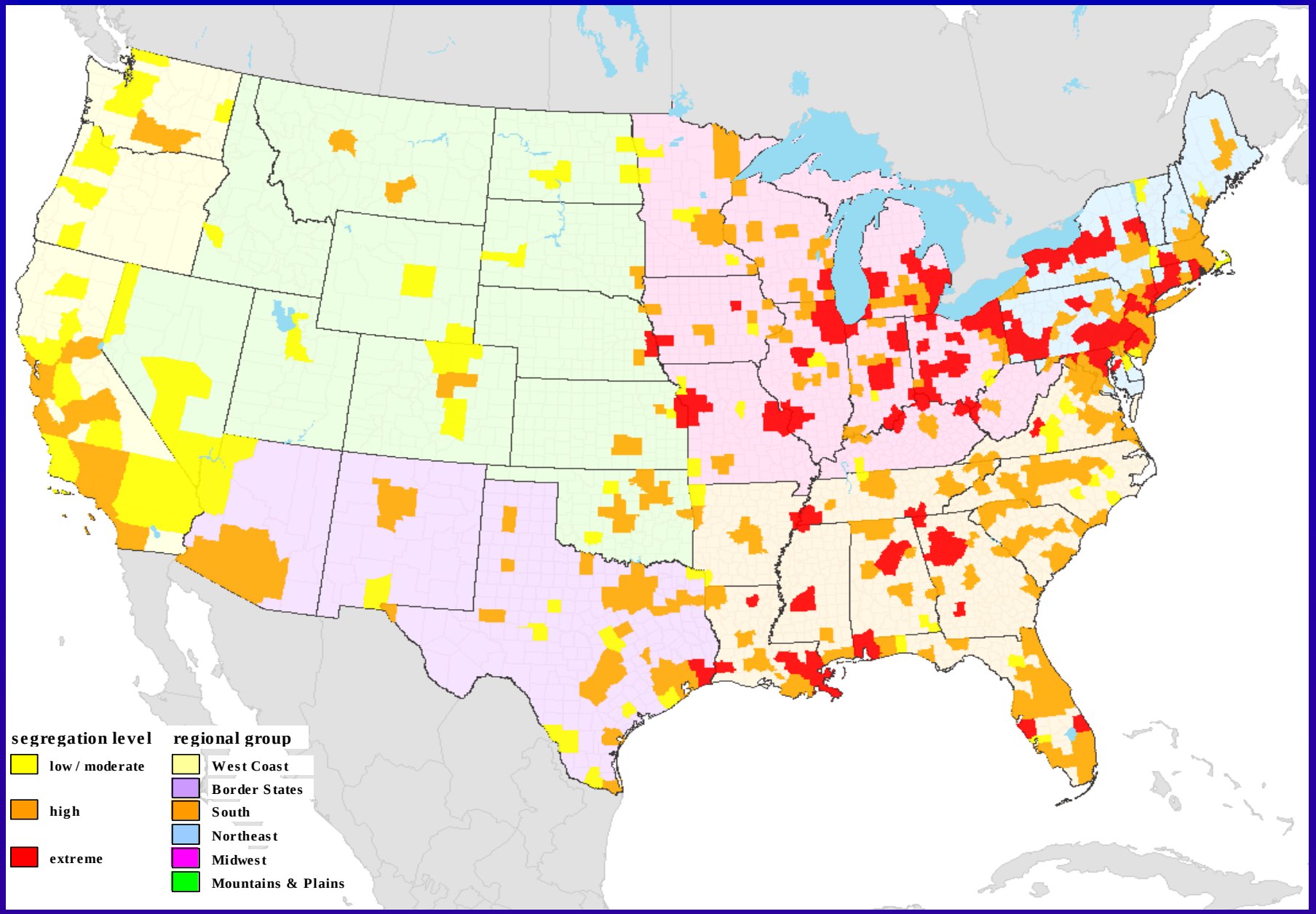


Consumer Federation of America, Consumers Union, *Rising Energy Prices Strain Household Budgets and the Economy, for Most Americans*, September 2004 (Cited in Dutzik, Sargent, et al. (2007)).

Climate Justice Benefits of GHG Reductions

- Communities of color and the poor could directly benefit from greenhouse gas reduction strategies
  - indirect reduction in air toxics, NOx, PM, and other pollutants.
- Many targeted GHG emission sources disproportionately affect low income communities of color
  - Mobile source emissions (Morello-Frosch et al. 2006)
  - Stationary sources (Morello-Frosch et at. 2001, Pastor, Sadd et a. 2003)

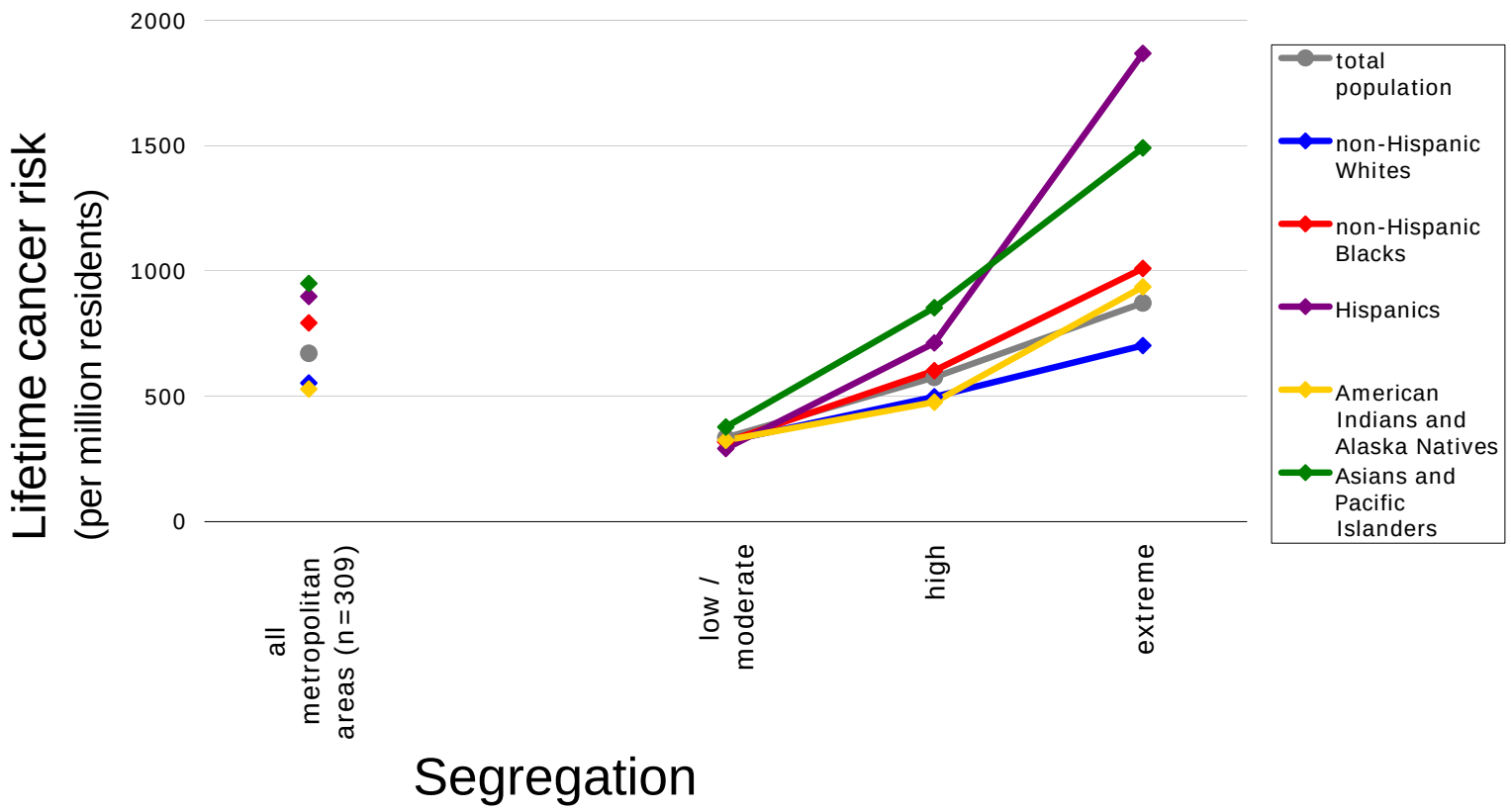
Multi-Group Racial/Ethnic Segregation in the United States



Morello-Frosch and Jesdale, EHP 2006

Dirtier Air: Segregation and Air Toxics

Estimated cancer risk associated with ambient air toxics by race/ethnicity and racial/ethnic residential segregation, continental United States metropolitan areas



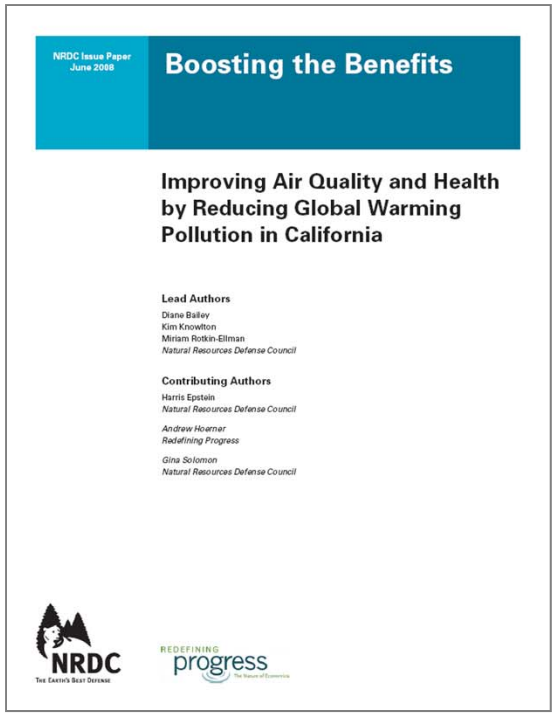
(Morello-Frosch & Jesdale 2006)

Minding the Climate Gap

What's at Stake if California's Climate Law isn't Done Right and Right Away

Report Available at: http://climategap.org

The Clean Air Opportunities of AB 32


NRDC Issue Paper
June 2008

Boosting the Benefits

Improving Air Quality and Health by Reducing Global Warming Pollution in California

Lead Authors
Diane Bailey
Kim Knowlton
Miriam Rotkin-Ellman
Natural Resources Defense Council

Contributing Authors
Harris Epstein
Natural Resources Defense Council

Andrew Hoerner
Redefining Progress

Gina Solomon
Natural Resources Defense Council

NRDC
THE EARTH'S BEST DEFENSE

REDEFINING progress

1. Large GHG-emitting facilities tend to be in urban areas

2. Reductions could also lead to cleaner air in the neighborhoods most plagued by pollution

Understanding the Connection

- Both emissions and people are distributed unevenly
- Health impacts are driven by concentration of several facilities and other emission sources
- A long history low-income communities of color bearing the burden of worst air pollution
- Greenhouse gas reduction policies present an ***opportunity*** to realize health benefits where they are needed most, but only if is done ***right***

Cap and Trade Concerns

Understanding the Implications

Under certain market-based scenarios, there is no certainty of where emissions reductions will take place

Oil refinery in a densely populated area in Southern California

Power plant in a sparsely populated area of California

Understanding the Opportunities

California Dataset – 146 Major GHG-Emitting Facilities

Facilities (most phase I C&T facilities)

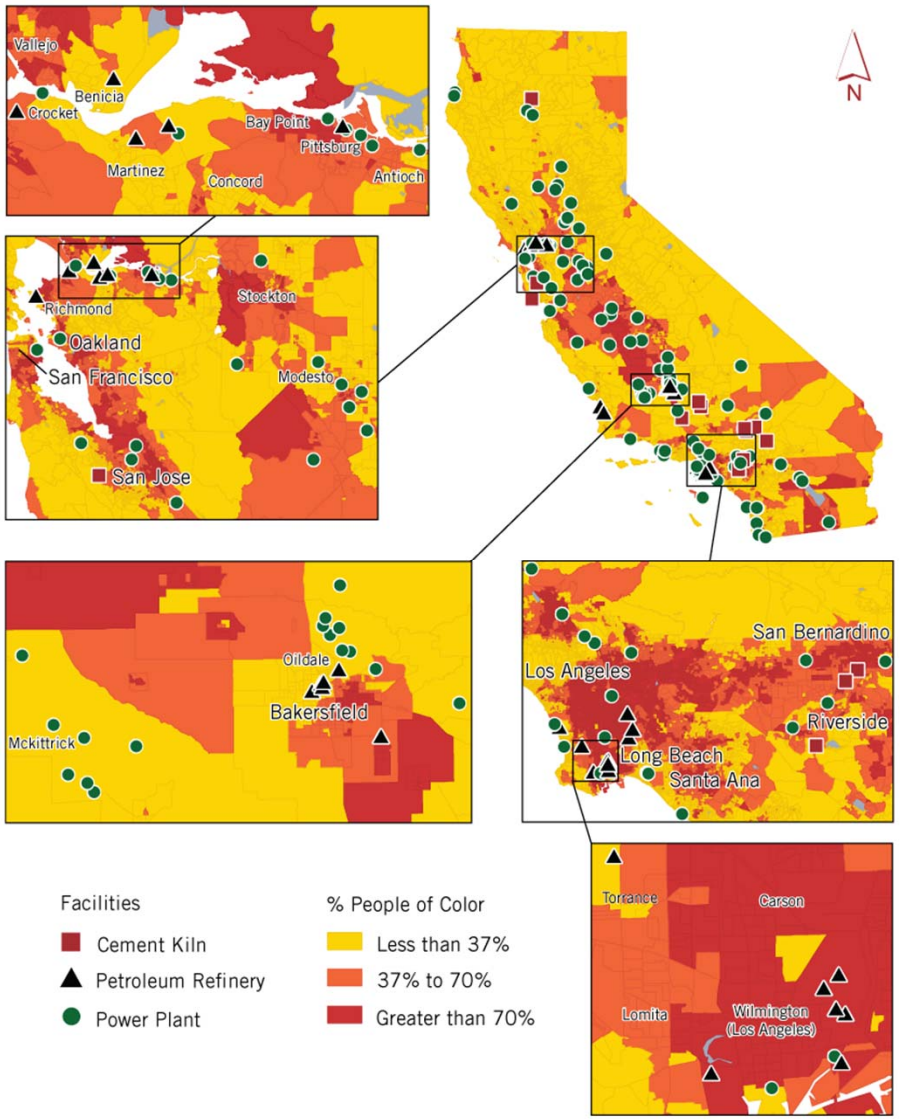
- Large or “Dirty” Power Plants
- Petroleum Refineries
- Cement Plants

Emissions

- PM10 (2006)
- NOx (2006)
- CO2 (2008)

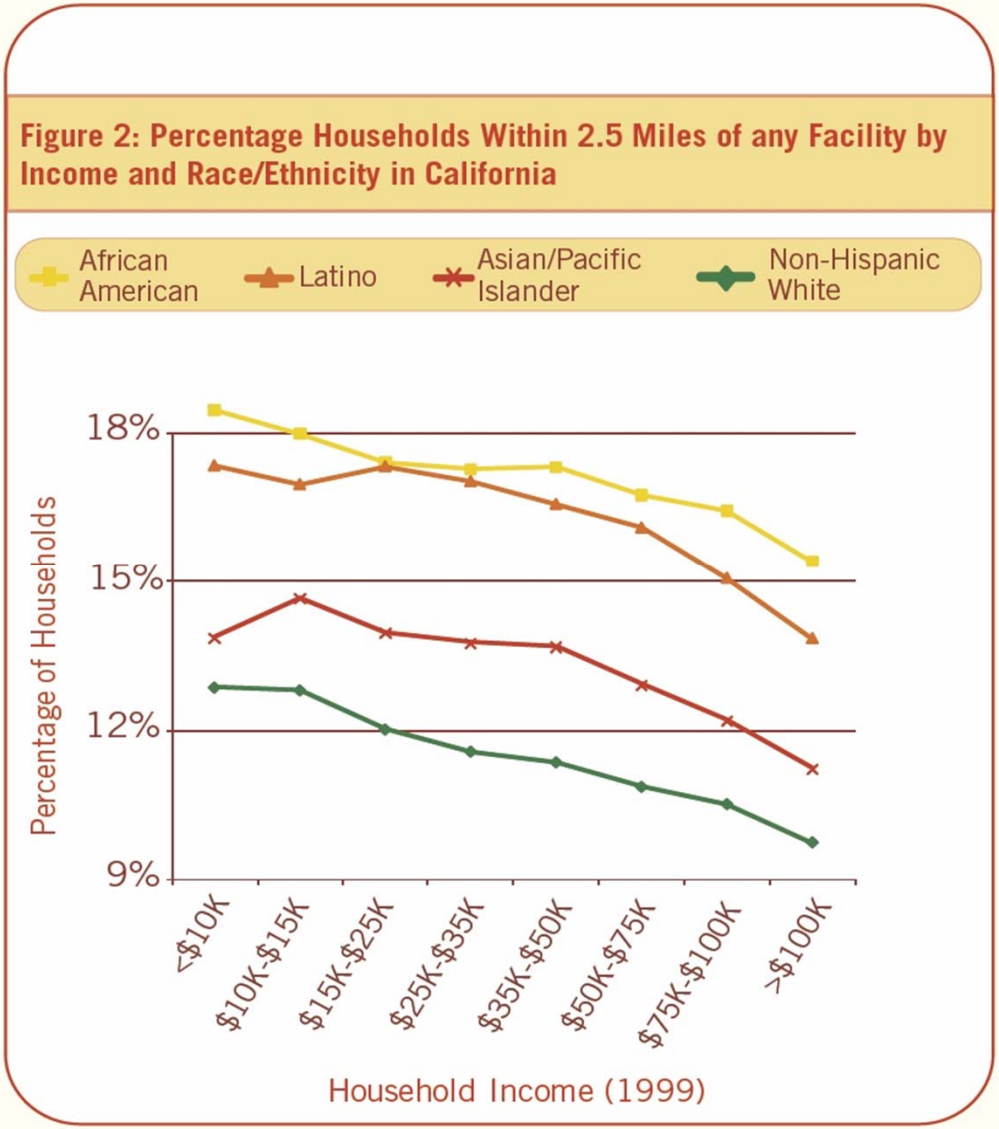
Methods:

- Located facilities geographically
- Linked neighbor-hood characteristics from the Census to facilities
- Developed a "pollution disparity index" and calculated a health impacts index that was used in Bailey et al. 2008



Findings:

- People of color and people living in poverty are disproportionately near major GHG-emitting facilities
- It isn't just income: disparities exist at all income levels

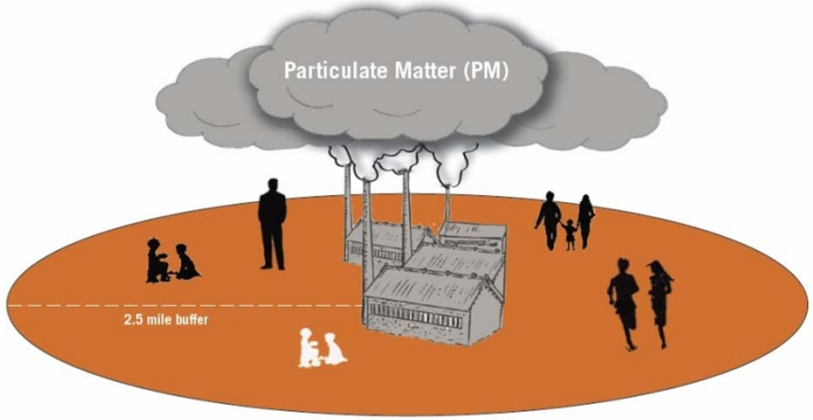


Findings:

- To quantify the gap more exactly in terms of sectors and facilities, we created a "pollution disparity index" for each facility

- The index measures racial disparity in PM_{10} emissions at the facility level by combining particulate emissions with an analysis of the population living within certain distances of each facility

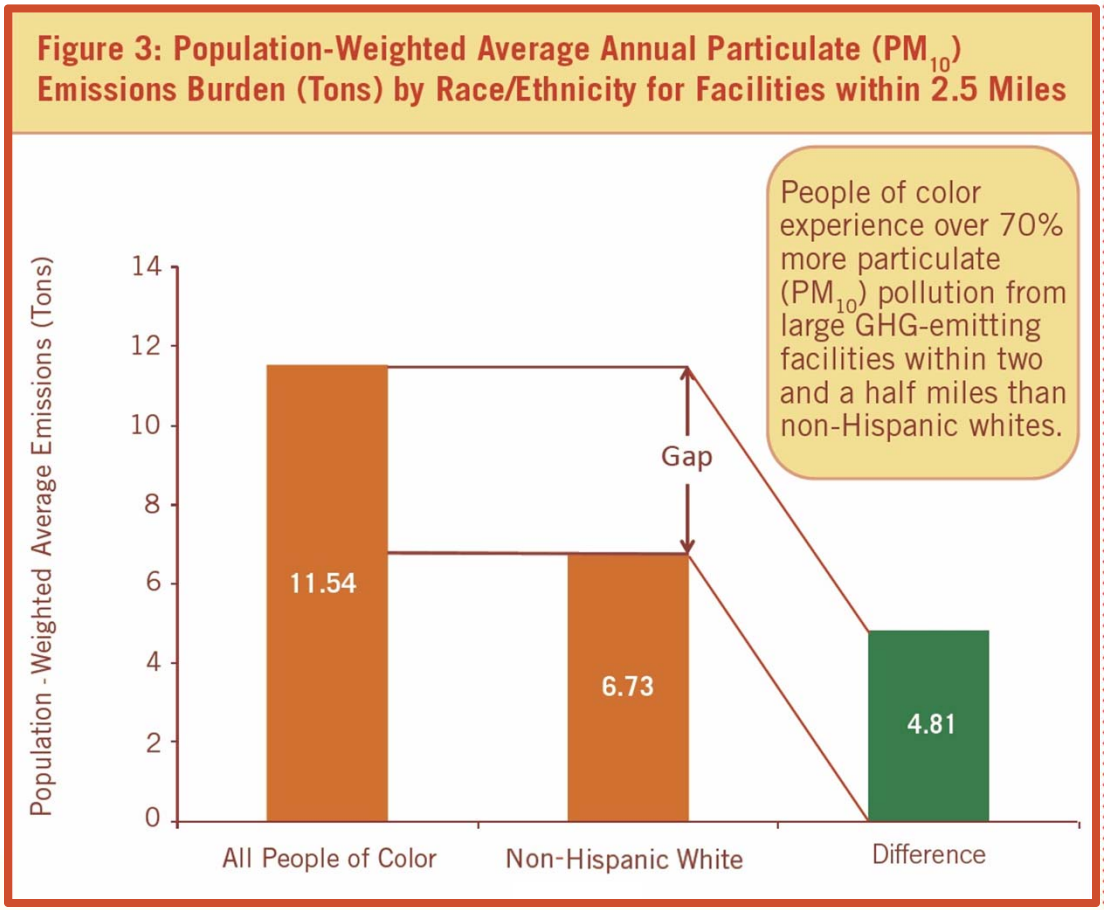
Calculation of the Pollution Disparity Index



The pollution disparity index measures the extent to which a facility disproportionately pollutes people of color as compared to non-Hispanic whites. It is calculated by considering total pollutants produced by the facility (tons of particulate matter), the number of people within a certain distance of the facility, and the demographics of that population. The resulting disparity index can be added up across all facilities to get the state-wide disparity score – or gap – in pollution burden by race/ethnicity.

Findings:

- On average, people of color experience over 70 percent more PM_{10} pollution from the high GHG-emitters

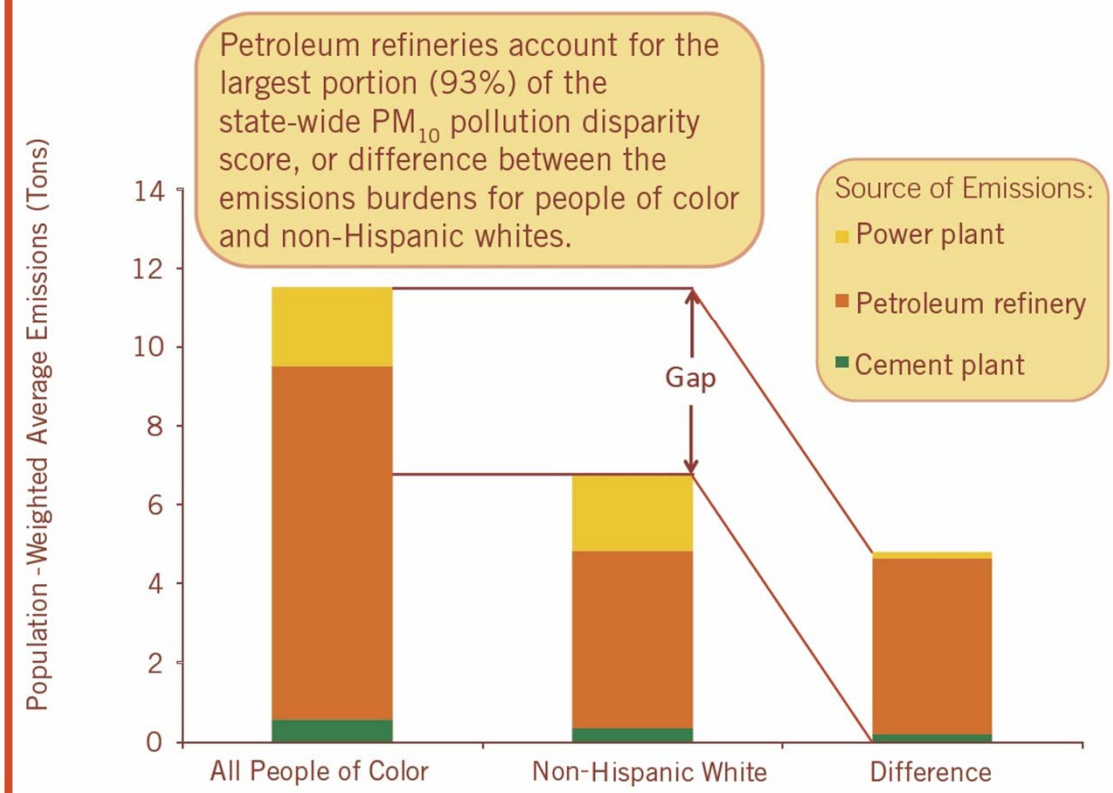


Findings:

- Petroleum refineries account for a large share of the pollution burden faced by all people

- They contribute even more to the racial disparity

Figure 4: Population-Weighted Average Annual Particulate (PM_{10}) Emissions Burden (Tons) by Facility Category and Race/Ethnicity for Facilities within 2.5 Miles



Findings: Top Ten Facilities by Pollution Disparity Index

Rank	Facility Name	City	Pollution Disparity Index
1	BP Carson Refinery	Carson	1.44
2	Tesoro Wilmington Refinery	Wilmington (Los Angeles)	1.01
3	Paramount Refinery	Paramount	0.62
4	ConocoPhillips Wilmington Refinery	Wilmington (Los Angeles)	0.52
5	ExxonMobil Torrance Refinery	Torrance	0.40
6	Chevron Richmond Refinery	Richmond	0.32
7	Malburg Generating Station (Vernon Power Plant)	Vernon	0.31
8	ConocoPhillips Carson Refinery	Carson	0.29
9	Valero Wilmington Refinery	Wilmington (Los Angeles)	0.24
10	California Portland Cement Company Colton Plant	Colton	0.16

Findings: Top Ten Percent of Facilities by Health Impacts Index

- Disparity and overall health impacts are inextricably linked: **eight** of the **ten** most disparate facilities by race/ethnicity also rank highly in terms of relative potential health impacts

Table 4: Top Ten Percent of California's Major Greenhouse Gas-Emitting Facilities Ranked by the Health Impacts Index

Rank	Facility Name	City	Health Impacts Index
1	ExxonMobil Torrance Refinery	Torrance	54.4
2	Tesoro Wilmington Refinery	Wilmington (Los Angeles)	50.0
3	BP Carson Refinery	Carson	46.3
4	Chevron El Segundo Refinery	El Segundo	41.2
5	ConocoPhillips Wilmington Refinery	Wilmington (Los Angeles)	30.3
6	Shell Martinez Refinery	Martinez	27.1
7	Valero Benicia Refinery	Benicia	19.1
8	Mountainview Power Plant	San Bernardino	17.5
9	Chevron Richmond Refinery	Richmond	17.3
10	California Portland Cement Company Colton Plant	Colton	14.1
11	Paramount Refinery	Paramount	13.8
12	Valero Wilmington Refinery	Wilmington (Los Angeles)	13.0
13	Cemex Victorville/White Mountain Quarry	Apple Valley	12.5
14	Tesoro Golden Eagle Refinery	Martinez	12.1
15	Etiwanda Generating Station	Rancho Cucamonga	11.1

Cap and Trade Concerns

- "Co-pollutant intensity" varies across regions, sectors and polluters
- Market systems could perpetuate or exacerbate disparities in pollutant burdens because of failure to price in co-benefits (e.g. PM reductions)
- No system to ensure that GHG reductions occur in communities that could benefit most from co-pollutant reductions.
  - Getting the "biggest bang for our carbon reduction buck"

Other Concerns

- Emerging siting controversies:
  - Biofuels production facilities in rural areas
- Gentrification pressure from “smart growth” strategies
- Enhancing community capacity to participate in the formulation of mitigation and adaptation initiatives

Solving climate change & closing the Climate Gap

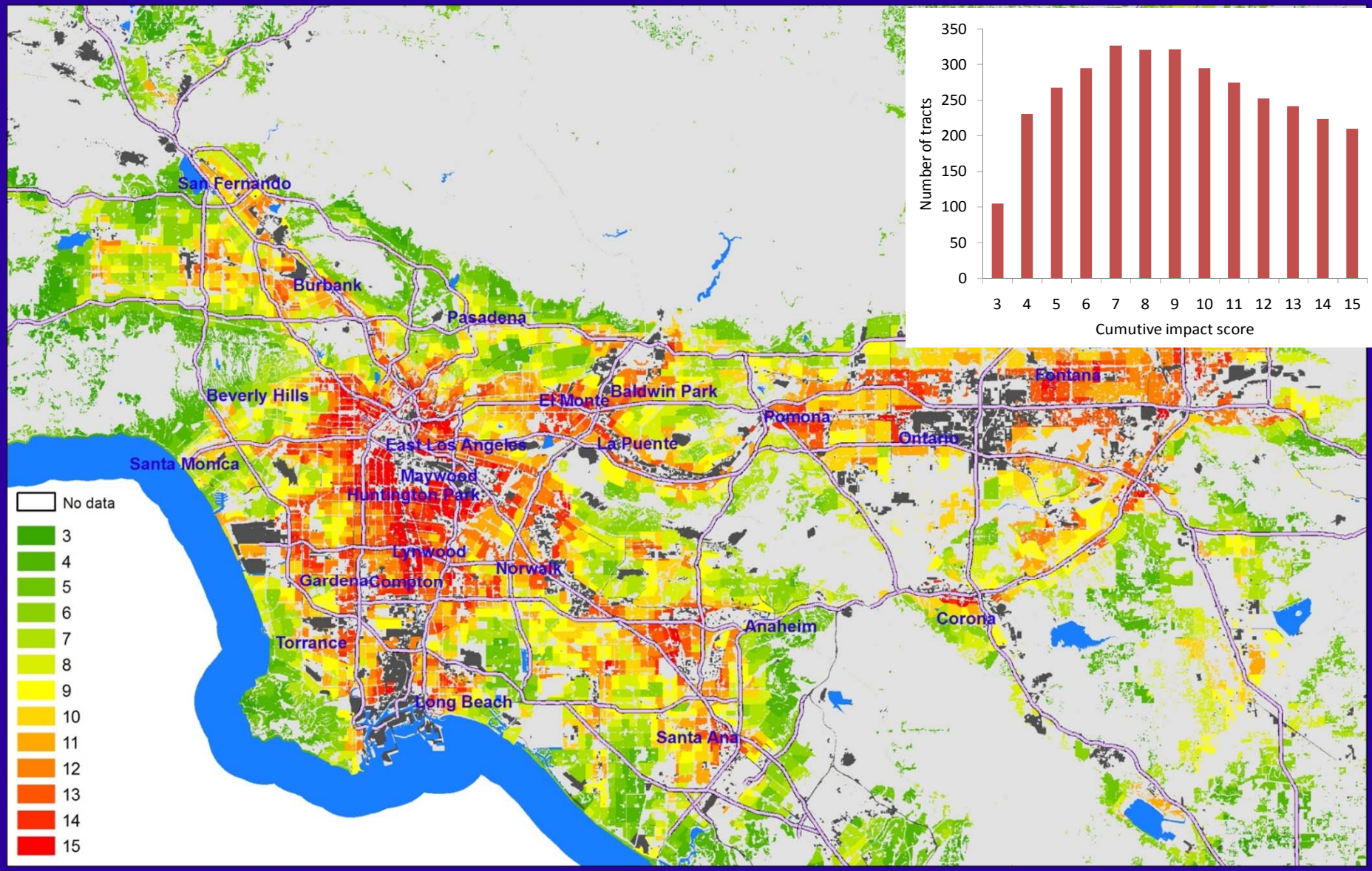
Identify Climate Gap neighborhoods

Invest portion of revenue stream there

Focus GHG reductions in communities that will benefit most

Target green zones development

Identifying Climate Gap Neighborhoods



Work being conducted for California Air Resources Board (CARB)

Metric categories for screening

- Proximity to hazardous land uses
  - E.g. Traffic density, large industrial facilities
- Air pollution exposures/health risks
  - E.g. PM levels, air toxics and estimated health risks
- Social and Health Vulnerability
  - E.g. Racial/Ethnic make-up, birth outcomes, income level, voter turnout, age
- *Climate Change Vulnerability (coming soon)*
  - Heat island risk
  - Transit access
  - Additional social vulnerability factors
  - Housing infrastructure

Purpose of Climate Gap Screening

- Highlight areas of concern/opportunity in terms of:
  - Cumulative impacts from major emission sources
  - Community adaptation capacity
  - Economic and social vulnerability

- Apply screening for:
  - Land use planning
  - Regulatory decision-making and enhanced enforcement of mitigation efforts
  - Community outreach and engagement
  - Green Zones Development
    - Oakland Climate Action Plan
    - San Diego/Pacoima Green Zones

Thank you

Sustainability & Environmental Justice Research Group

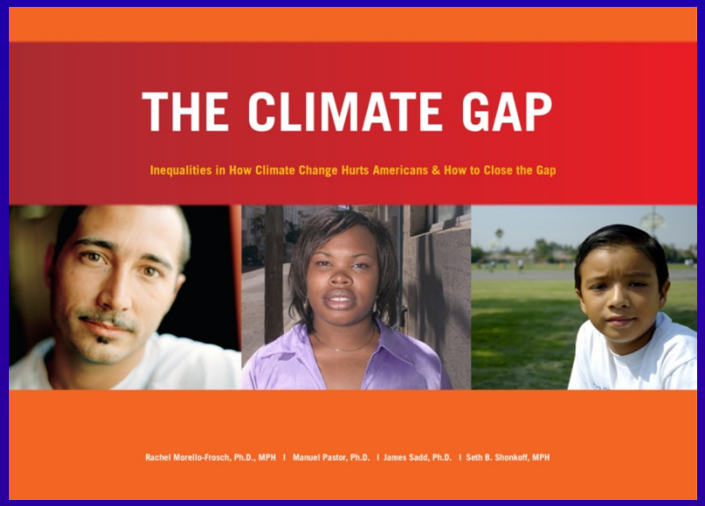
UC Berkeley, Department of Environmental Science, Policy and Management

School of Public Health

rmf@berkeley.edu

Climate Justice

- Collaborators:
  - James Sadd, Occidental College
  - Manuel Pastor & Justin Scoggins, University of Southern California
  - Seth Shonkoff & Bill Jesdale, UC Berkeley
- Funders:
  - CARB
  - CEC
  - Cal-EPA
  - Hewlett Foundation



Available at: http://college.usc.edu/pere/publications/index.cfm