Source: CBE

Source: David Woo

Environmental Justice Screening Method (EJSM) and Community Participation

06.05.2012

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One key research premise: the need for regulatory science to consider **cumulative impact**

- ***Multiple*** hazards where communities live, work, and play
- ***Vulnerability*** due to social stressors
  - poverty, malnutrition, chronic health problems

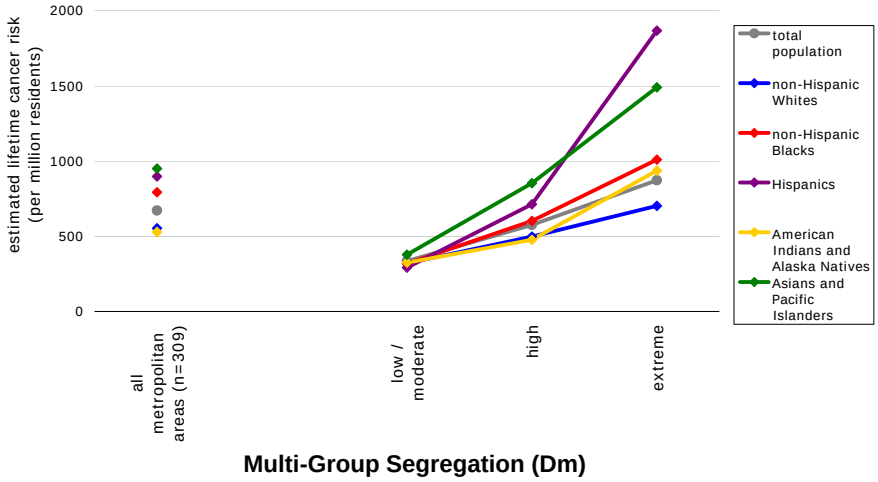
Cumulative Impacts in Richmond, CA

Science of Cumulative Impacts

- *Disparities in exposures* to environmental hazards between racial and socioeconomic groups are significant and are linked to adverse health risks

Disparate Cumulative Impacts—Segregation and Air Quality

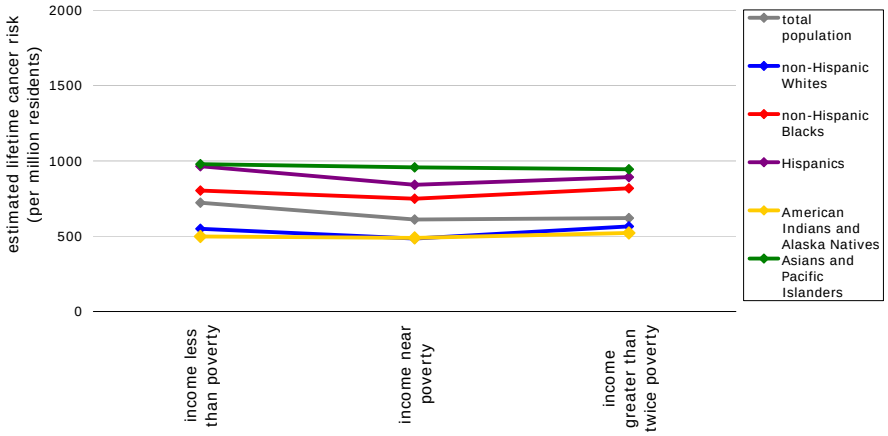
Estimated cancer risk associated with ambient air toxics by race/ethnicity and racial/ethnic residential segregation, continental United States metropolitan areas



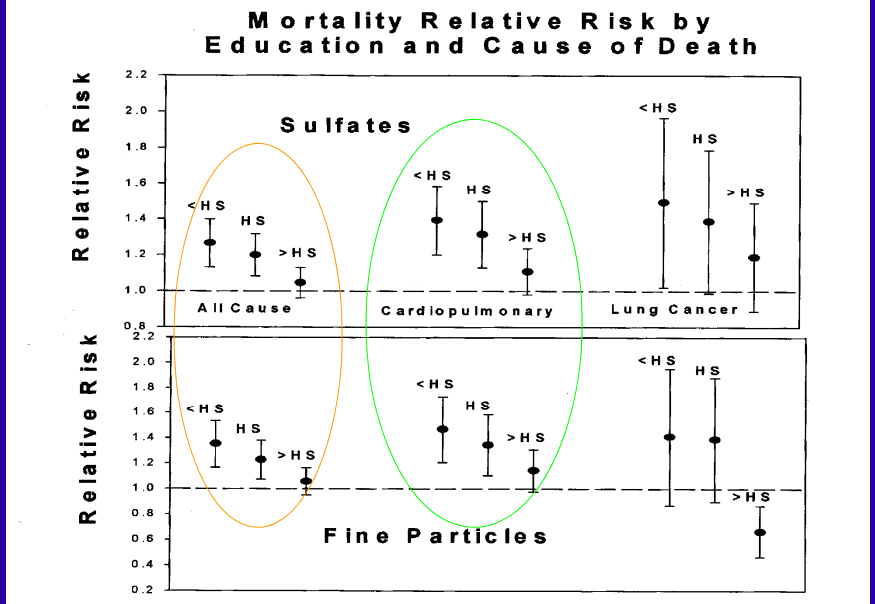
Multi-Group Segregation (Dm)

Morello-Frosch & Jesdale, EHP 2006

Estimated cancer risk associated with ambient air toxics by race/ethnicity and poverty status, continental Unites States metropolitan areas

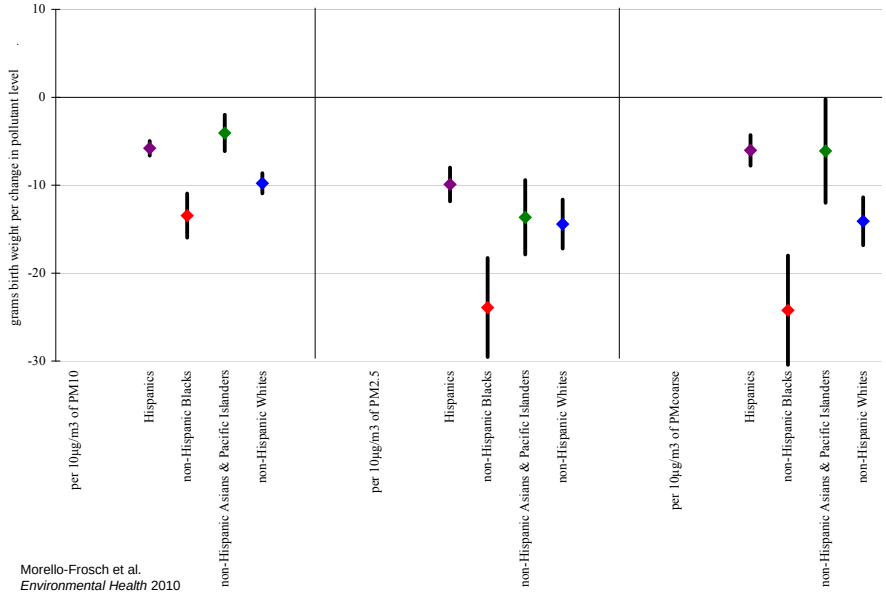


Morello-Frosch & Jesdale, EHP 2006



Kwreski et al. *Journal of Toxicology and Environmental Health, Part A*, 68:1093–1109, 2005

Difference in birth weight in grams associated with full pregnancy particulate pollutant exposures for births, stratified by maternal race and ethnicity – CA 1996-2006



Morello-Frosch et al.
Environmental Health 2010

Tools for Decision-making: Environmental Justice Screening Methodology (EJSM)

- We have developed indicators of cumulative impact that:
  - Reflect research on air pollution, environmental justice, and health
  - Are transparent and relevant to policy-makers and communities
- Key Caveats:
  - Focus is mostly (currently) on air quality but now on climate vulnerability and other metrics as well
  - Reliance on available secondary databases (to facilitate replication)
  - This is *screening*

References for EJSM work

Sadd JL, Pastor M, Morello-Frosch R, Scoggins J, Jesdale B (2011): "Playing It Safe: Assessing Cumulative Impact and Social Vulnerability through an Environmental Justice Screening Method in the South Coast Air Basin, California. *International Journal of Environmental Research and Public Health*. 8: 1441-1459.

Morello-Frosch R, Zuk M, Jerrett M, Shamasunder B, Kyle AD. (2011) "Synthesizing the Science on Cumulative Impacts and Environmental Health Inequalities: Implications for Research and Policy-making. *Health Affairs*, 30(5):879-887.

Four Categories of Cumulative Impact

Proximity to hazards & sensitive land uses

- Air Resources Board land use guidelines (sensitive receptors)
- State data on environmental hazards

Health risk & exposure

- Available state and national data
- Modeling from emissions inventories
- Health risk estimates (cancer/respiratory)

Social & health vulnerability

- Based on epidemiological literature on social determinants of health
- ACS 2005-2009 and state-level data

Climate change vulnerability

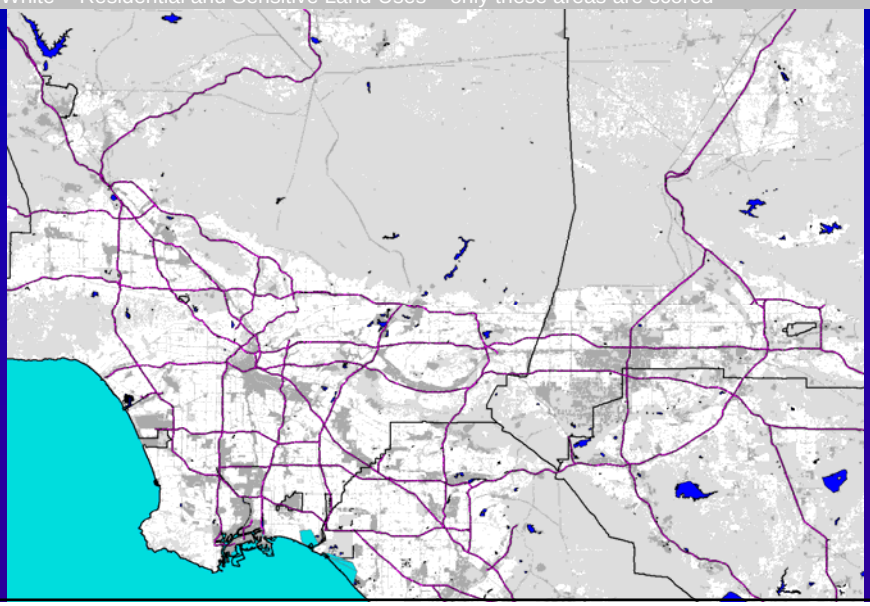
- Based on climate change and health literature
- Heat islands, temperature, social isolation

California Regions covered by the EJSM

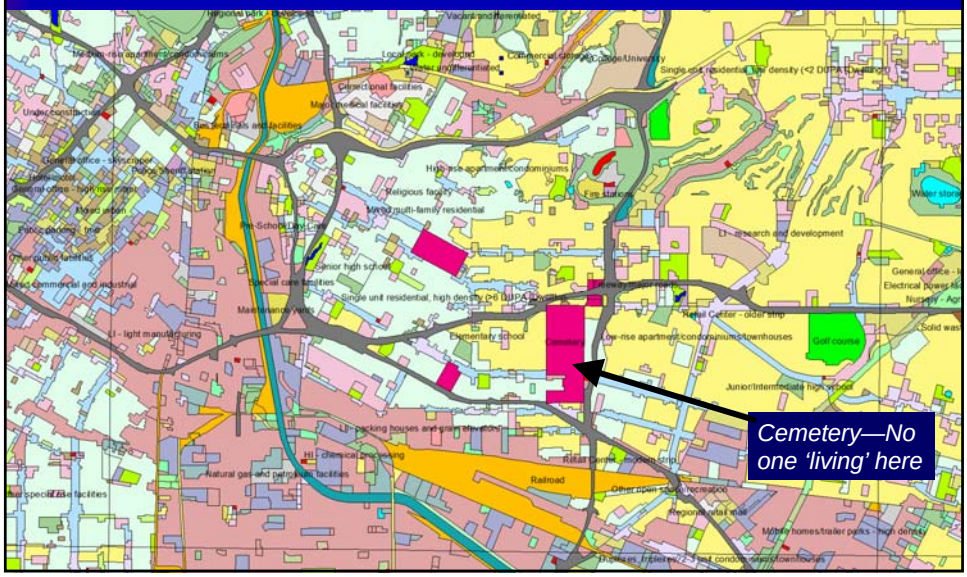
EJSM Completed
Air Basins

Land Use – Focus screening on where people live

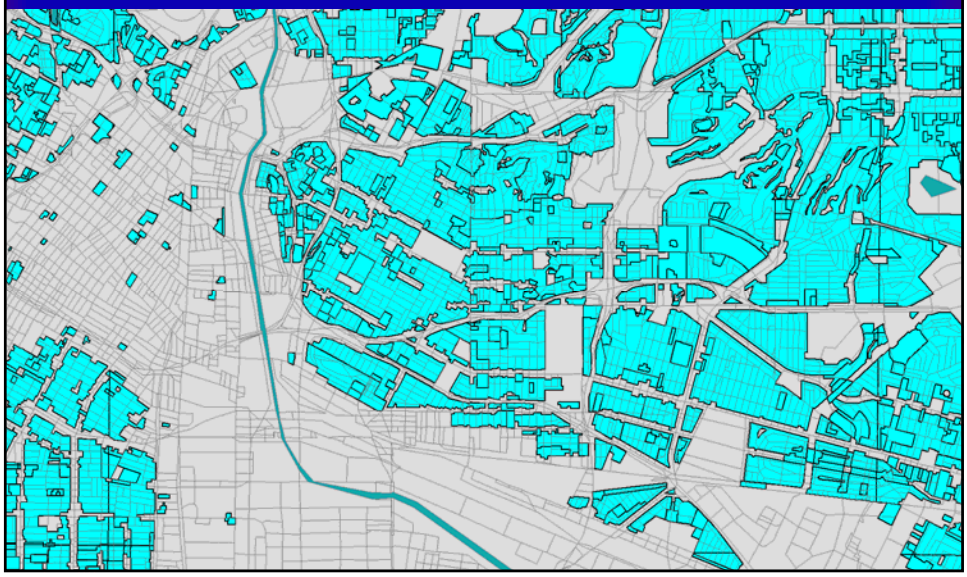
Dark Gray = Industrial, Transportation, etc.;
Light Gray = Open Space, Vacant, etc.
White = Residential and Sensitive Land Uses – only these areas are scored



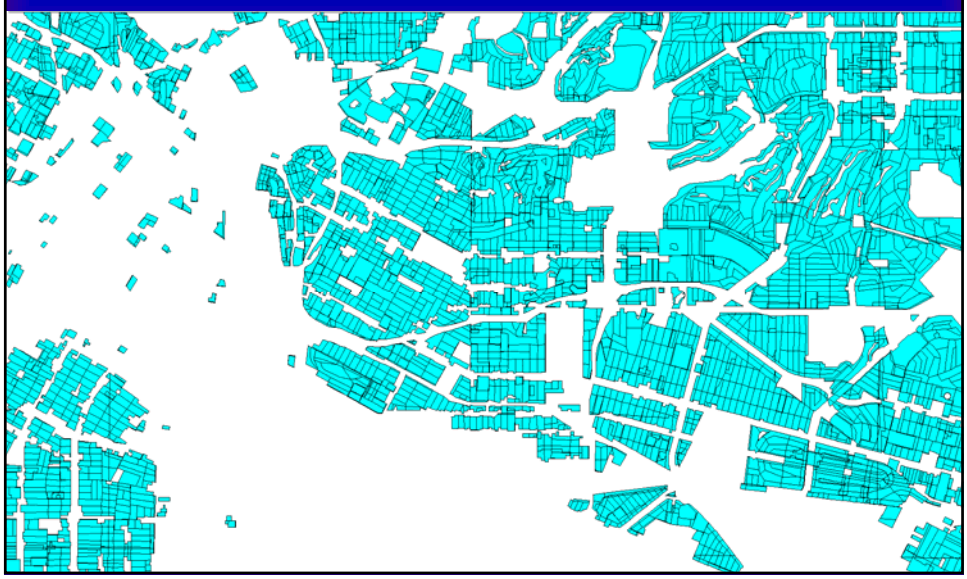
Southern California Assoc. of Governments (SCAG) 2005 Land Use Polygons



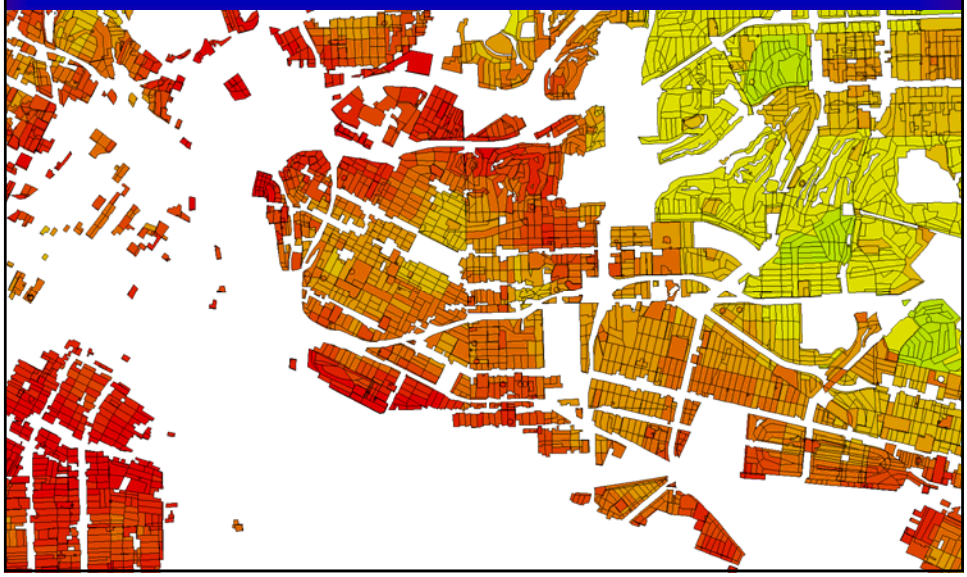
Intersect Land Use Polygons with Blocks



Result: Cumulative Impact (CI) Polygons, each associated with a specific block and land use



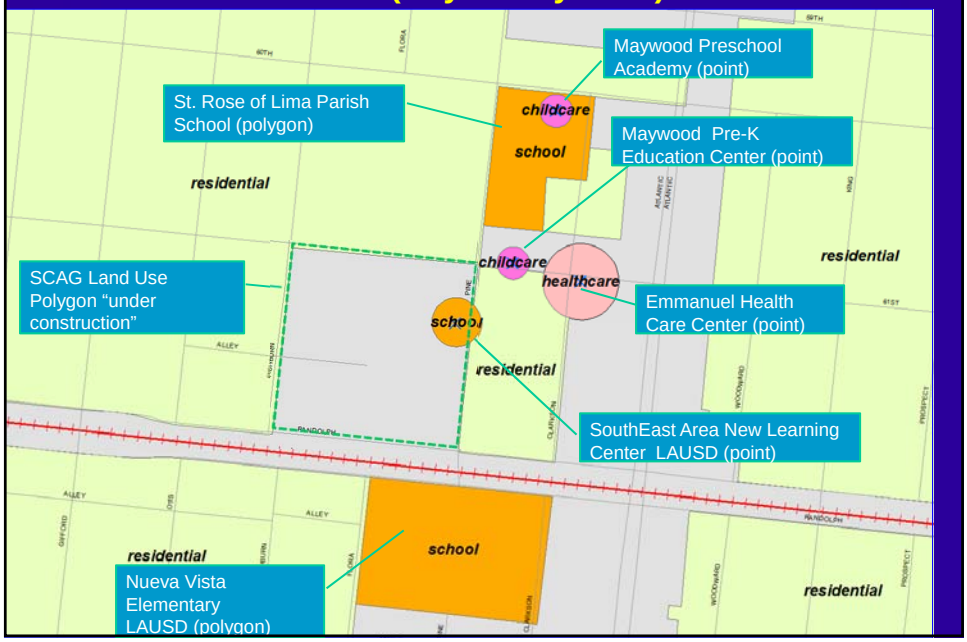
Each CI Polygon receives a Cumulative Impact (CI) Score



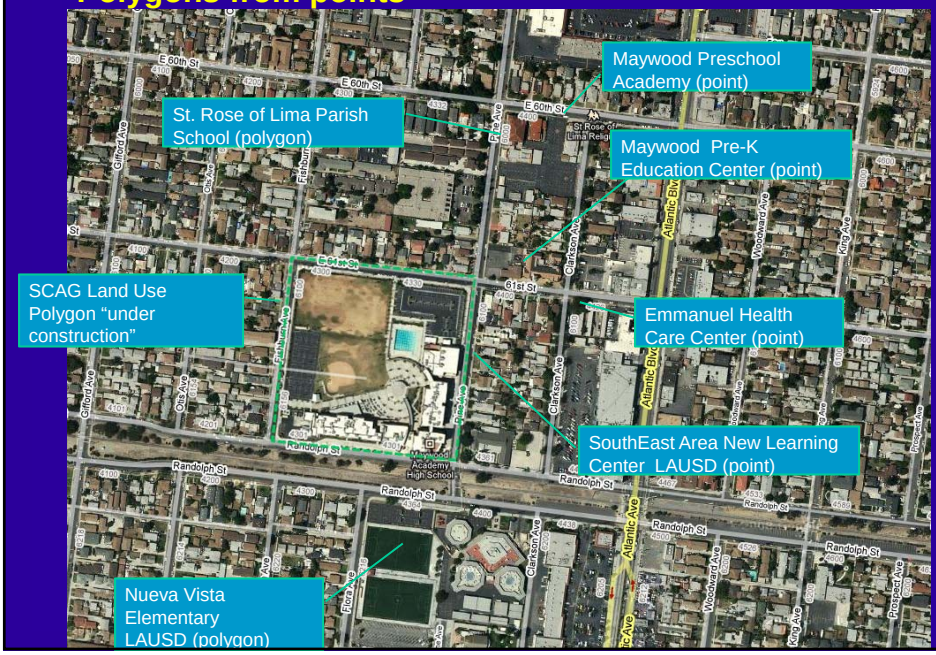
Category 1:

Proximity to Hazards & Sensitive Land Uses

Geocoded Sensitive Land Uses - Polygons from points (City of Maywood)



Geocoded Sensitive Receptor Land Uses Polygons from points

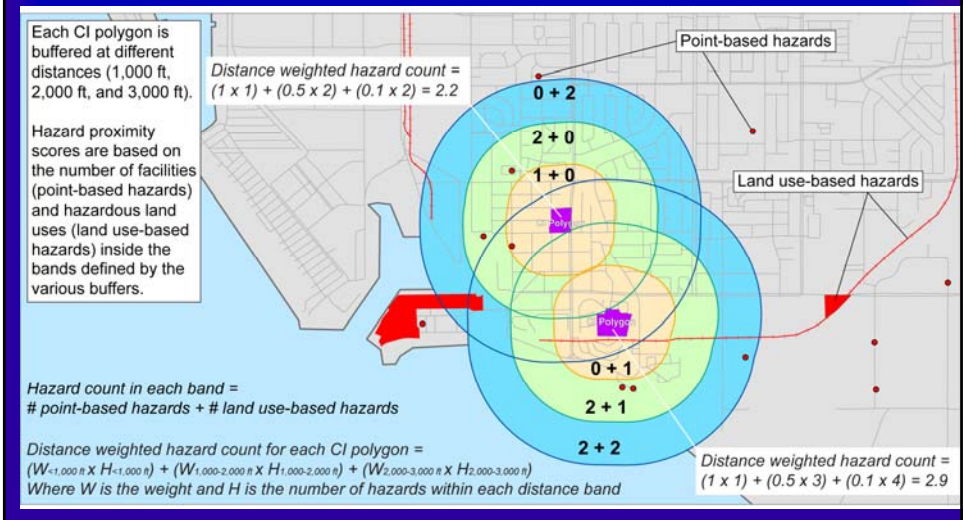


Hazardous Land Uses

- Area facilities (CARB)
- Chrome Platers (CARB)
- Hazardous Waste TSDs (DTSC)
  - Federal Response (includes Superfund)
  - State response
  - Voluntary cleanup
  - Military evaluation
  - School investigations and cleanup
- Rail
- Traffic Volume
- Ports
- Airports
- Refinery
- Intermodal distribution facilities

- *Number of sites within buffers of polygon edge is derived for each CI polygon*
  - *distance weighted approach*

Method for assessing hazard proximity



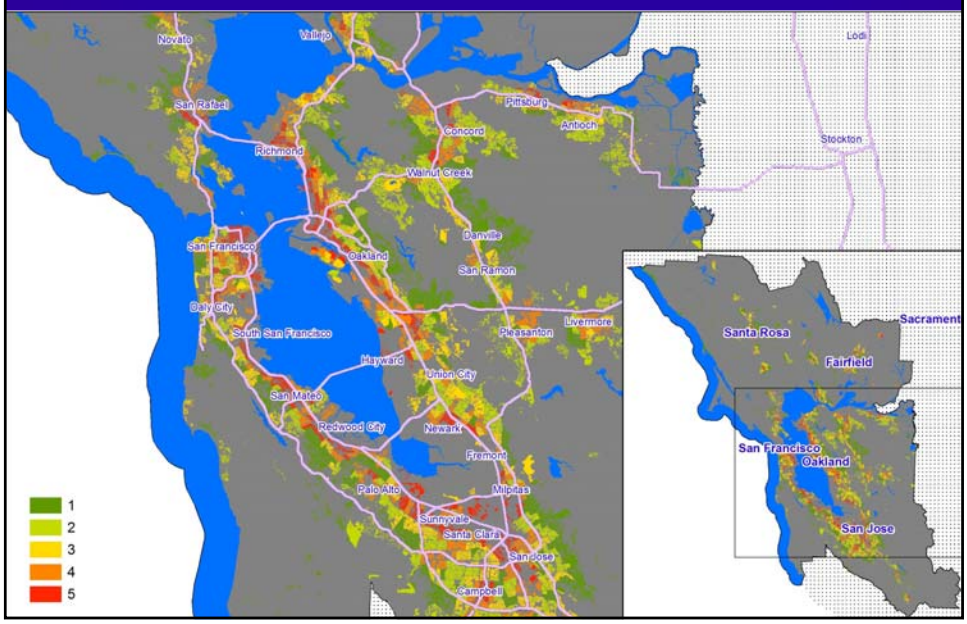
Hazard Proximity & Sensitive Land Use Counts at the Tract Level

To get hazard proximity and sensitive land use counts at the census tract level:

- Estimate population in each CI polygon, based on its share of the total residential and sensitive land use area in the census block
- Take the population weighted average of the hazard and sensitive land use counts across the CI Polygons within each census tract
- Rank each census tract in regions into quintiles (1-5) across all proximity dimensions

Hazard proximity and sensitive land use quintile scores at the tract level-- 9-County Bay Area

Mapped on CI Polygons



Category 2:

Health Risk and Exposure

Health Risk & Exposure Indicators - Tracts

- RSEI (Risk Screening Environmental Indicators)
  - (2007) toxic conc. hazard scores from TRI facilities
- NATA 2005 (National Air Toxics Assessment)
  - Respiratory hazard from mobile & stationary sources
  - Calculated from modeled air toxics concentrations
- NATA 2005
  - Estimated Inhalation Cancer Risk from mobile and stationary sources

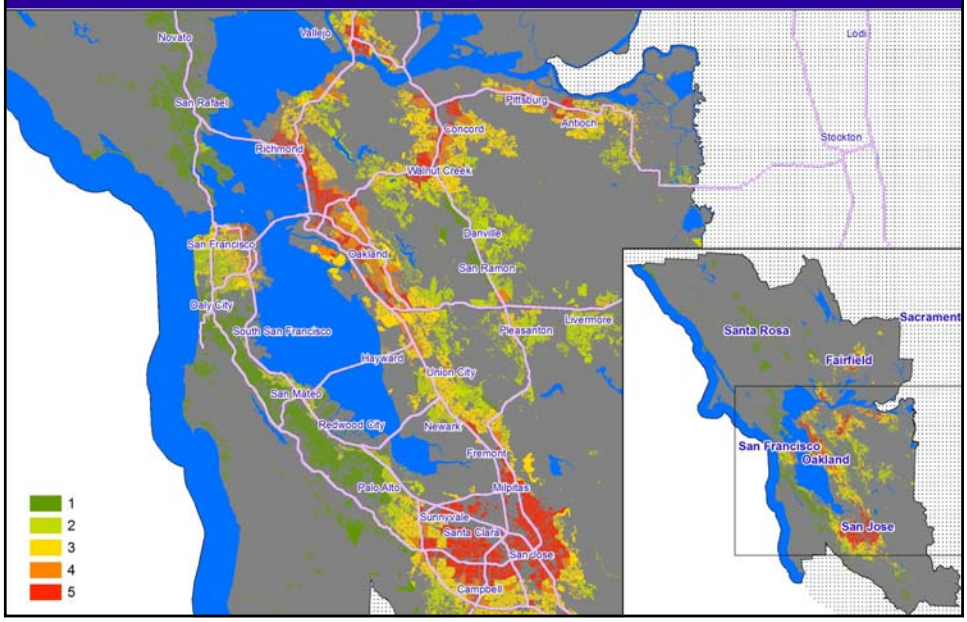
- CARB estimated $PM_{2.5}$ concentration (2004-06)
- CARB estimated Ozone concentration (2004-06)

Health Risk & Exposure Scores -Tracts

- Each health risk indicator is ranked into quintiles (1-5) across all tracts in the region
- Quintile rank values are added up across indicators for each tract and the sum is ranked once again into quintiles (1-5) across all tracts in the region
- The resulting quintile rank for each tract is it's final health risk score

Air pollution exposure and health risk quintile score at the tract level--9-County Bay Area

Mapped on CI Polygons



Category 3:

Social and Health Vulnerability

Social & Health Vulnerability Indicators

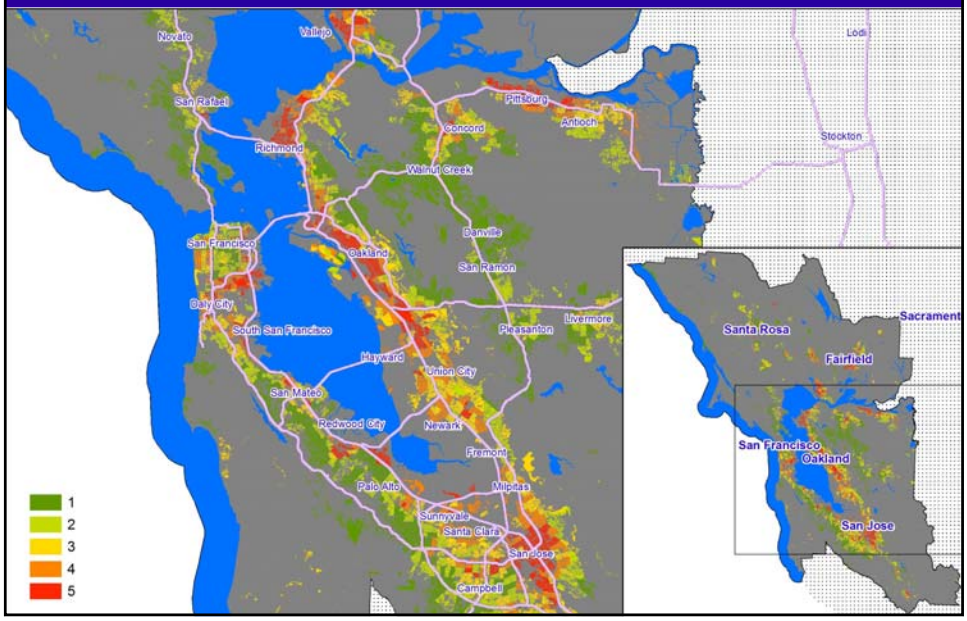
Census Tract Level Metrics (ACS 2005-09)

SES
- % residents of color
- % residents below twice national poverty level
- Home ownership - % living in rented households
- Housing value – median housing value
- Educational attainment – % population > age 24 with less than high school education

Biological Vulnerability
- Age of residents (% <5)
- Age of residents (% >60)
- Birth outcomes – % preterm or SGA infants 2001-2006

Civic Engagement
- Linguistic isolation - % pop. >age 4 in households where no one >age 15 speaks English well
- Voter turnout - % votes cast among all registered voters averaged for 2000 and 2008 general election

Social and health vulnerability quintile scores at the tract level—
9-County Bay Area Mapped on CI Polygons



Cumulative Impact Scores at the Tract Level

Combine four categories of tract level impact and vulnerability to get Cumulative Impact Score

Cumulative Impact Score =

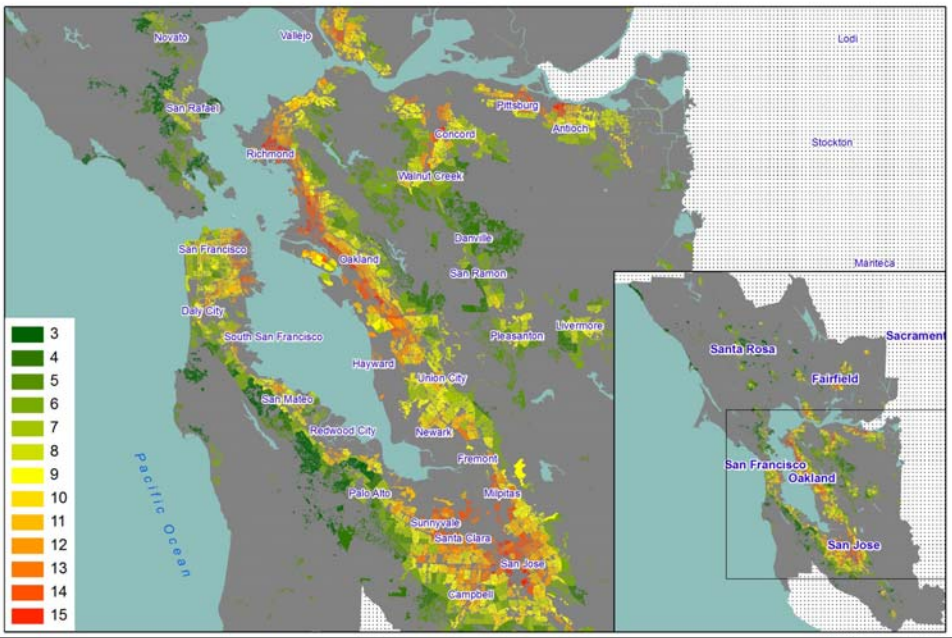
Hazard Proximity and Sensitive Land Use Score (1-5) +

Health Risk and Exposure Score (1-5) +

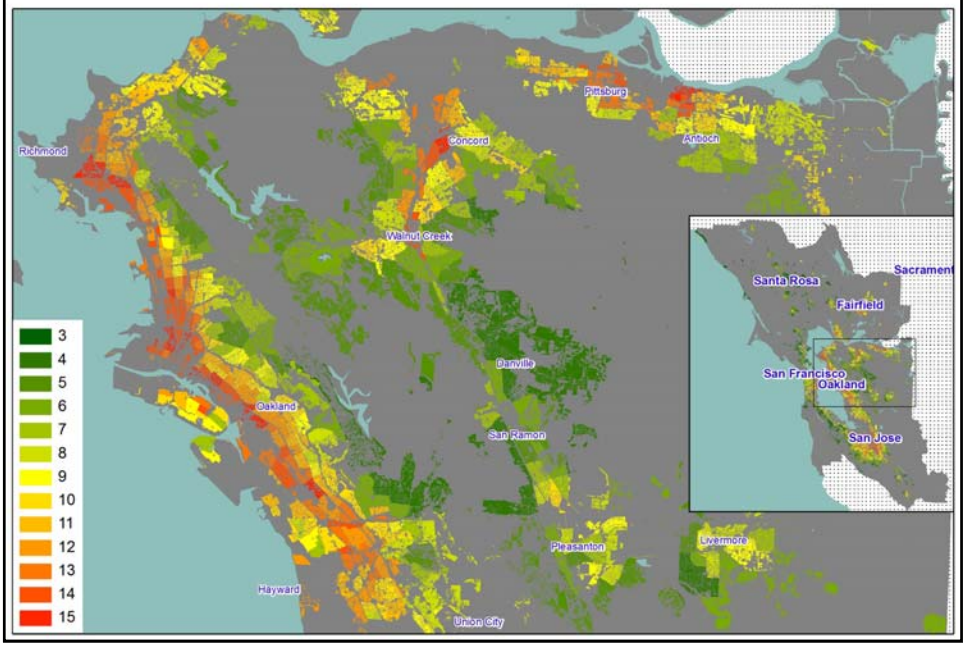
Social and Health Vulnerability Score (1-5)

➢ *Final Cumulative Impact Score Ranges from 3-15*

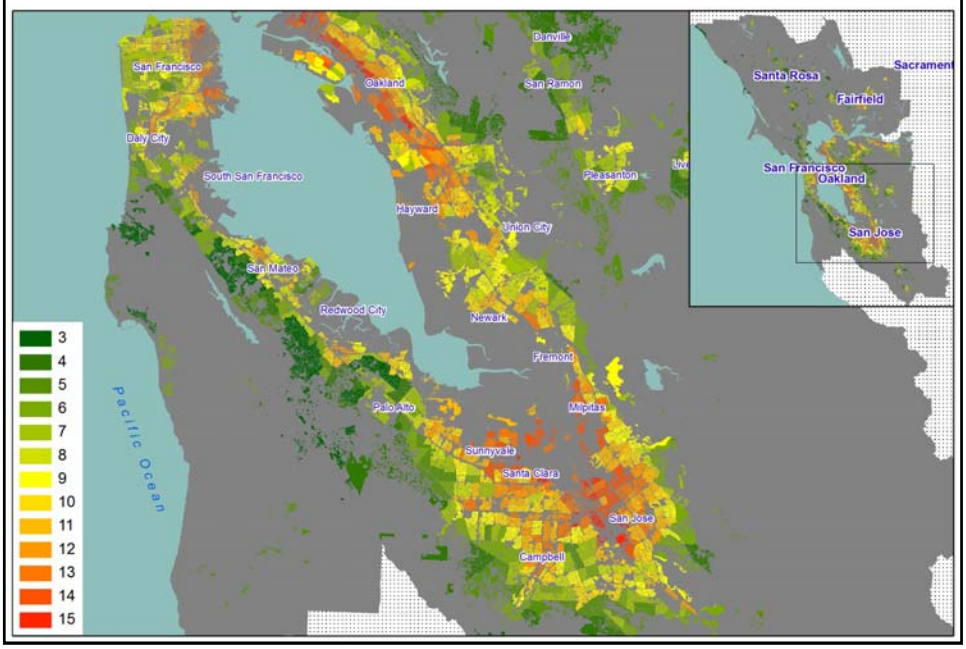
Total Cumulative Impact (CI) Score 9-County Bay Area (Mapped on CI Polygons)



Total Cumulative Impact (CI) Score East Bay Zoom (Mapped on CI Polygons)



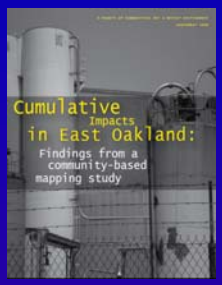
Total Cumulative Impact (CI) Score – Excluding Climate Vulnerability
SF Peninsula Zoom (Mapped on CI Polygons)

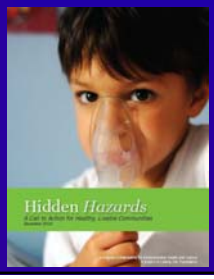


Potential Applications

- National:
  - USEPA Plan EJ 2014

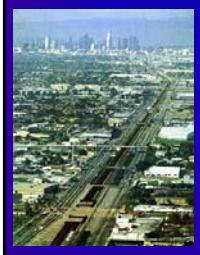
- State:
  - AB 32 and SB 535
  - OEHHA and CARB





- Local:
  - "Ground Truthing" efforts in Los Angeles and Oakland

Potential Contributions

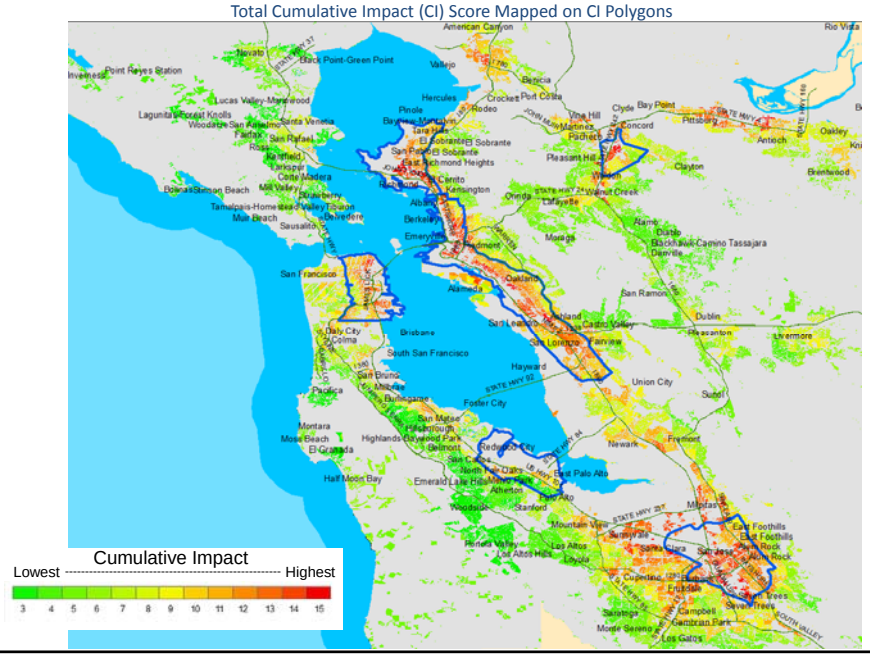


- Screening provides a way of drilling down regionally and highlighting communities of potential regulatory concern
  - Transparent approach and metrics that use publicly available data and is not too difficult to implement & update
    - Open to modification by sophisticated users (change scoring weights, indicators, scoring approaches)

Looking at CARE and EJSM Results Together

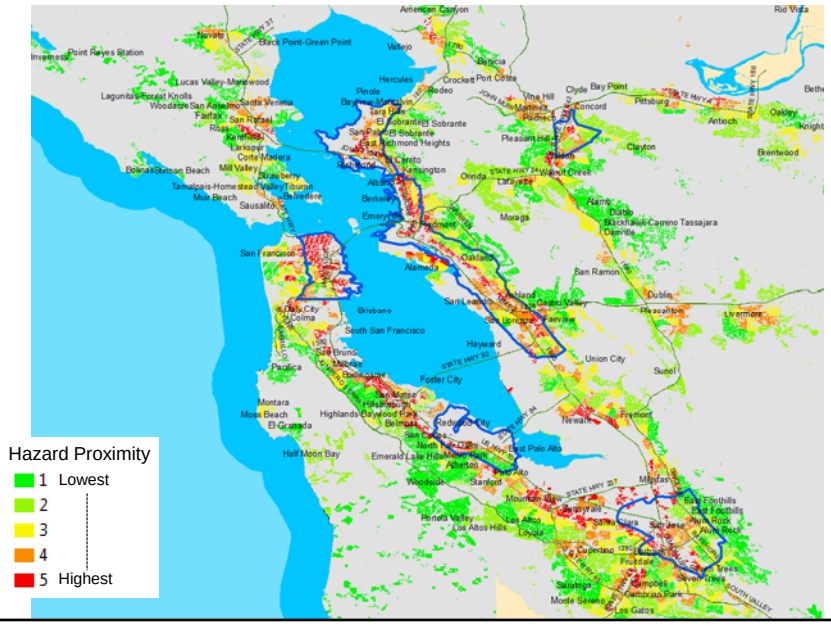
EJSM vs. CARE Impacted Communities
San Francisco Bay Area

Total Cumulative Impact (CI) Score Mapped on CI Polygons



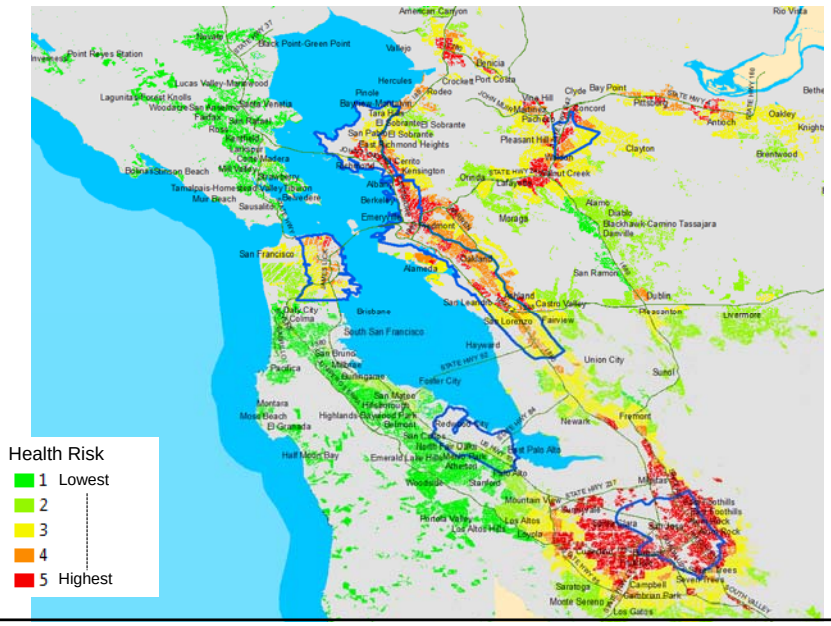
EJSM vs. CARE Impacted Communities
San Francisco Bay Area

Hazard Proximity and Land Use Score Mapped on CI Polygons



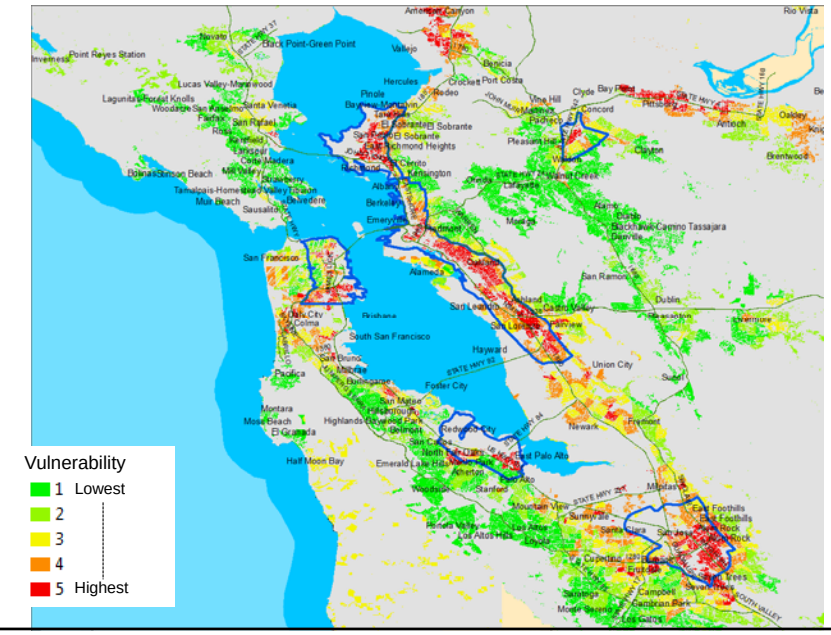
EJSM vs. CARE Impacted Communities
San Francisco Bay Area

Health Risk and Exposure Score Mapped on CI Polygons



EJSM vs. CARE Impacted Communities
San Francisco Bay Area

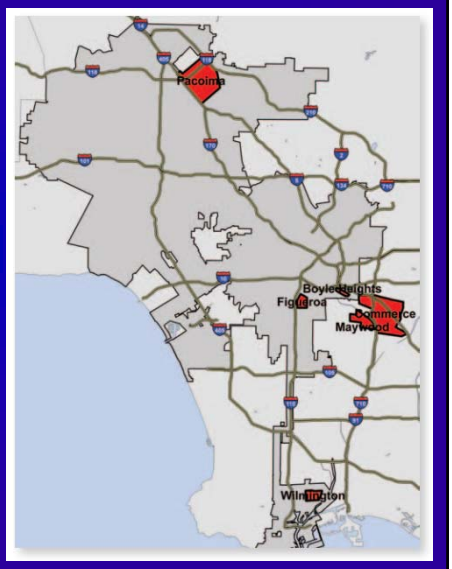
Social and Health Vulnerability Score Mapped on CI Polygons



What is Ground Truthing?

Community Based Participatory Research in six Los Angeles area communities:

- Verify location and accuracy of information on air quality hazards and sensitive receptor land uses as reported in state regulatory agency databases
- Locate and map additional air quality hazards and sensitive receptors missing from state regulatory agency databases.
- Conduct community-based air monitoring.



Training Time

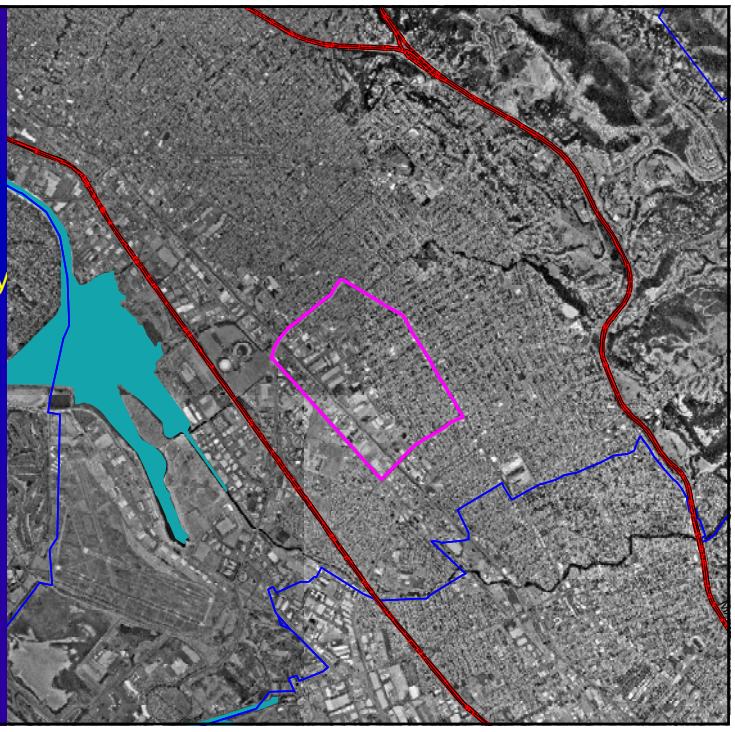
Figure 4. CBE Community Leaders, Myrtle Washington and Maxine Oliver-Benson, learn to use iPaq handheld computers with GPS and GIS.

Hegenberger Micro-Study

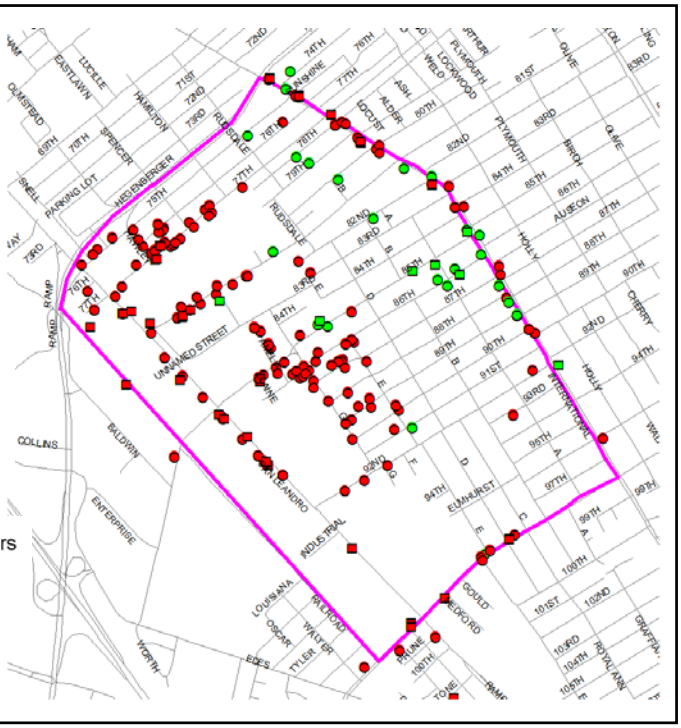
Objectives:

- Work with CBE to train community members on concepts and science of cumulative impact
- Train community to collect information on hazards of concern and susceptible receptors
  - Focus is on identifying pollution sources not captured on current data systems
  - Use GPS devices to improve data collection methods
  - Conduct air sampling in areas of concern

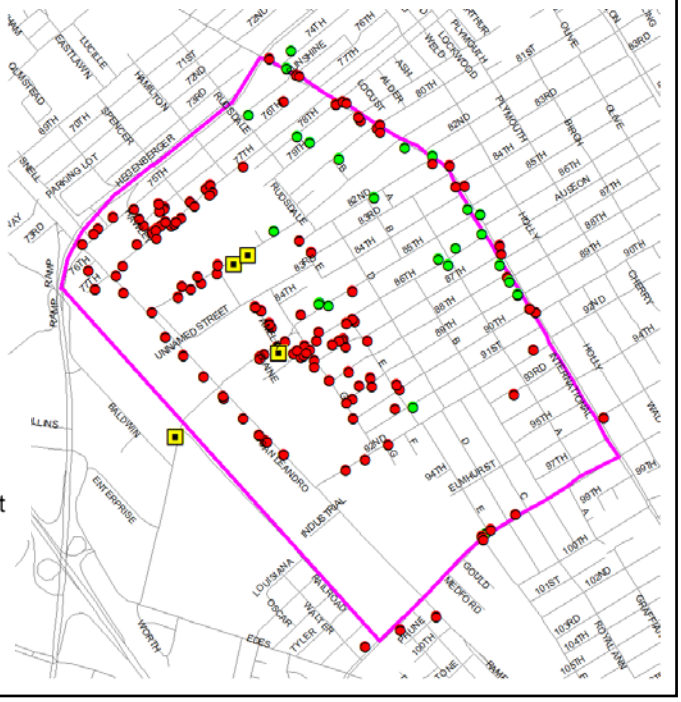
Hegenberger Corridor Study Area

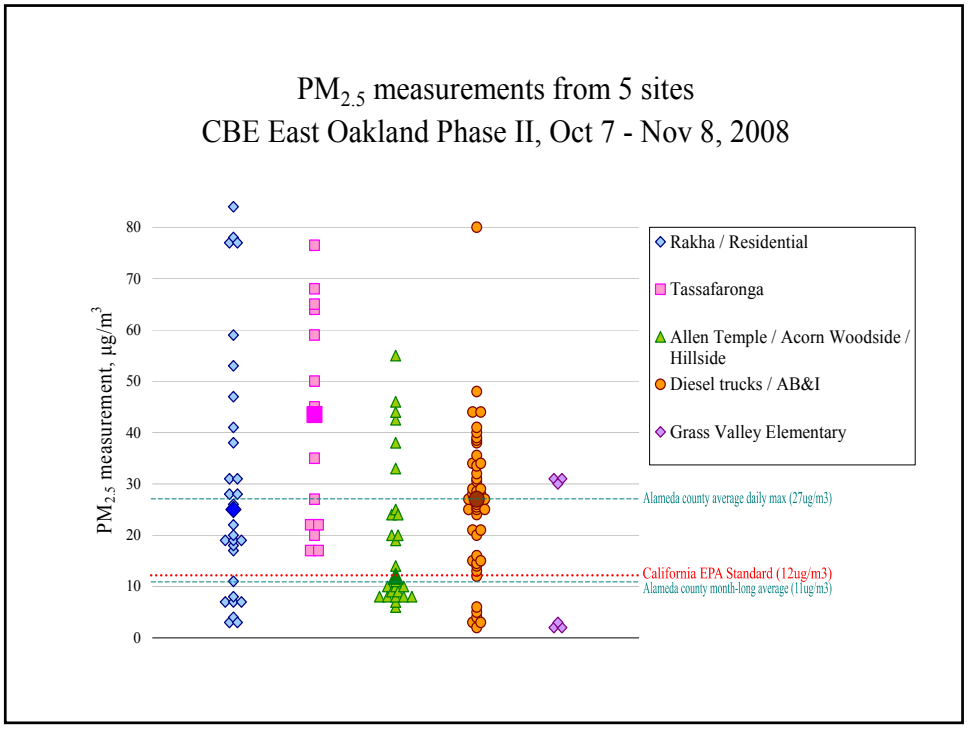


Both Data Sets



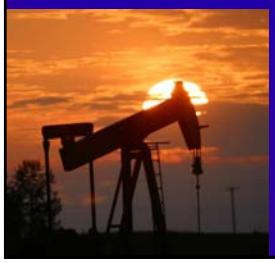
Diesel Idling





Implications for Science & Policy

- Need to move away from chemical-by-chemical, facility-by-facility analysis toward a cumulative impact approach with neighborhoods and regions as the unit of analysis
  - Engaging community can improve information base and build confidence in more technical screening tools – balancing agency and community credibility is key
  - Such an approach can be scaled up to other regions and states



Thank you

Collaborators on EJSM and Ground-Truthing:

- Bill Jesdale, UC Berkeley
- Justin Scoggins, USC
- Paul English, California Public Health
- Los Angeles EJ Collaborative
- Liberty Hill Foundation

Funders:

- California Air Resources Board
- California Energy Commission
- Cal-EPA
- The California Endowment
- US EPA, Region 9