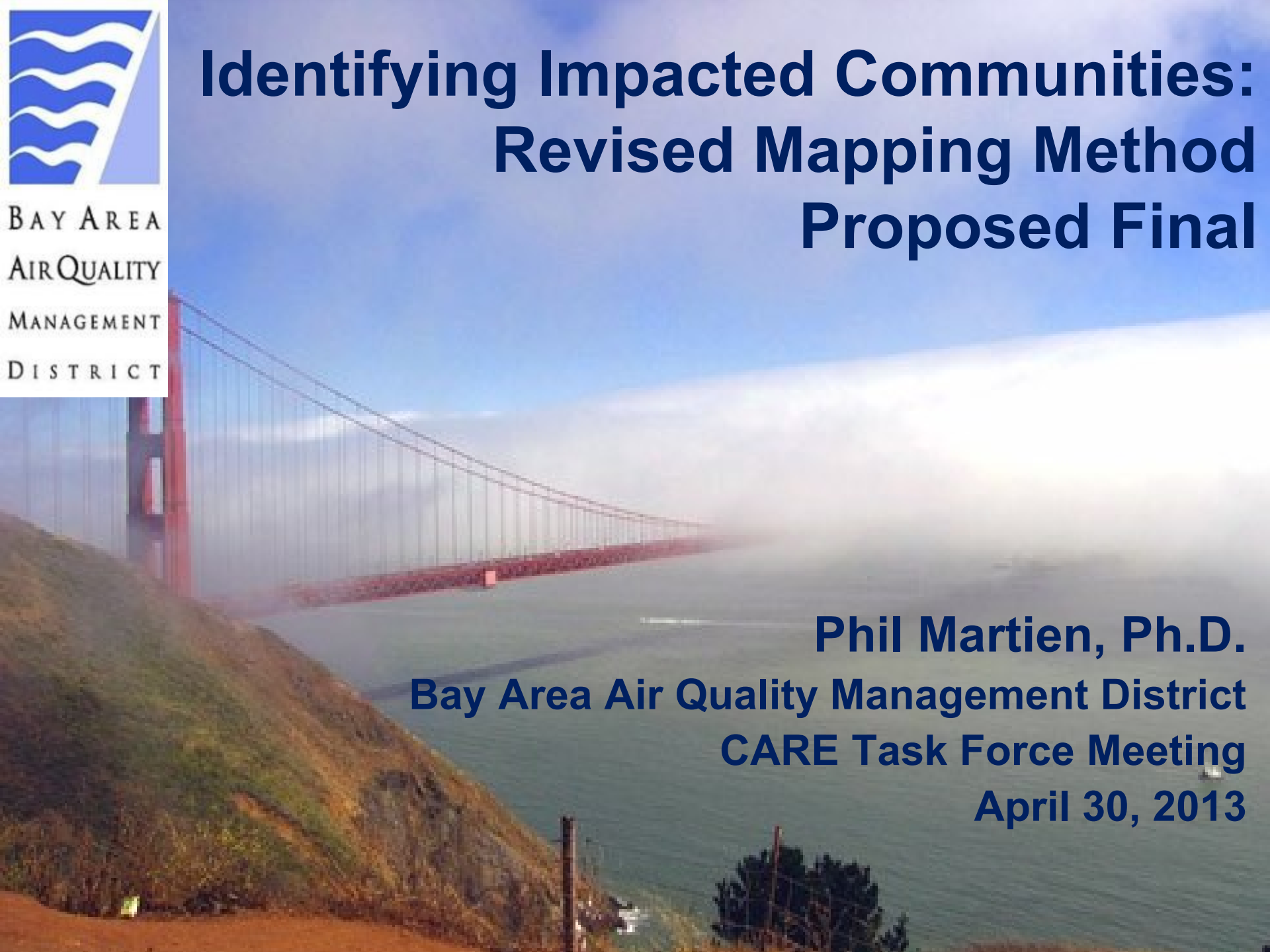


Identifying Impacted Communities: Revised Mapping Method Proposed Final

Phil Martien, Ph.D.

Bay Area Air Quality Management District

CARE Task Force Meeting

April 30, 2013

Overview

- Background and Review
  - Previous meetings comments/questions
  - Changes since last meeting
- Proposed Final Updated Mapping Method
- Maps and Discussion
- Questions
- Next Steps

Previous Meeting Comments

- Be specific about what the impacted communities maps will be used for
- Clearly link maps of impacted communities to elements of the Clean Air Communities Initiative (CACI)
- Focus on mitigations!
- Think about how to track progress
- Seek peer review of updated methodology

Clean Air Communities Initiative

MONITORING
- Ambient Monitoring Network
- Community Monitoring
- Local Measurement Studies
- Collaborate with Universities and Community Research Monitoring Programs
- Photochemical Monitoring
- General Aviation Airport Sampling
- Near Roadway Monitoring

MODELING & ASSESSMENT
- Regional and Local Modeling
- Regional and Local Exposure and Health Impacts Assessment
- Permit Modeling and Risk Assessment

REGULATIONS
- NSR / Permits
- 2588 Hot Spots Program
- Source Specific Rules
- Wood Smoke Rule
- Back-up Generators
- Indirect Source Rule

PLANNING & GUIDELINES
- CEQA Guidelines
- Community Risk Reduction Plans
- 2010 Clean Air Plan
- PM Strategy
- General Plan Guidelines
- SB375/SCS
- Climate Protection Program/ GHG Co-Benefits
- Healthy Community Development Guidelines

OUTREACH/EDUCATION
- Public Engagement Policy and Plan
- Collaborate with Local Governments
- Collaborate with Health Departments
- Collaborate with Transportation Agencies
- Community Meetings
- Resource Teams
- Collaborate with Community Groups
- Wood Smoke Outreach

GRANTS/INCENTIVES
- Carl Moyer Program
- TFCA
- Mobile Source Incentive Fund
- I-Bond/Goods Movement
- Bay Area Clean Air Foundation

ENFORCEMENT
- Diesel Enforcement Program
- Inspection/Enforcement of District Regulations
- Enforcement of CARB Regulations
- Respond to Complaints
- Inspection of Grantees

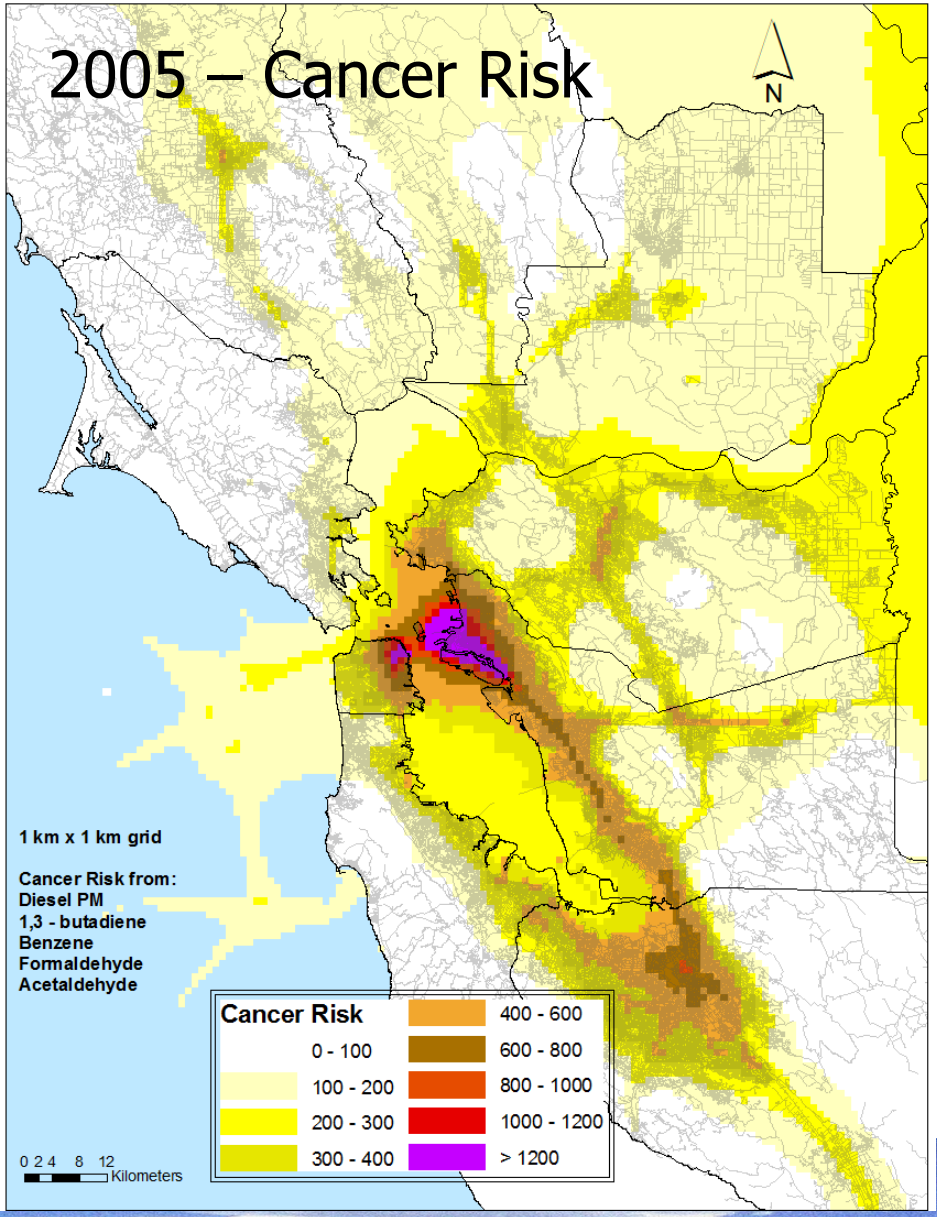
Changes since last meeting

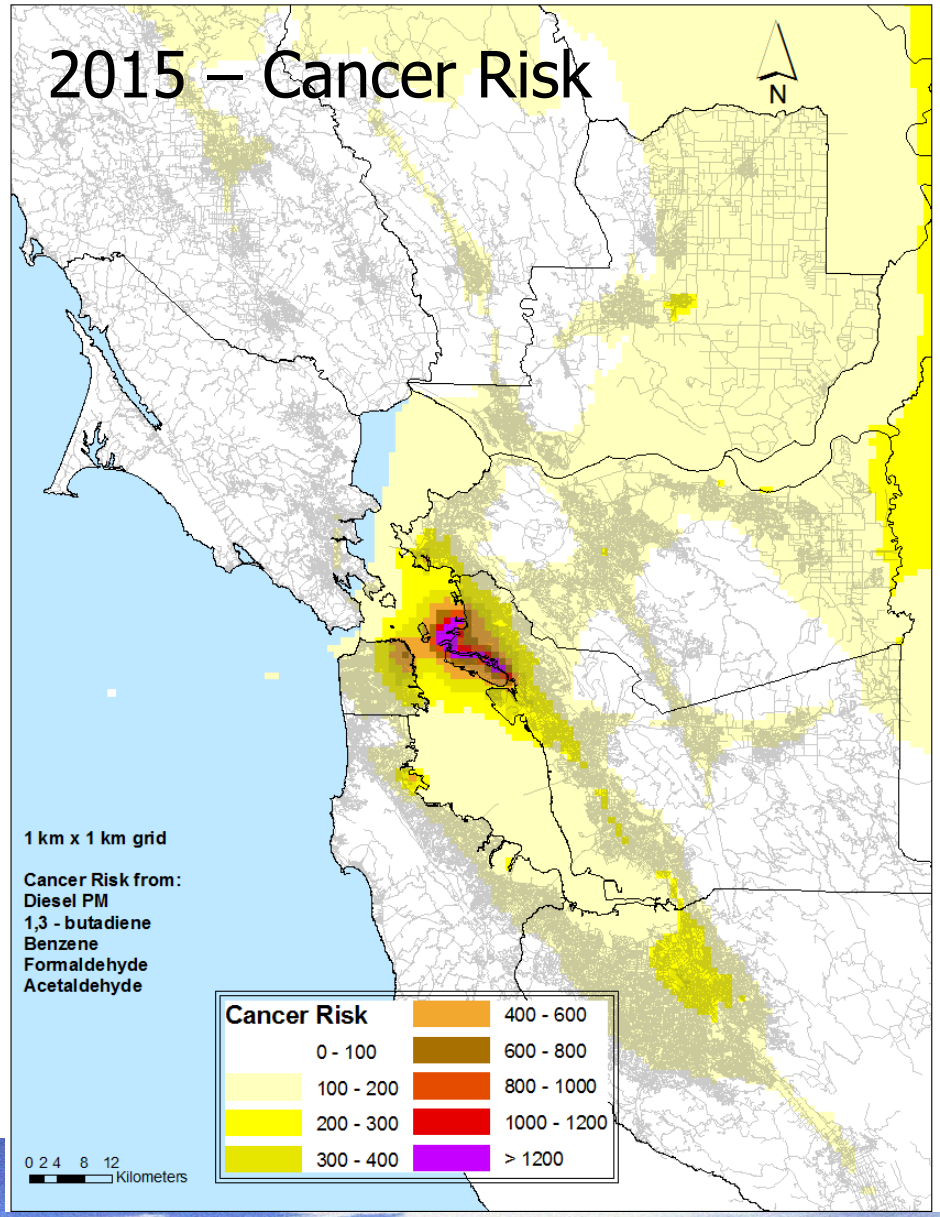
- Obtained and incorporated asthma hospitalization data
- No longer "score" metrics of impact (e.g., 0,1,2,3)
  - Instead, applied simple ranking
- Used health data to set base rates when determining pollution impacts
  - Not "double counting" health data
- Used emissions index to help develop boundaries, not as part of evaluation metric
- Developed boundaries (lines on a map)

Why Update Current Maps?

- Use latest data
- Add additional air pollutants
  - In addition to toxic compounds: fine particles and ozone
- Use new methods
  - Use health outcomes estimated from air pollution levels to identify impacts
    - Air pollution levels and
    - Health outcome records (deaths, emergency room visits, and hospital admissions) used as part of the pollution impacts calculation

Example: Estimated Toxic Air Contaminants Decreasing





Goals of Proposed Method

- Focus actions where most needed
  - High pollution impacts, vulnerable populations
  - Target emissions causing high exposures
- Consider examples of similar analyses
  - Cal/EPA (CalEnviroScreen), EJSM
  - BenMAP
  - Air District Multi-Pollutant Plan

Draft Proposed Method Outline

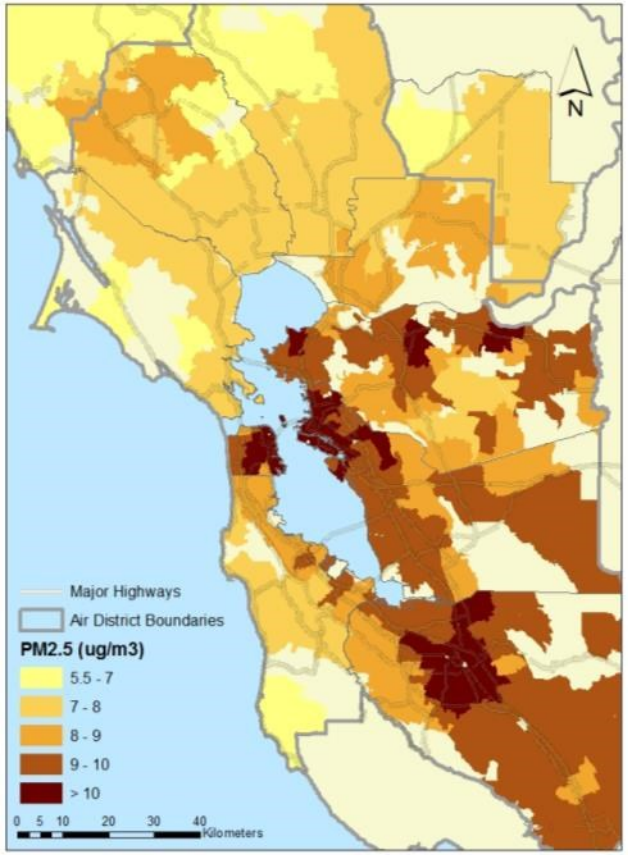
- Identify where air pollution is causing health impacts
  - Use health data to help determine expected impacts
  - Examine who is impacted
- Identify where emissions are high
- Bound identified areas
  - Use coastlines, county boundaries, and major roadways

Identify where air pollution is causing health impacts

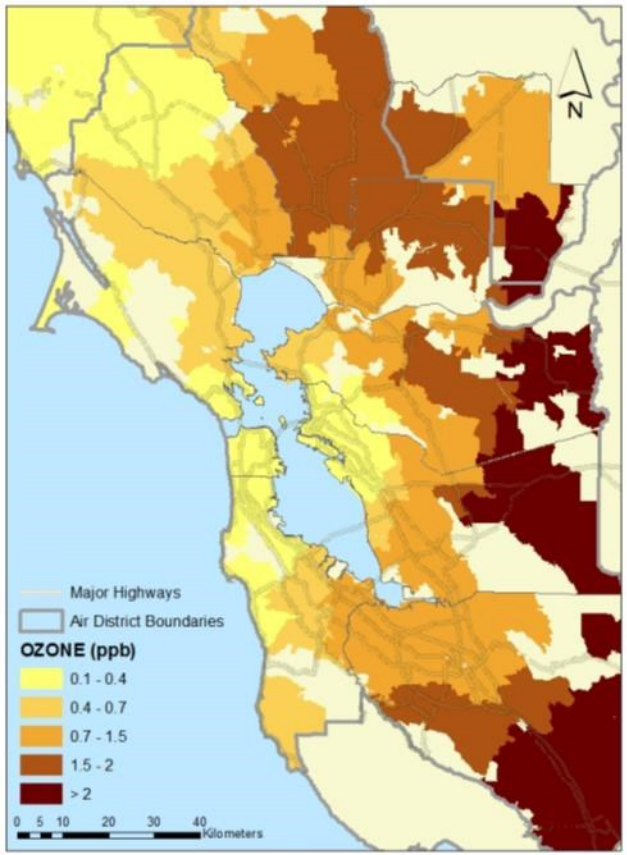
- Use recent, regional air quality modeling and measurements to map pollutant concentrations: toxic air contaminants (TAC), fine PM (PM2.5), and ozone
- Use “BenMAP approach” to link PM2.5 and ozone to increased heath impacts
- Use cancer unit risk factors to link TAC to increased cancer risk
- Aggregate and map estimated health impacts, to identify areas with greatest impacts

Regional Air Pollution Mapped to ZIP code areas

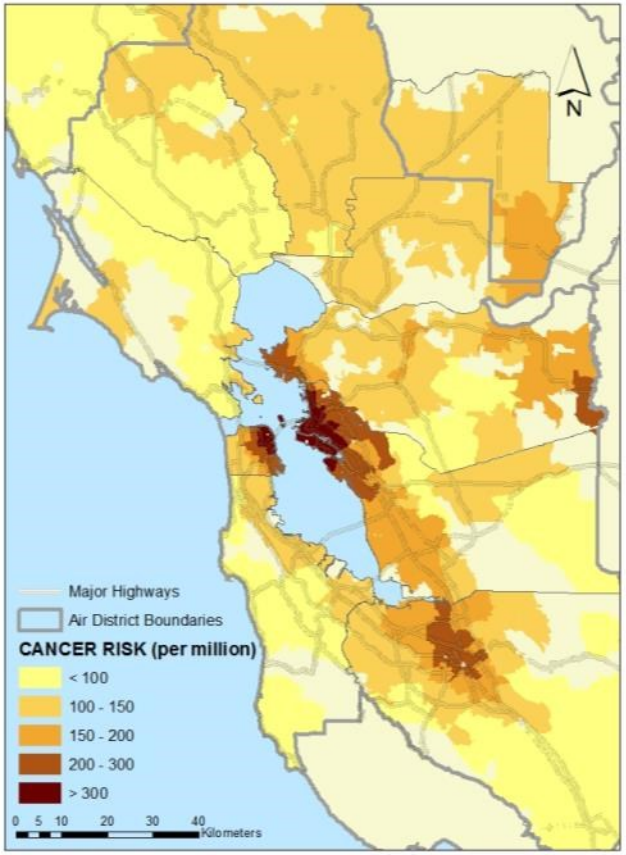
$PM_{2.5}$
Modeled annual average
(2010)



Ozone
Interpolated measurements
Mean 8-hour daily max. above 40 ppb
(2010-2011)



Cancer Risk
Modeled annual average
(2015)



Pollution to Health Outcomes

Pollutant	Method	Result
$PM_{2.5}$ Ozone	BenMAP	• Increased mortality rate • Increased costs for ER visits, hospitalization
TAC	Risk Factors	• Increased cancer risk

Use BenMAP approach to estimate health impacts from $PM_{2.5}$ and ozone

BenMAP is a US EPA model used to estimate the health impacts, and costs, associated with changes in air pollution. Air District used a BenMAP approach for the 2010 Clean Air Plan.

Rate Increase = Air Pollution Level X

Effect Estimate X

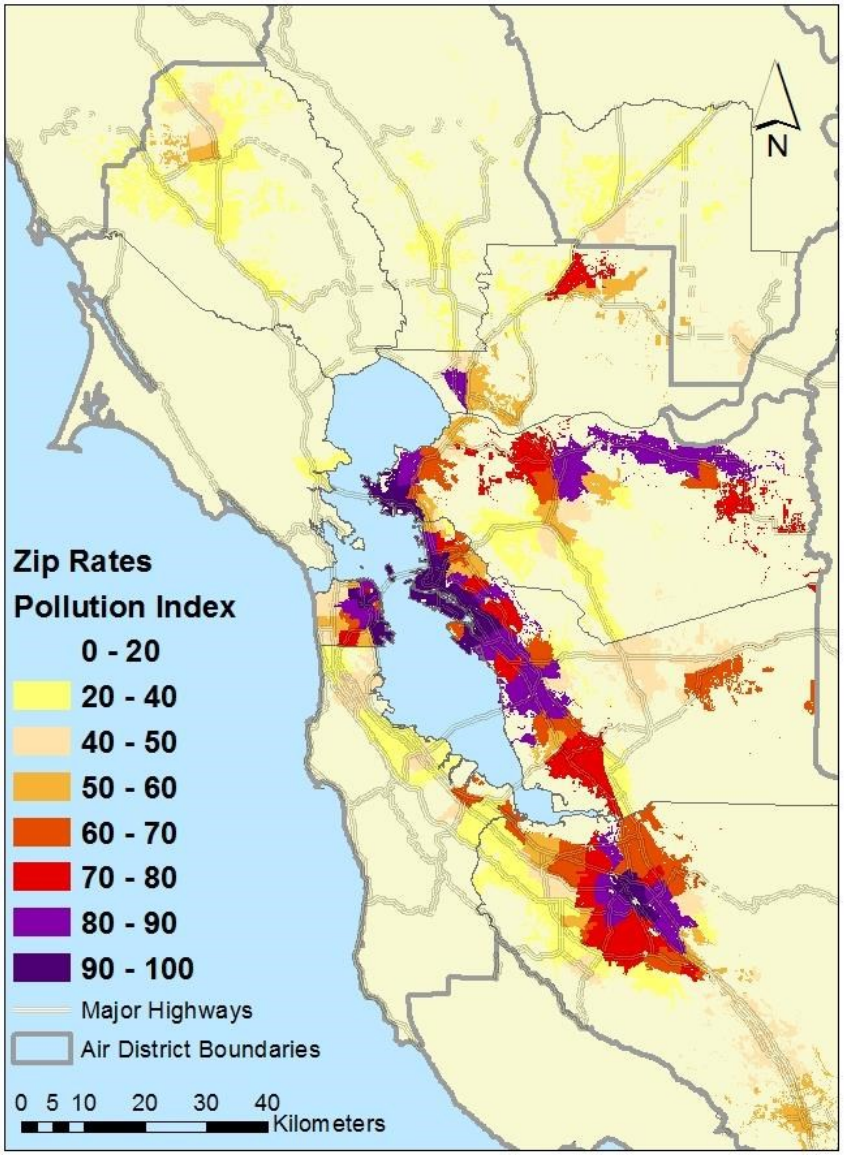
Baseline Rate

- **Air Pollution Level**. Above background.
- **Effect Estimate**. Percentage change in health outcome due to a unit change in ambient air pollution. Based on epidemiological studies.
- **Baseline Rate**. For example, for mortality, the baseline rate is the probability that a person will die in a given year.

Baseline rates determined from health records

- Use health outcome records for health effects aggravated by air pollution:
- Death rates (2008-2010)
- Emergency room visits, hospital admission rates (2009-2011)
  - COPD Hospital Admissions
  - Pneumonia Hospital Admissions
  - Myocardial Infarction (MI, heart attack) Hospital Admissions
  - Cardiovascular Hospital Admissions (without MI)
  - Asthma Hospitalizations and Emergency Room Visits
  - Hospital Admissions for Respiratory Diseases
  - Use tabulated costs for each type of ER visit/hospital admission to combine all types to a total cost

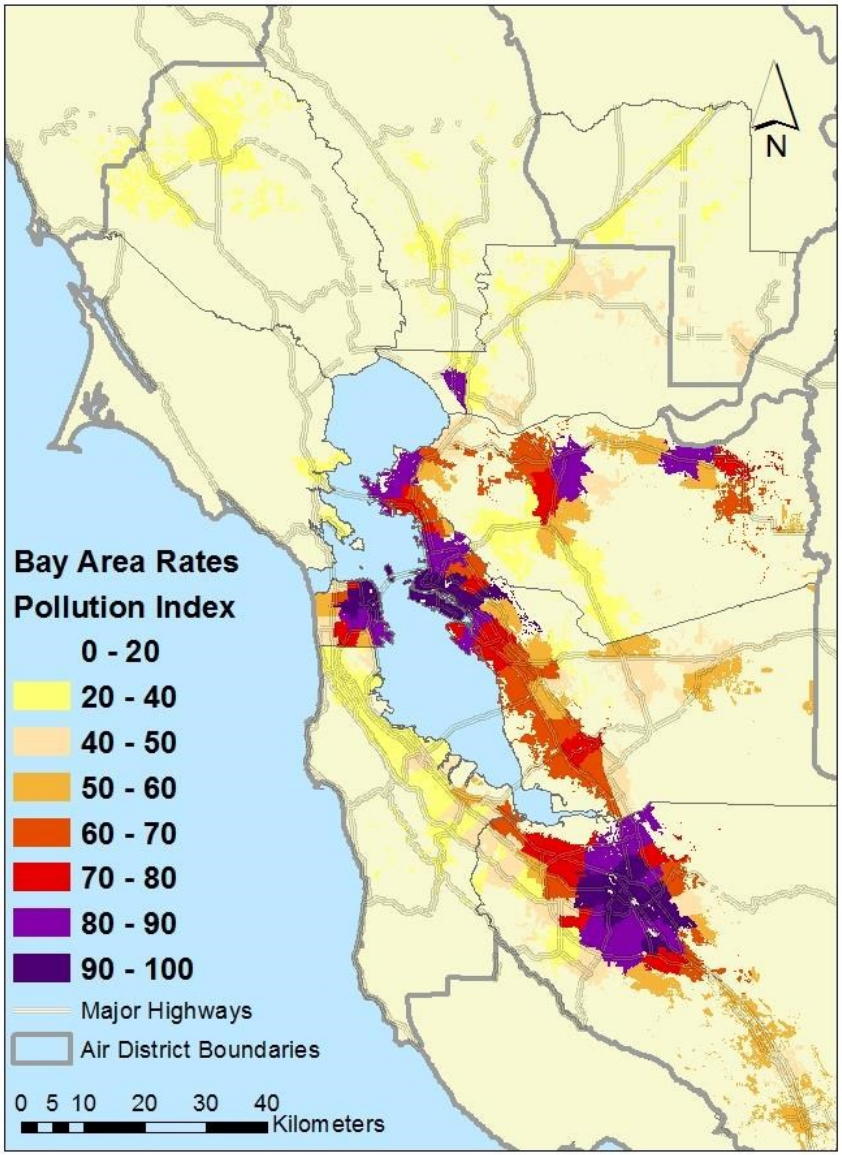
Pollution-Vulnerability Index



Metric to combine health impacts from air pollution

- **Increased mortality rate**
- **Increased health costs**
- **Increased cancer risk**
- Use base health rates from each zip code
- Ranks of these three impacts were summed
- Expressed as a percent of maximum sum

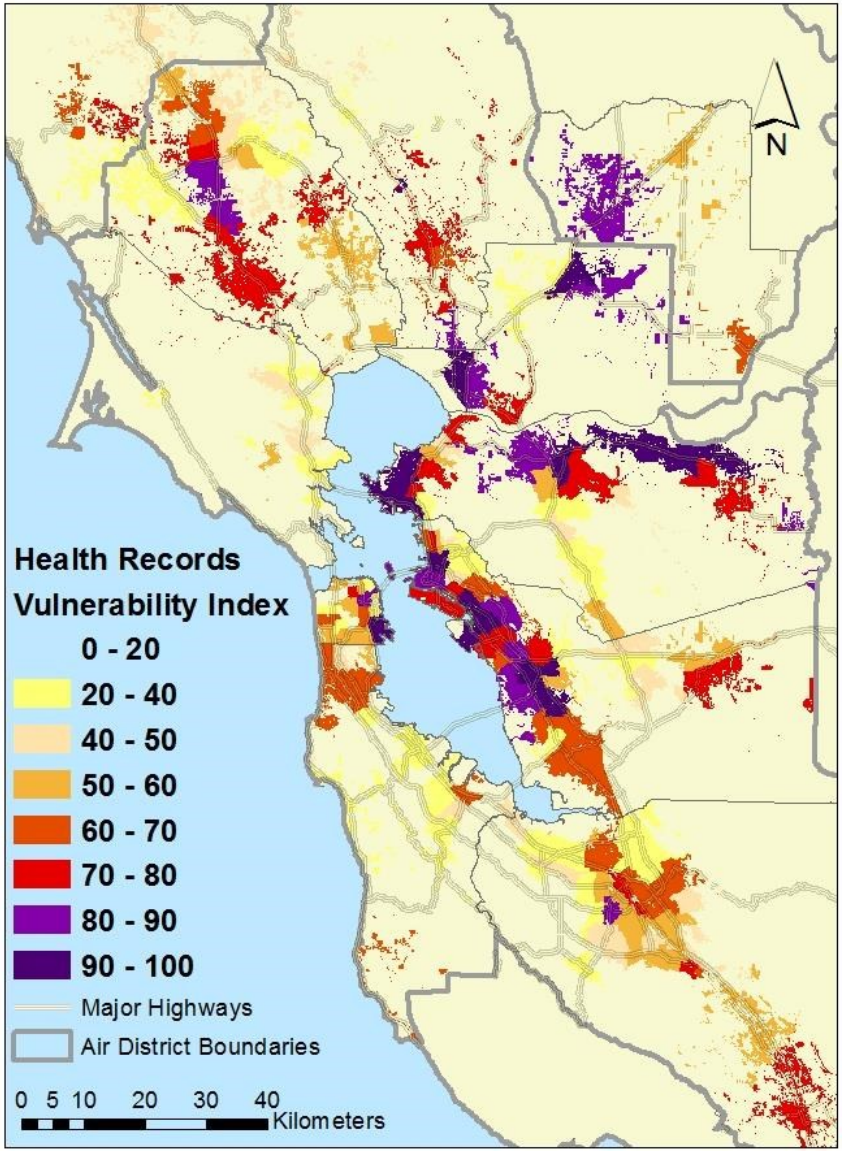
Pollution Index



Same as pollution-vulnerability index, **but:**

- Use average set of base health rates for all Bay Area
- This is *only for comparison* to the pollution-vulnerability index

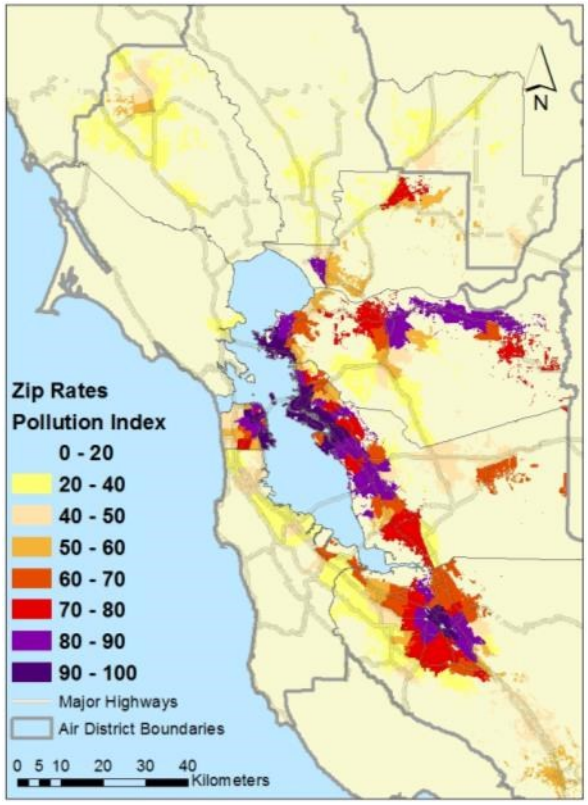
Vulnerability Index



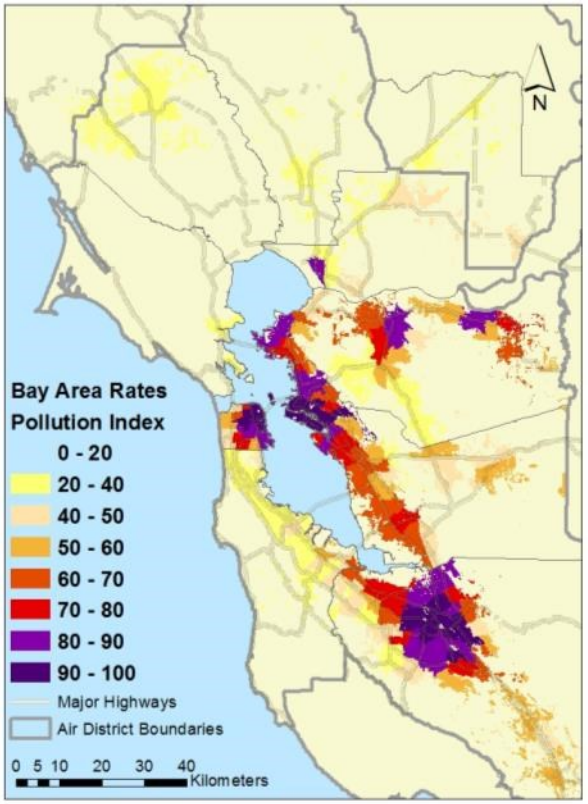
Metric combines adverse health outcomes, based on health records

- **Mortality rate**
- **Health costs**
- Ranks of each were summed for each zip code
- Expressed as a percent of maximum sum
- This is *only for comparison* to the pollution-vulnerability index

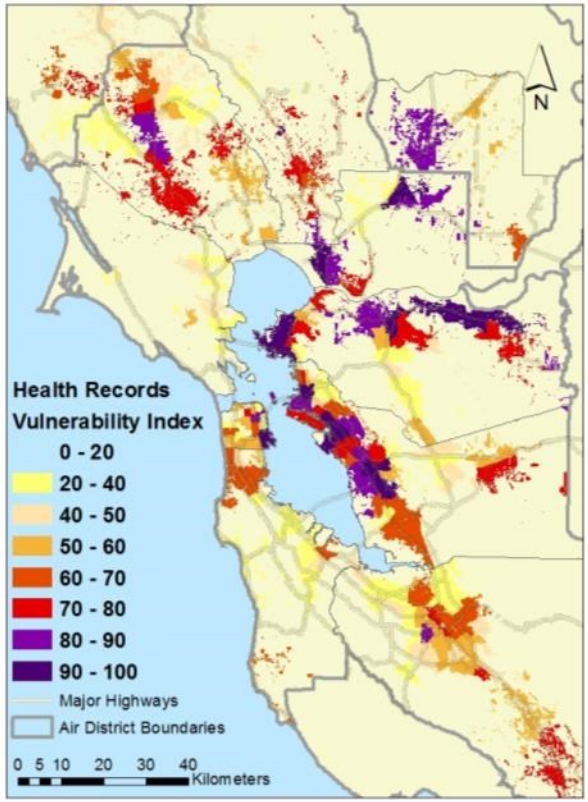
Comparison of Impact Metrics



Pollution-Vulnerability Index



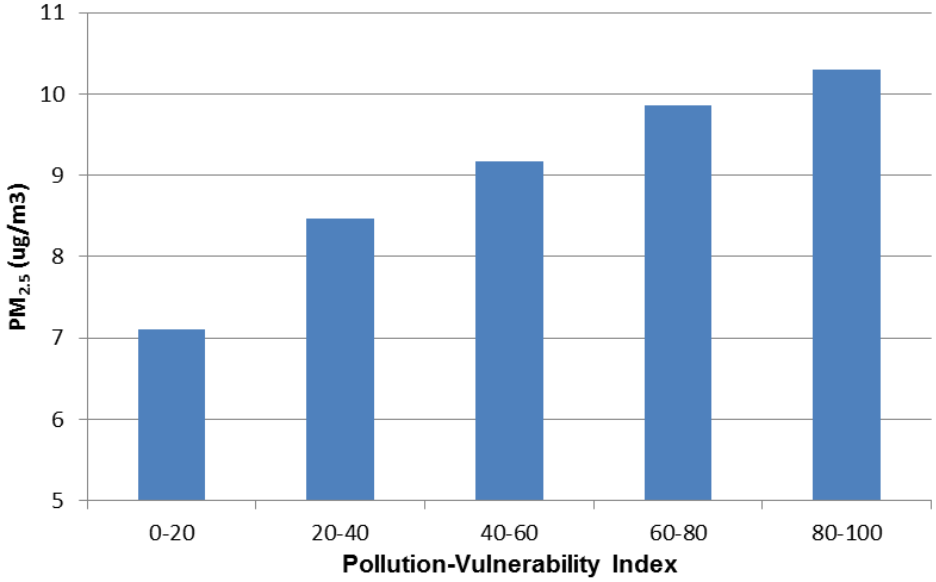
Pollution Index



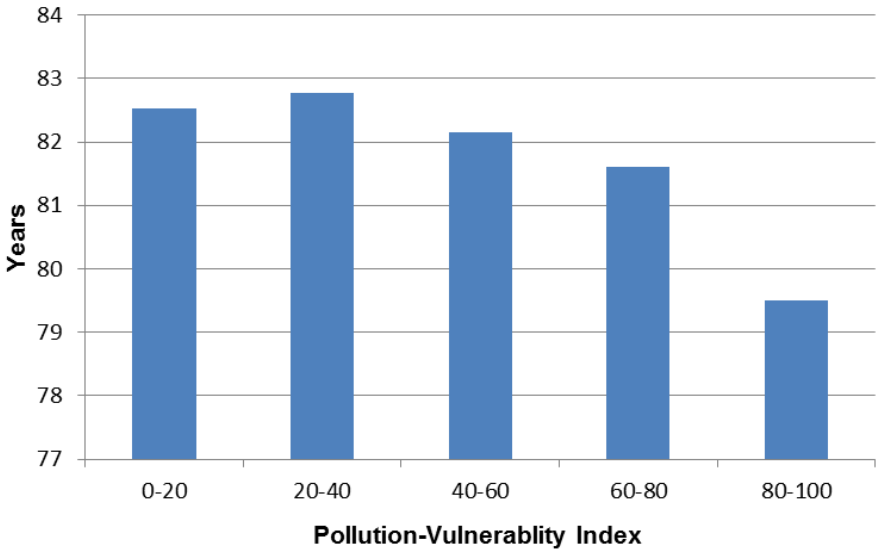
Vulnerability Index

Pollution levels and life expectancy by pollution-vulnerability index

Fine particulate matter concentrations



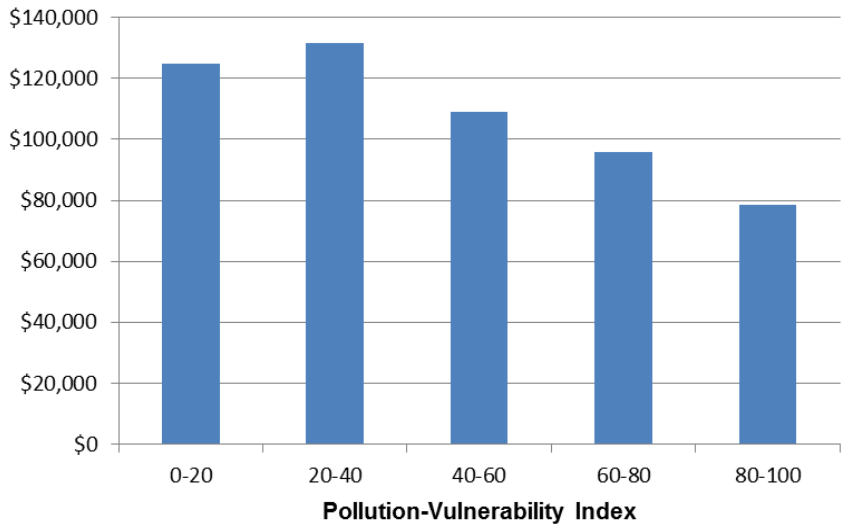
Life expectancy



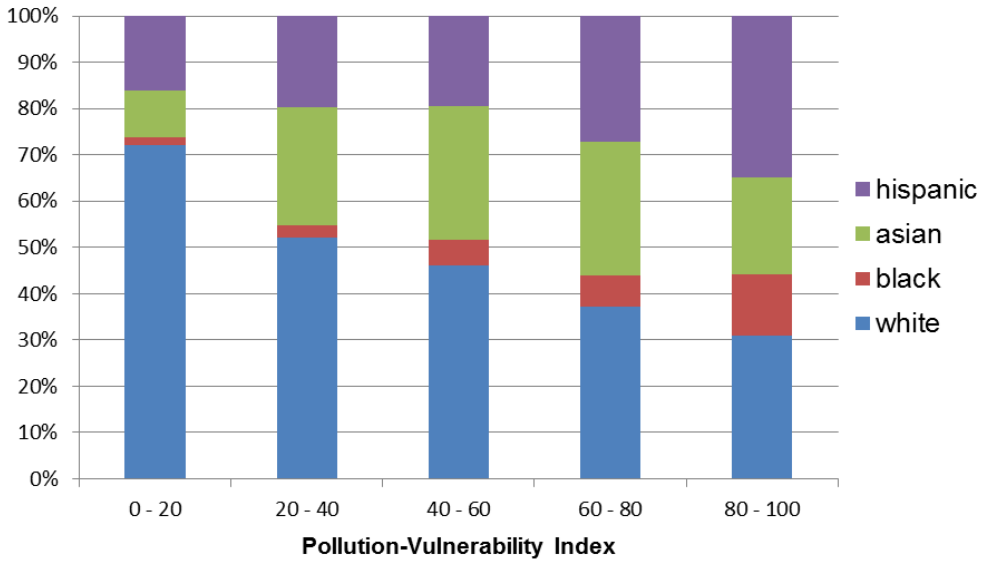
We expect pollution level and health outcomes to be correlated to the pollution-vulnerability index.

Socio-economic factors by pollution-vulnerability index

Household Income

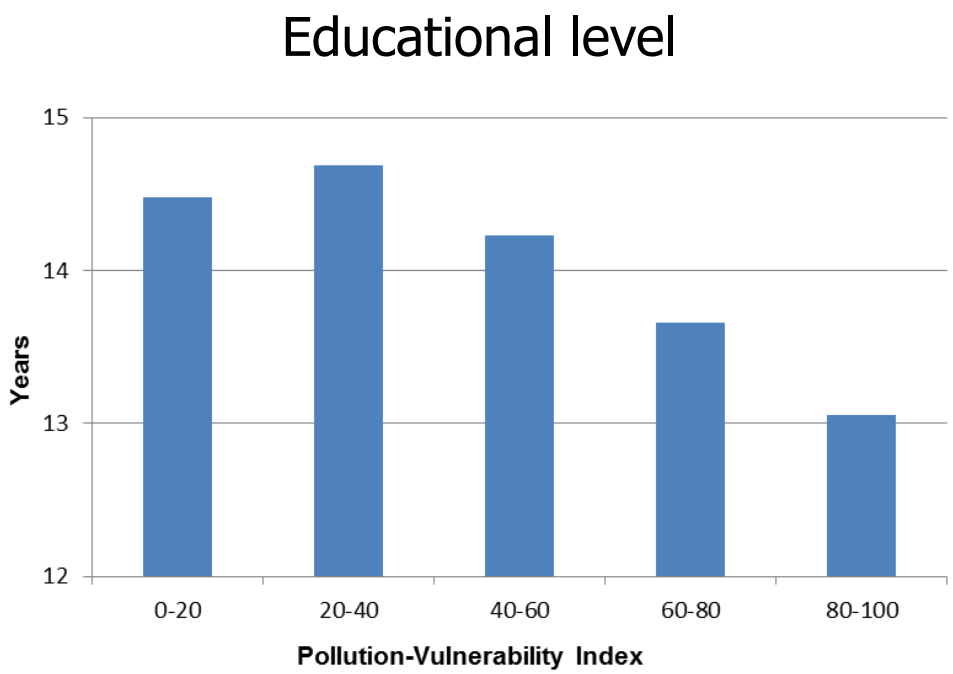


Race/Ethnicity



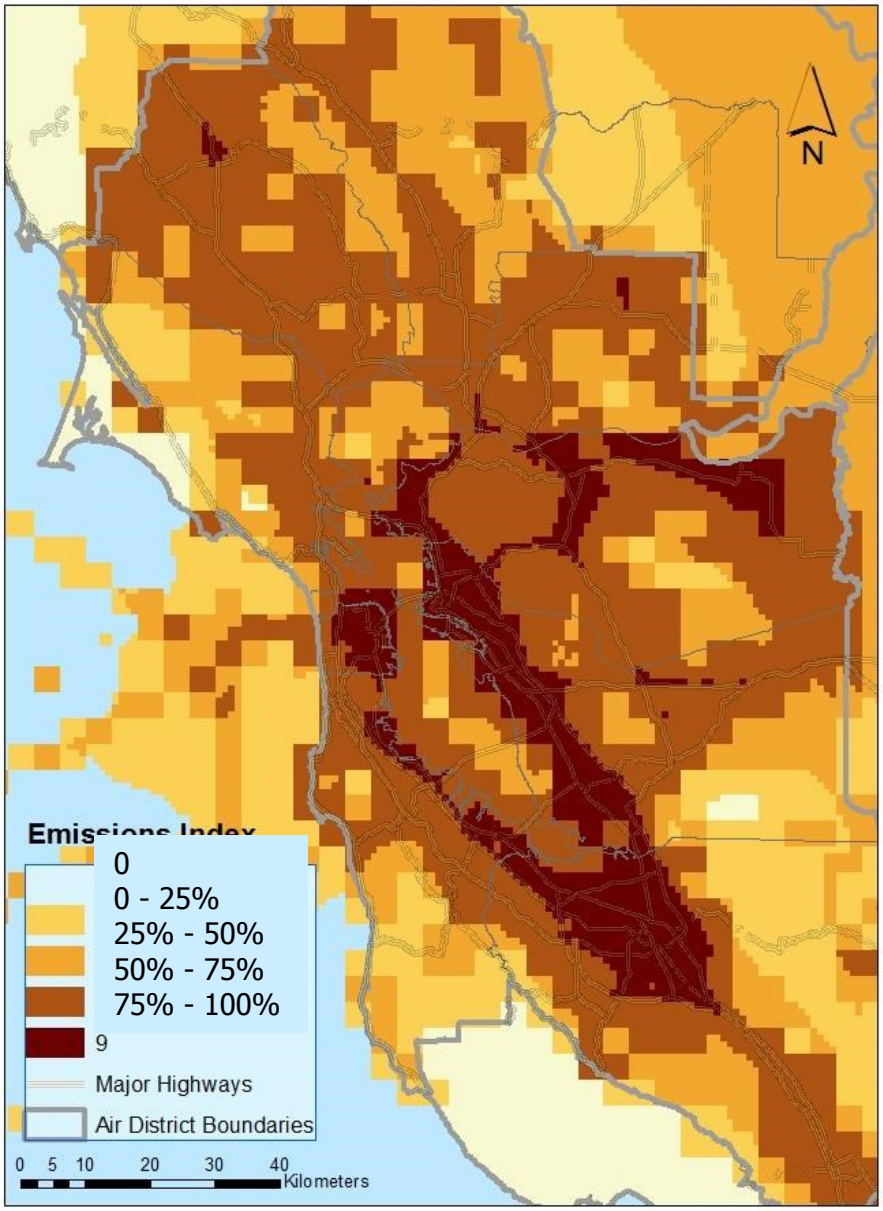
Factors not included (income, race/ethnicity) in developing the pollution-vulnerability index (air pollution, health outcomes) are reflected in the result.

Socio-economic factors by pollution-vulnerability index



Factor not included (education level) in developing the pollution-vulnerability index is reflected in the result.

Emissions Index – identify source areas around impacted areas

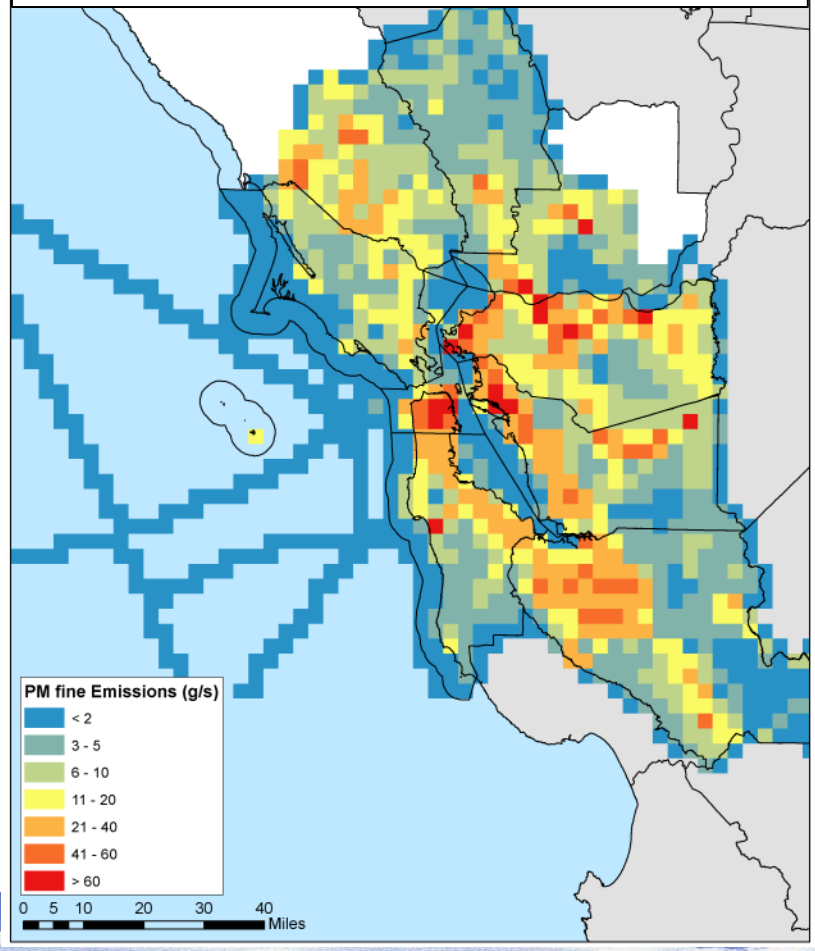


Emissions index to combines emissions of different pollutants

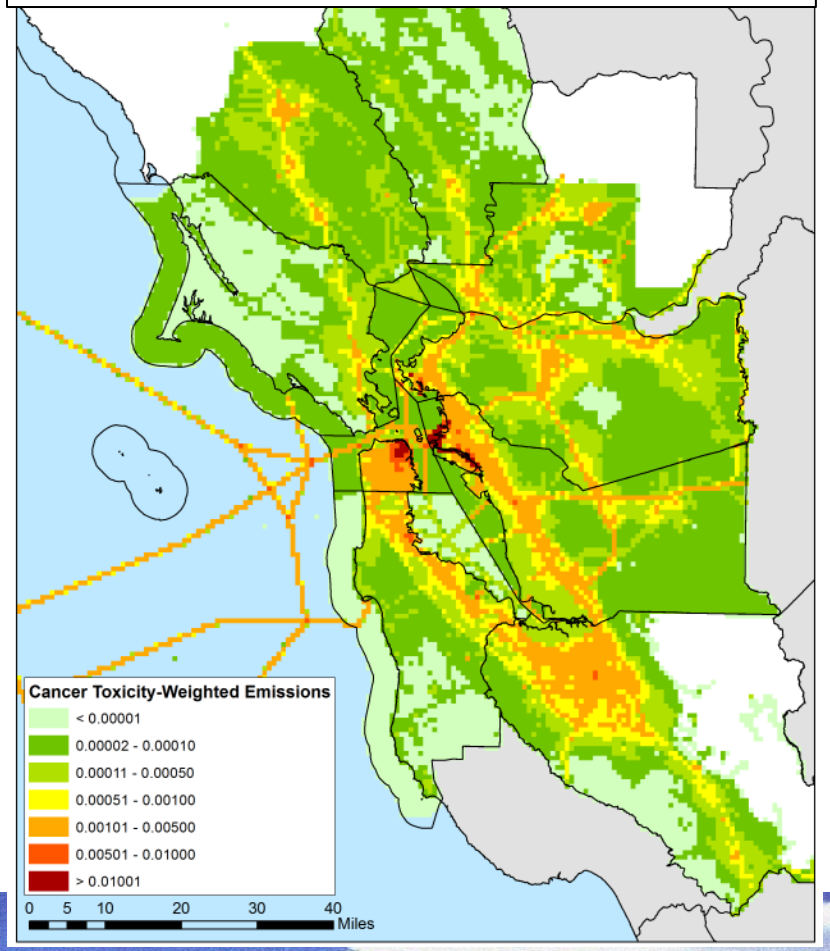
- **PM2.5 direct emissions**
- **TAC direct emissions (cancer weights)**
- **Combined precursor emissions**
- Ranks of each were summed for each zip code
- Expressed as a percent of maximum sum

Direct Emissions

$PM_{2.5}$ Direct Emissions (2010)

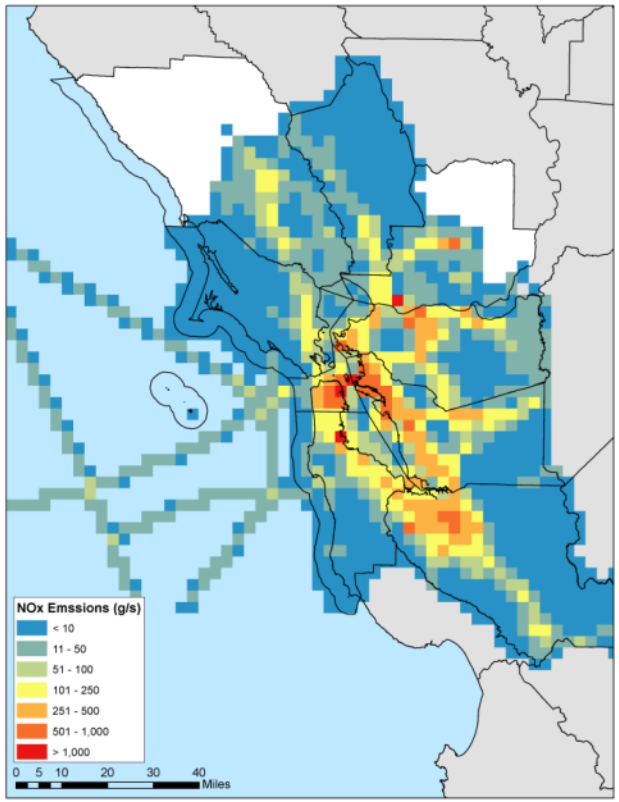


Toxic Air Contaminants Direct Emissions with Cancer-risk Weighting (2015)

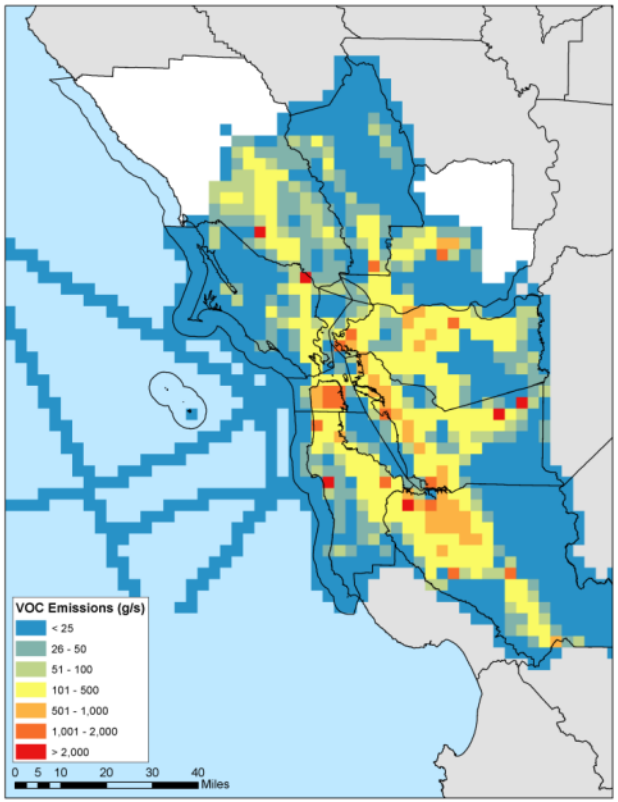


Precursor Emissions

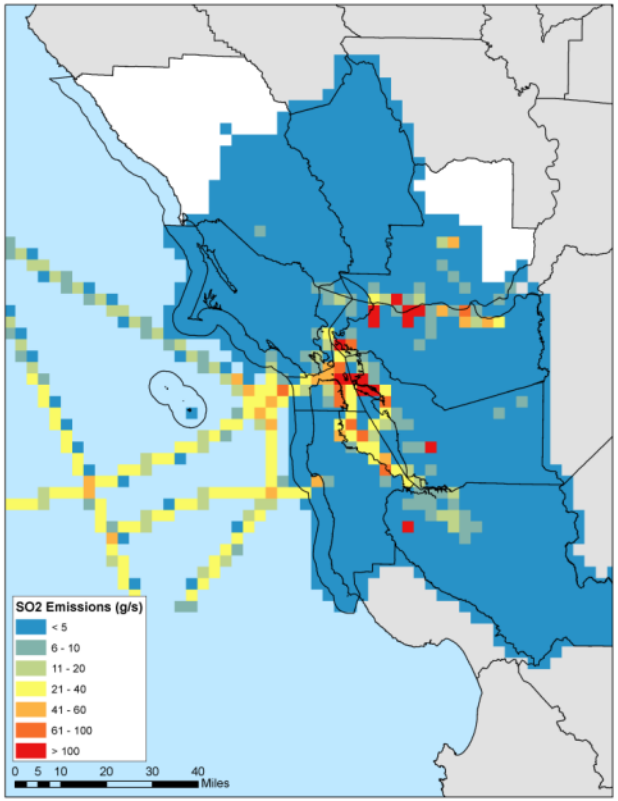
NOx (2010)



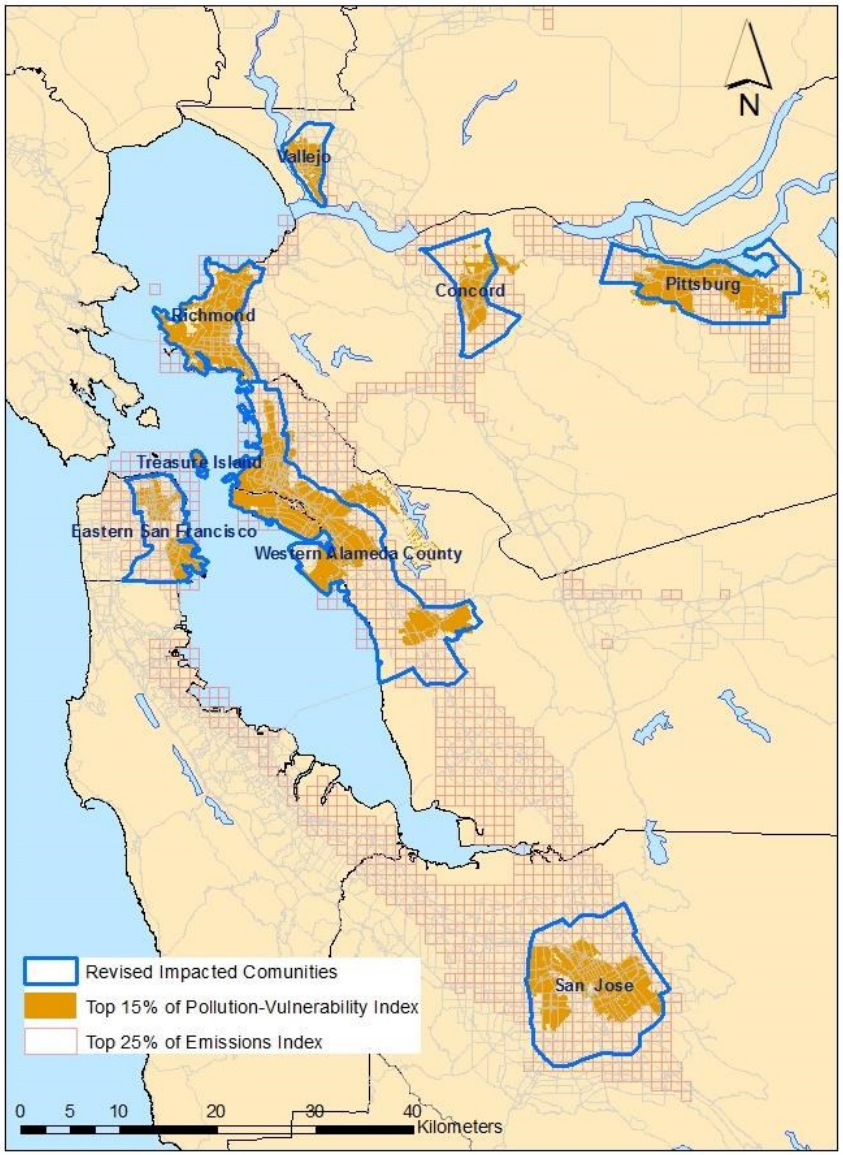
VOC (2010)



SO2 (2010)

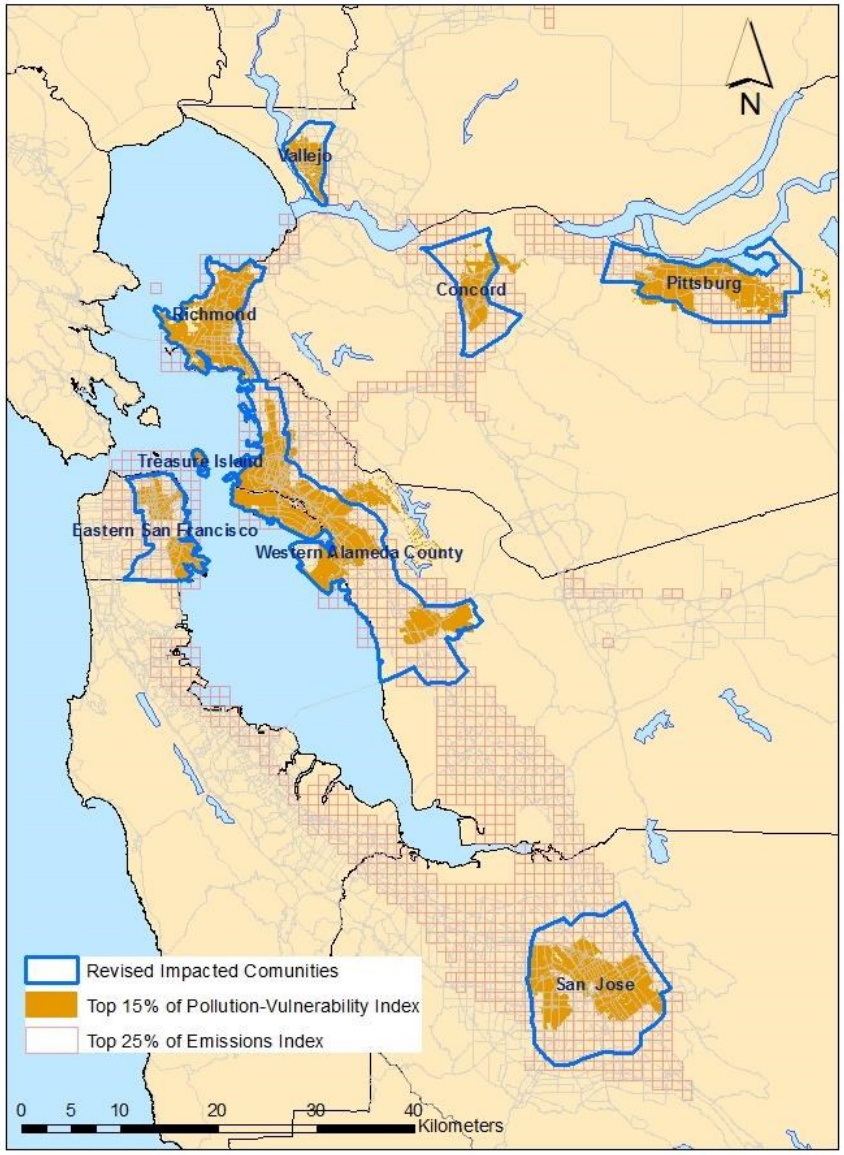


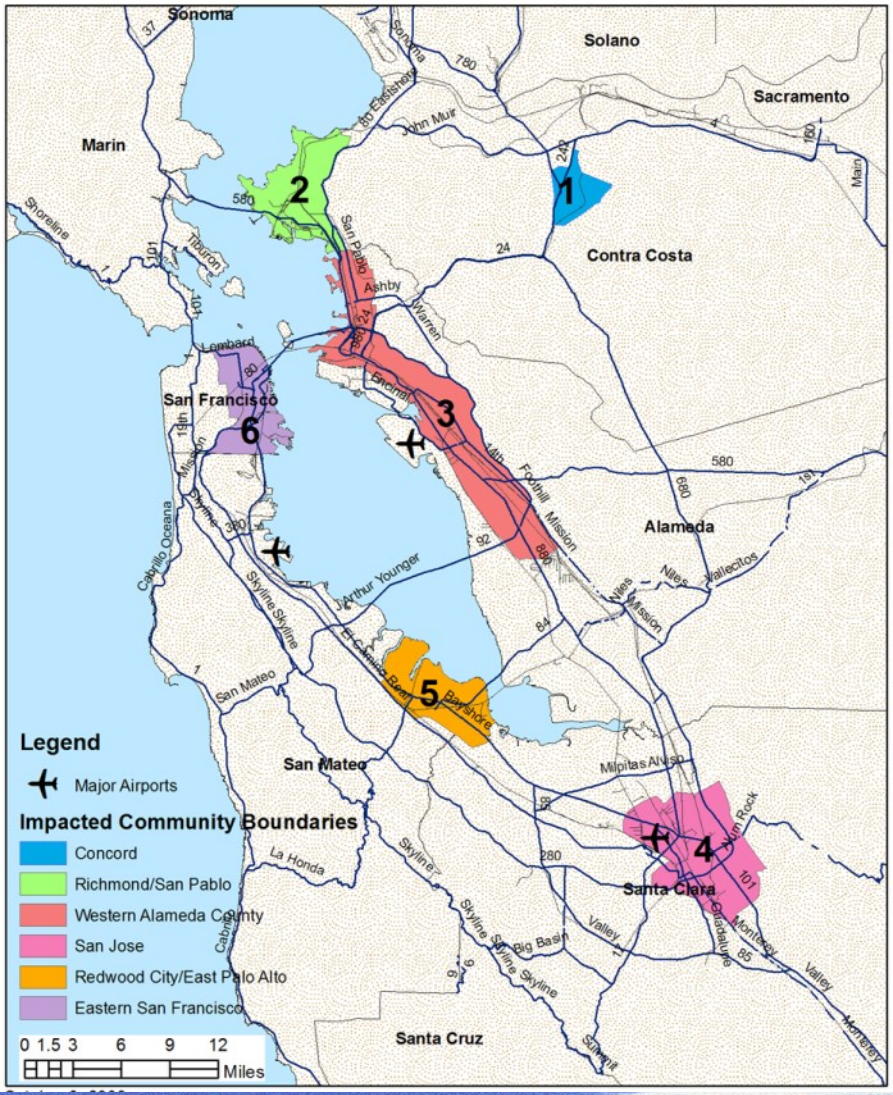
Revised Impacted Communities



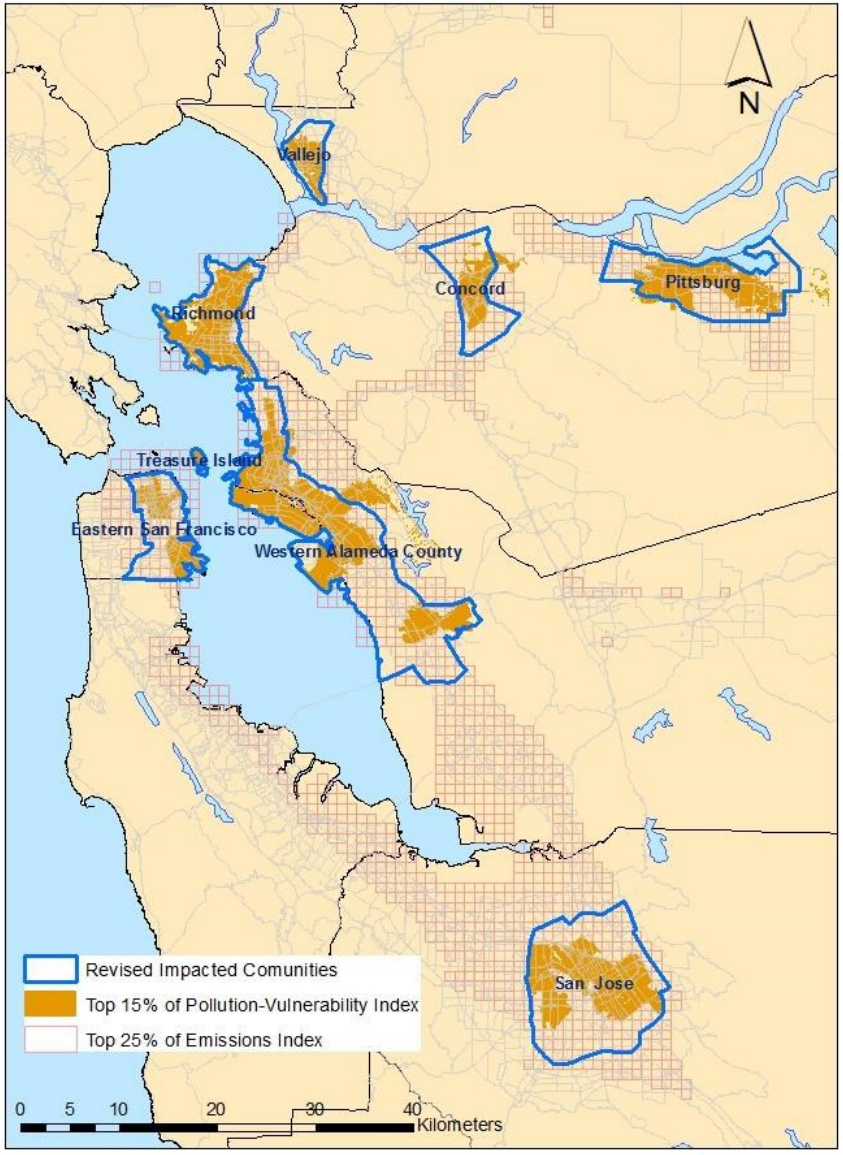
- Map top 15% of pollution-vulnerability index (PVI)
- Map to 25% of emissions index
- Develop boundaries to encompass top PVI areas
- Consider where emissions are likely to contribute
- Use major roadways, coast and county boundaries to form lines

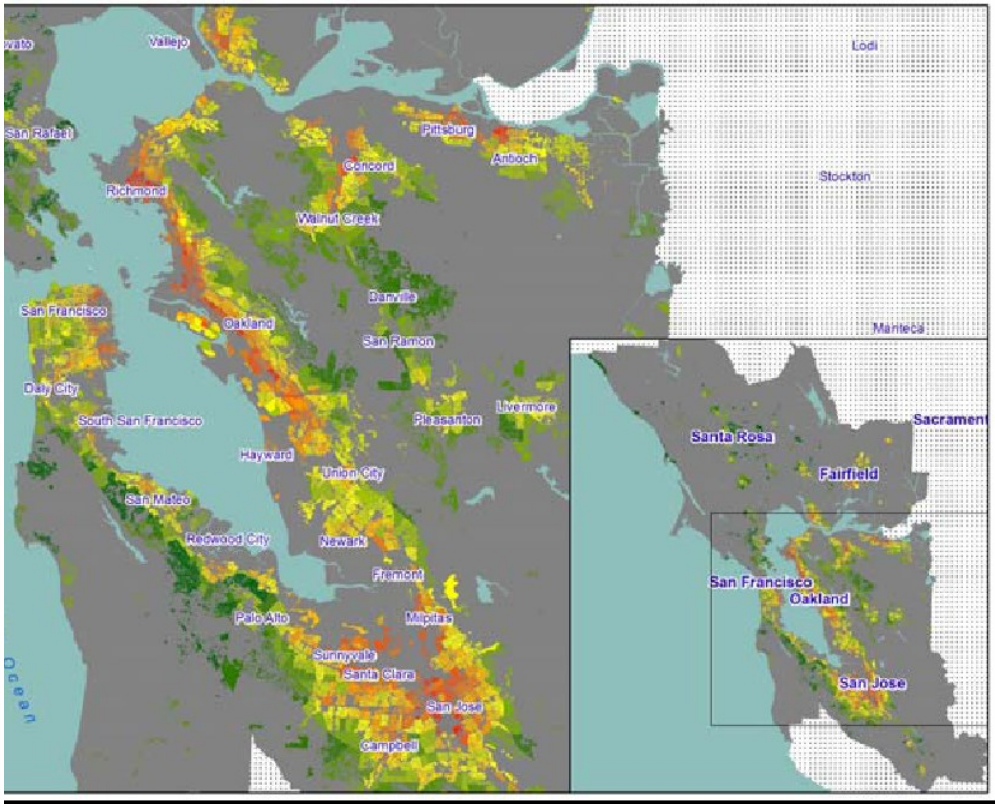
Comparison to Current Method



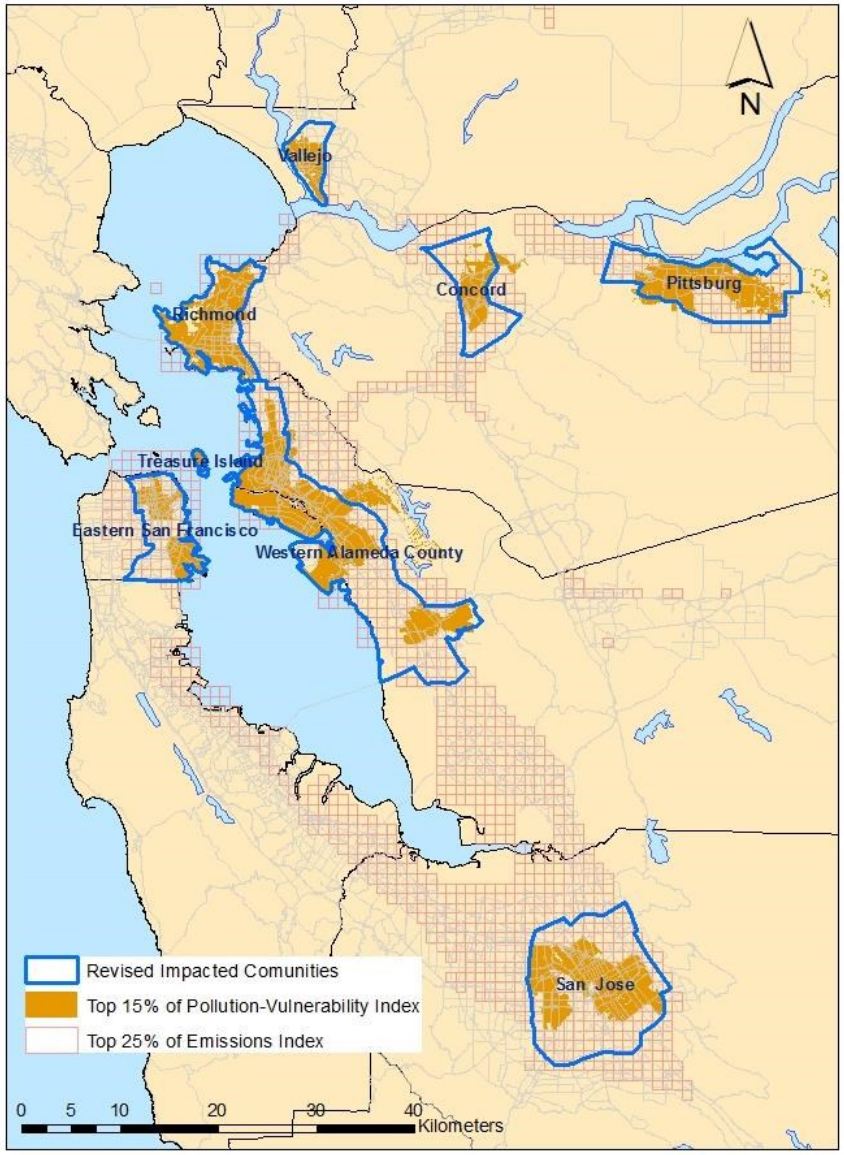


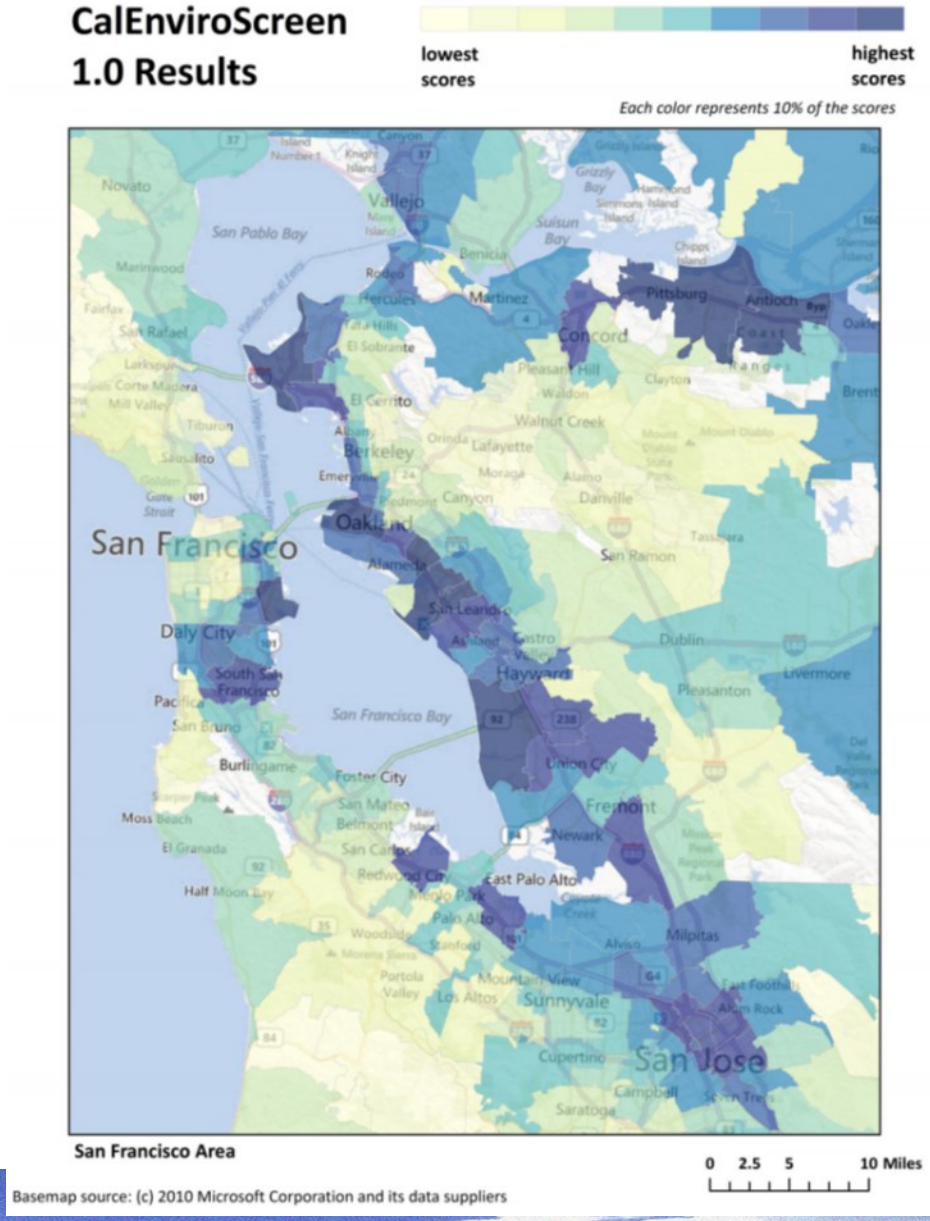
Comparison to EJ Screening Method



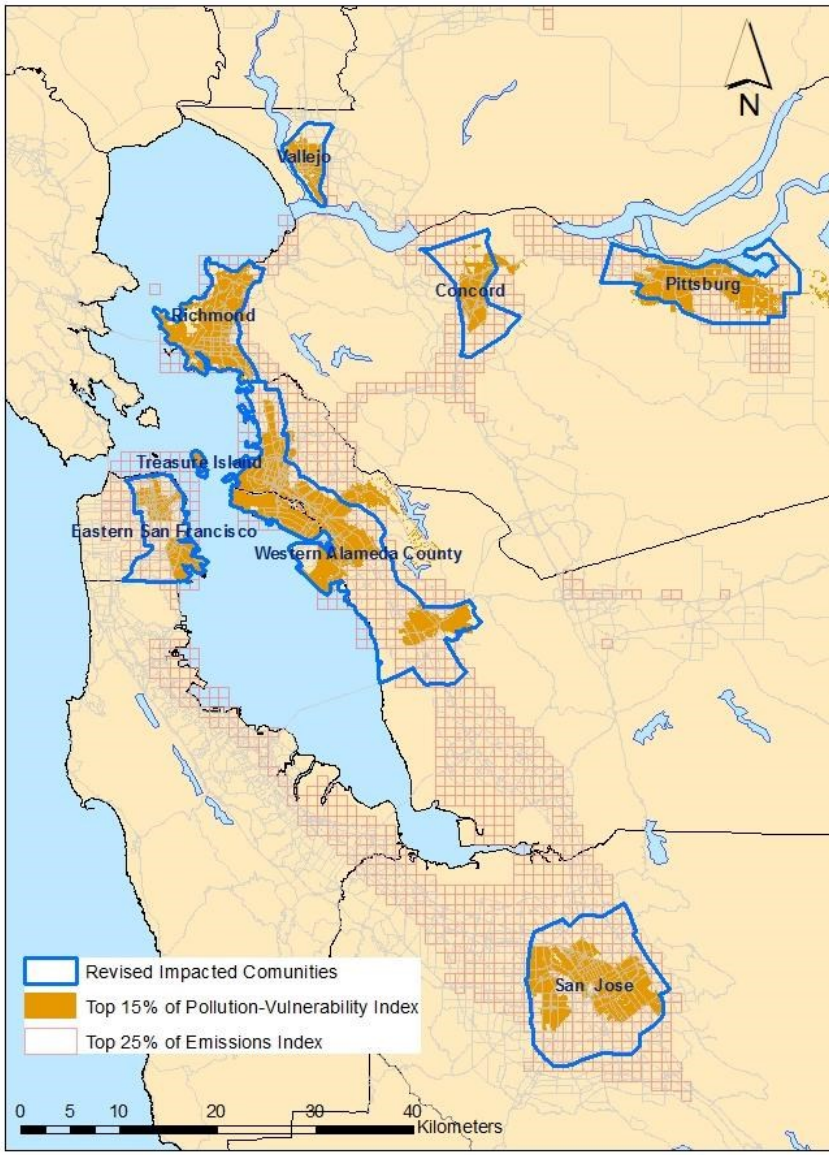


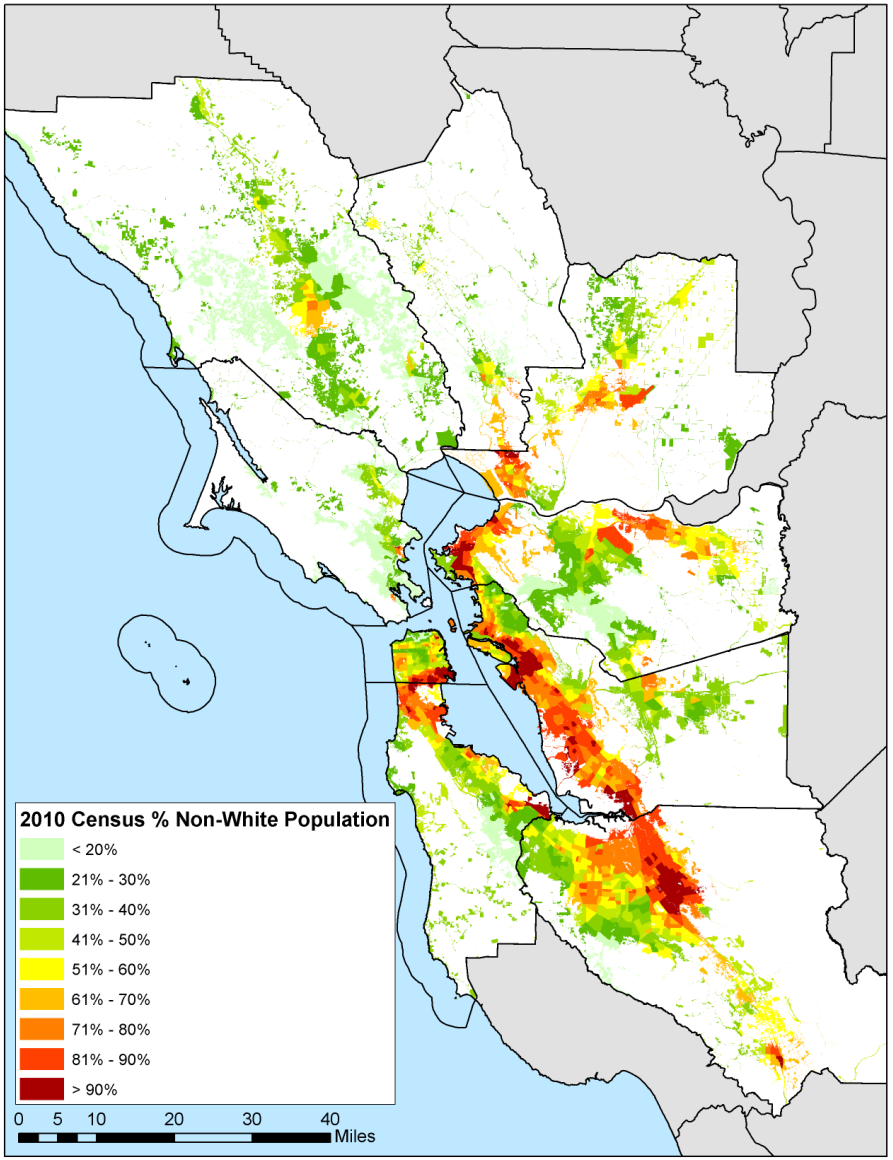
Comparison to CalEnviroScreen





Compared to Race/Ethnicity Data





Next Steps

- Seek input on updated method and report (May 2013)
- Finalize report (early June 2013)
- Continue ongoing research (version 3)
  - Refine PM modeling/monitoring
  - Refine health outcome data
  - Relate emission sources areas to impacted areas
- Continue ongoing mitigation activities