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Environmental Justice Screening Method (EJSM)

Source: CBE

Source: David Woo

Research Team:

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Purpose of Screening

- Develop indicators of cumulative impact that:
  - Reflect research on air pollution, environmental justice, and health
  - Are transparent and relevant to policy-makers and communities
  - Reviewed by community EJ groups, California Air Resources Board, academic peers and other agencies
- Can apply "screening method" to multiple uses:
  - Local land use planning
    - (e.g. Los Angeles, City of Commerce & Richmond – community plans)
  - Regulatory decision-making and enforcement
  - Community outreach

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Focus of Screening

- Developed with specific reference to ambient air quality in neighborhoods
  - Not screening for occupational, indoor, water or pesticides.
- Developed to incorporate land use information into environmental decision-making
  - Performs best with detailed and high spatial resolution land use data.
- Developed using secondary databases, not micro-studies
  - This is screening not assessment

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Categories of Impact & Vulnerability

- Proximity to hazards & sensitive land uses
  - Based on EJ literature
  - ARB land use guidelines (sensitive receptors)
  - State data on environmental disamenities
- Health risk & exposure
  - Based on EJ literature
  - Available state and national data
  - Modeling from emissions inventories
- Social & health vulnerability
  - Based on social epidemiological literature on social determinants of health
  - Based on EJ literature on area-level measures of community vulnerability

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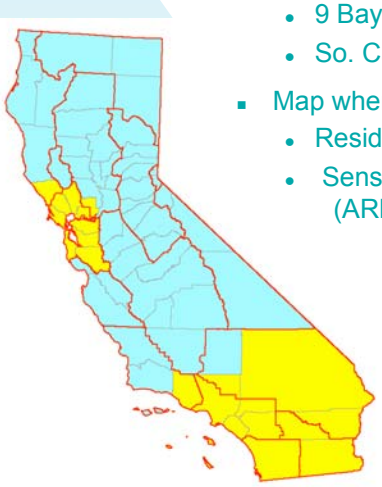
Current Coverage



- Two regions; 6 air basins
  - 7 Southern California counties
  - 9 Bay Area counties
  - So. California – higher quality land use data
- Map where people are exposed
  - Residential land use
  - Sensitive land use categories (ARB land use guidelines, 2005)

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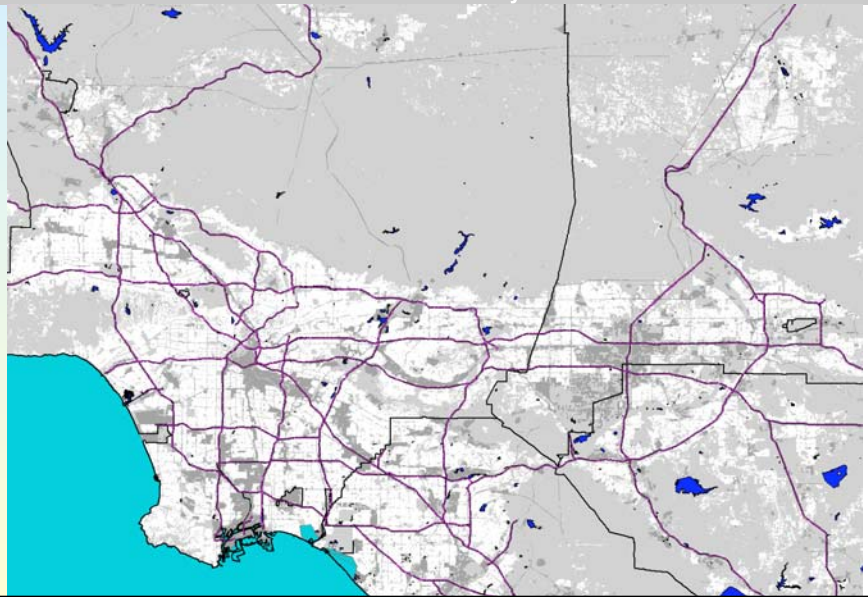
Land Use – Focus screening on where people live

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



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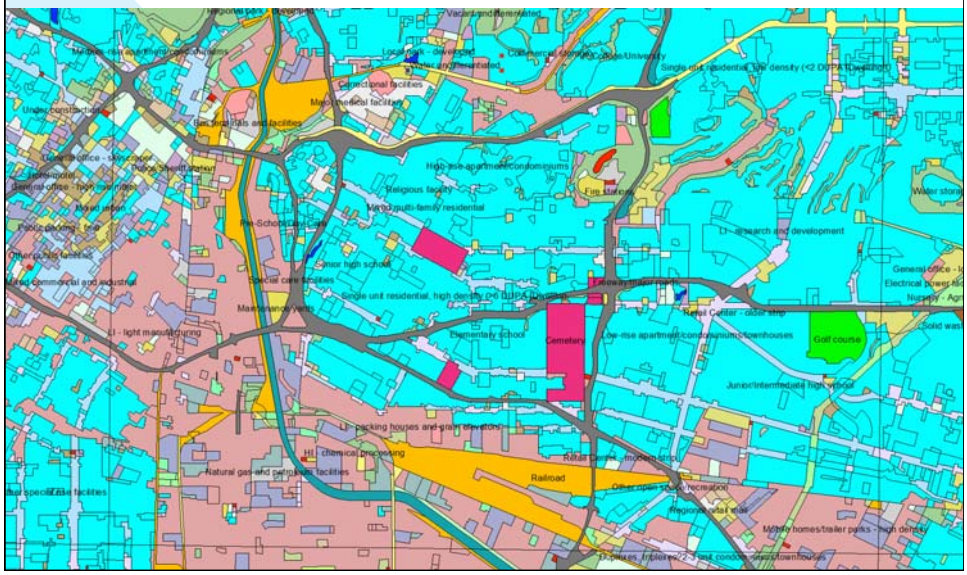
Select Residential & Sensitive Land Uses



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2000 Census Blocks

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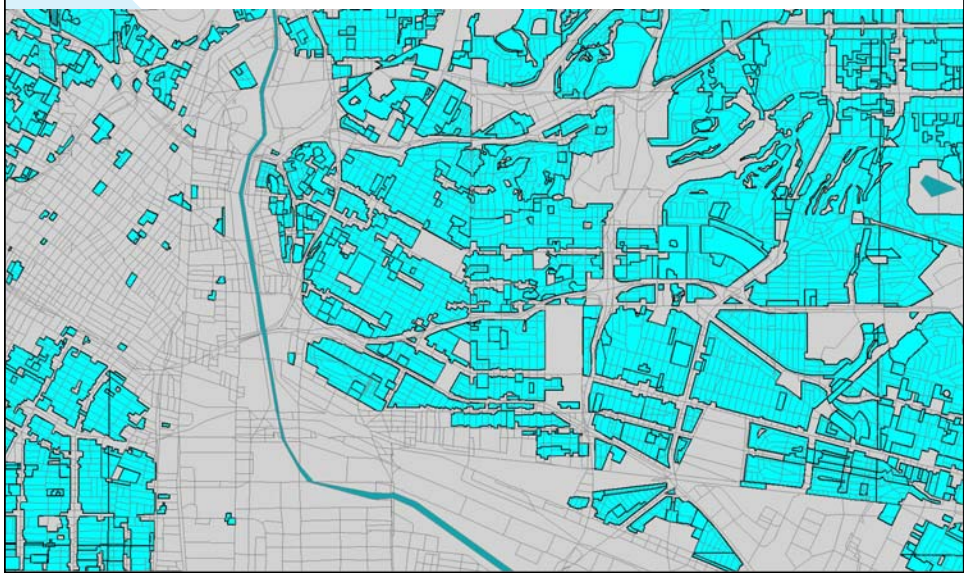
Intersect Land Use Polygons with Blocks



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

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Each CI Polygon or Host Tract (Neighborhood) can receive a Cumulative Impacts Score

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Category 1:

Proximity to Hazards & Sensitive Land Uses

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Sensitive Land Use Component

- Sensitive land uses as defined by ARB
  - Air Quality and Land Use Handbook, 2005
    - Childcare facilities (SCAG 2005, geocoded)
    - Healthcare facilities (ARB/CaSIL/SCAG 2005)
    - Schools (SCAG 2005, geocoded from CA DOE)
    - Urban Playgrounds & Parks (SCAG 2005)
    - Land use data layer - SCAG 2005 polygons
- *Polygons receive a score of 1 if they contain at least one sensitive land use category*

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Geocoded Point Sensitive Land Uses

- Some sensitive receptor locations identified as geocoded points must be converted into polygons to create CI polygons, but actual area unknown
- Points buffered to create circle polygons
  - Area equal to that of the smallest equivalent land use in the SCAG data
    - Childcare = 1013 m^2
    - Schools = 2279 m^2
    - Healthcare = 5524 m^2
- These polygons added to CI Polygon base map using GIS Union to avoid area overlap

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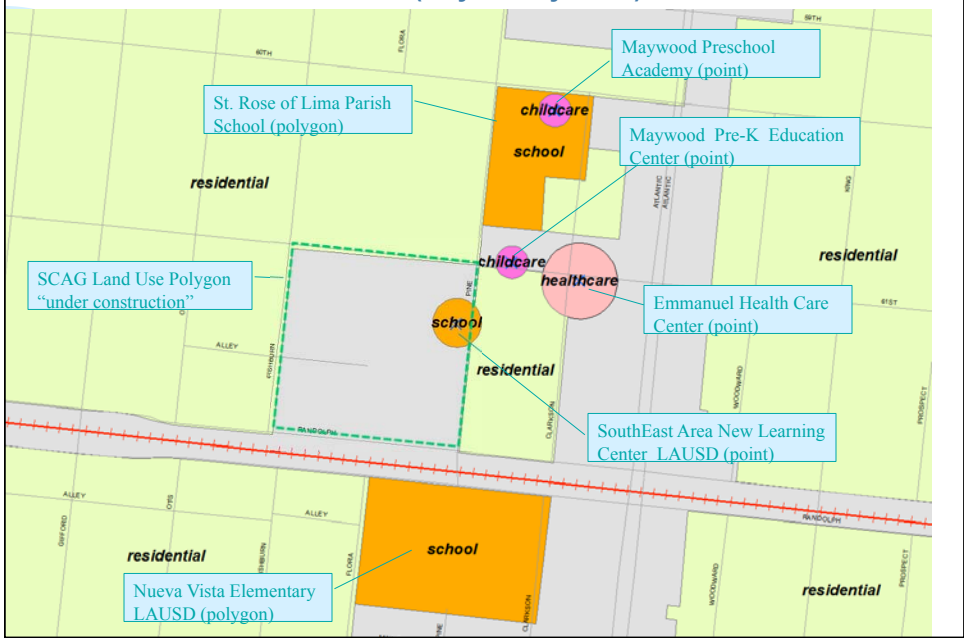
Geocoded Sensitive Land Uses - Polygons from points (City of Maywood)



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Geocoded Sensitive Receptor Land Uses Polygons from points

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Proximity to Air Pollution Sources & Hazardous Land Uses

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

From ARB's "Air Quality and Land Use Handbook" (2005)

- *Number of sites within various buffers of polygon edge are counted, with those closer having a stronger weight (i.e., distance weighting)*

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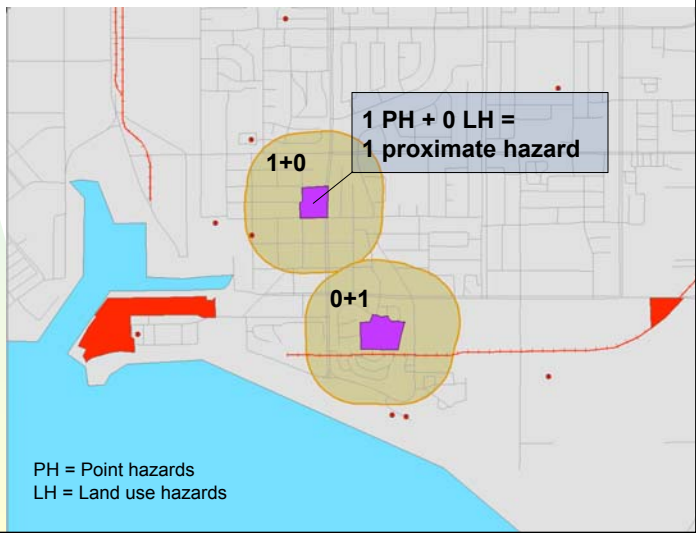
Defining Hazard Proximity
1,000 ft. Buffers

- Buffer CI polygon boundaries at different distances
- Hazard proximity based on number of facilities (point-sources) and hazardous land uses inside the buffer



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Distance Weighting the Hazard Count

Because of the potential for inaccurate hazard locations, a distance weighted approach is used to get the hazard count for each CI polygon:

Distance Weighted Hazard Count =

(1 x #Hazards within 1,000ft) +

(**0.5** x #Hazards 1,000-2,000ft) +

(**0.1** x #Hazards 2,000-3,000ft)

** The above weights can be set to any desired value*

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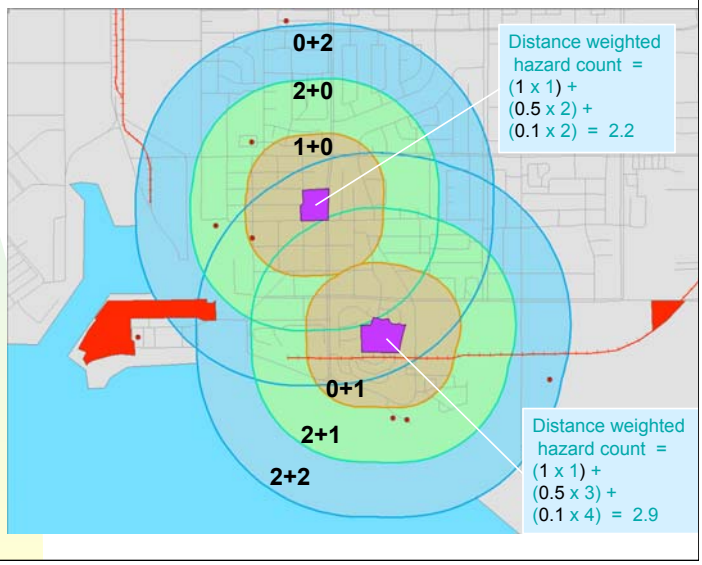
Defining Proximity – Distance Buffers

1000-3000 Foot Buffers, Distance Weighted Hazard Count

- Buffer CI polygon boundaries at different distances
- Hazard proximity based on number of facilities (point-sources) and hazardous land uses inside the buffer



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Mapping Accuracy and Distance Weighting

- There is error in reported location of some facilities
- Facilities represented as points in the GIS are actually much larger polygon areas
- Both of these factors introduce error into facility proximity/buffering procedure
- Effect is to "underscore" hazard proximity for some CI polygons

➢ *Distance-weighted hazard scoring is an method to address these problems*

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Point Location Air Quality Hazards From ARB Data (City of Maywood)

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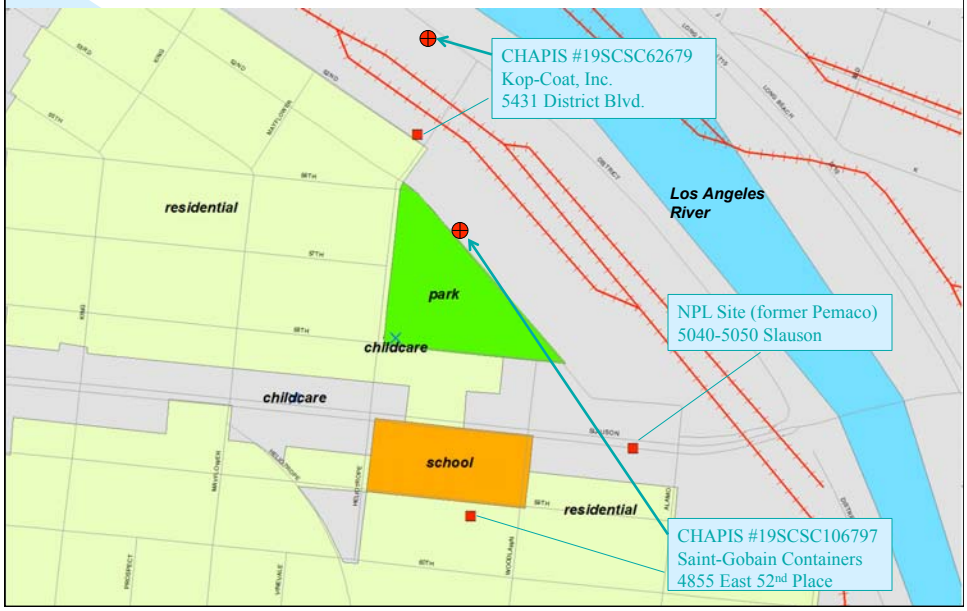
Error in Reported Facility Locations



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Facilities Mapped as Points Using Available Data But Actual Facility Area is Much Larger

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Hazard Proximity & Sensitive Land Use Scores Then Taken to the Tract Level

Why the Tract Level?

- It is a consistent level of geography for many sources of data
- All of the health risk and social vulnerability measures (discussed later) are available at the tract level
- Also helps with issues of geographic accuracy

To get hazard proximity and sensitive land use scores 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

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Hazard Proximity & Sensitive Land Use Scores at the Tract Level

- Take the resulting total figures at the tract-level and rank all tracts in the region into quintiles (1-5) to get the final hazard proximity and sensitive land use **score** at the tract level
- Quintile distribution is used here and throughout the CI Screening Method because it is an accessible and normal ranking procedure
  - No "right" distribution to follow (magnitudes of hazards unknown)
  - Other distributions could easily be applied

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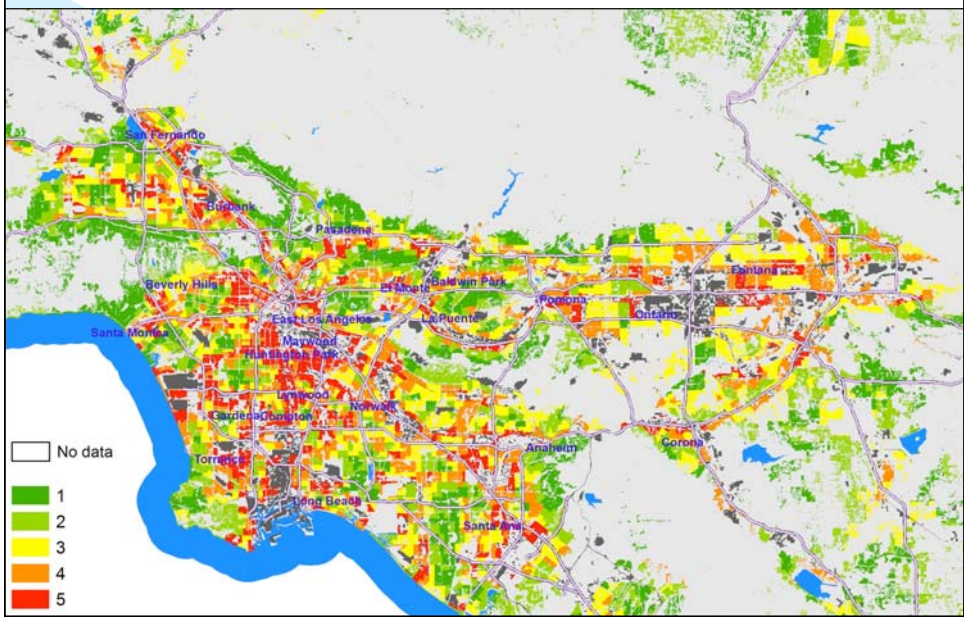
Hazard Proximity & Sensitive Land Use Score at the Tract Level

Mapped on CI Polygons (quintile distribution)



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Category 2:

Health Risk and Exposure

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Health Risk & Exposure Indicators
(Tract Level)

- RSEI (Risk Screening Environmental Indicators)
  - (2005) toxic conc. hazard scores from TRI facilities
- NATA 1999 (National Air Toxics Assessment)
  - Respiratory hazard from mobile & stationary sources
- CARB Estimated Inhalation Cancer Risk 2001
  - Calculated from modeled air toxics concentrations using emissions from CHAPIS (mobile & stationary)
  - Corrected version of this data
- CARB estimated $PM_{2.5}$ concentration
- CARB estimated Ozone concentration

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Health Risk & Exposure Scores
(Tract Level)

- 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

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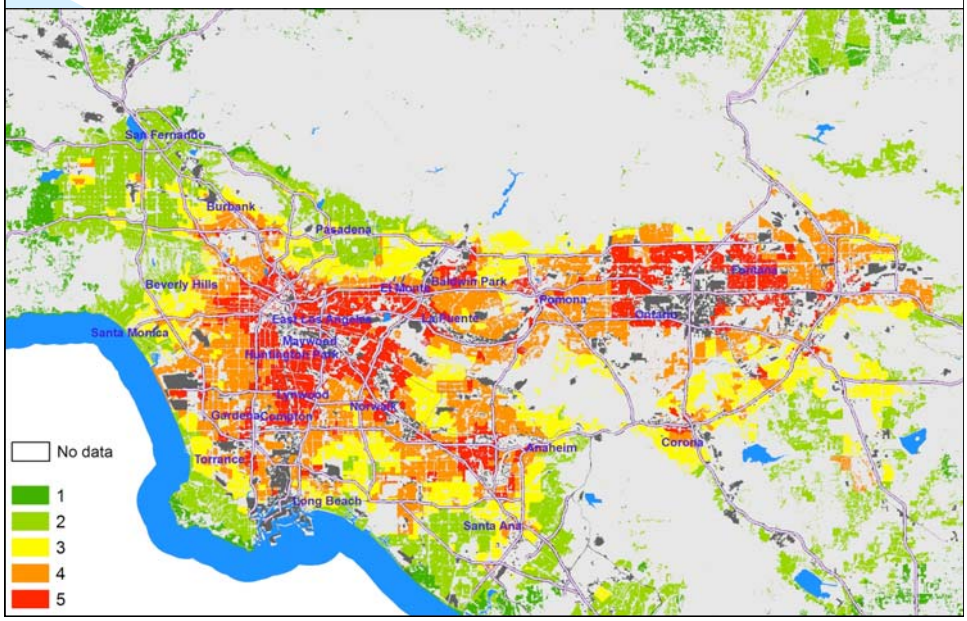
Health Risk & Exposure Score at the Tract Level

Mapped on CI Polygons (quintile distribution)



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Category 3:

Social and Health Vulnerability

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Social & Health Vulnerability Indicators

Census Tract Level Metrics (2000)

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 1996-03

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 in 2000 general election

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Social & Health Vulnerability Scores

- Each social and health vulnerability metric is ranked into quintiles (1-5) across all tracts in the region
- Final score is derived by taking average ranking (across all metrics) for each tract, and ranking the average once again into quintiles (1-5)

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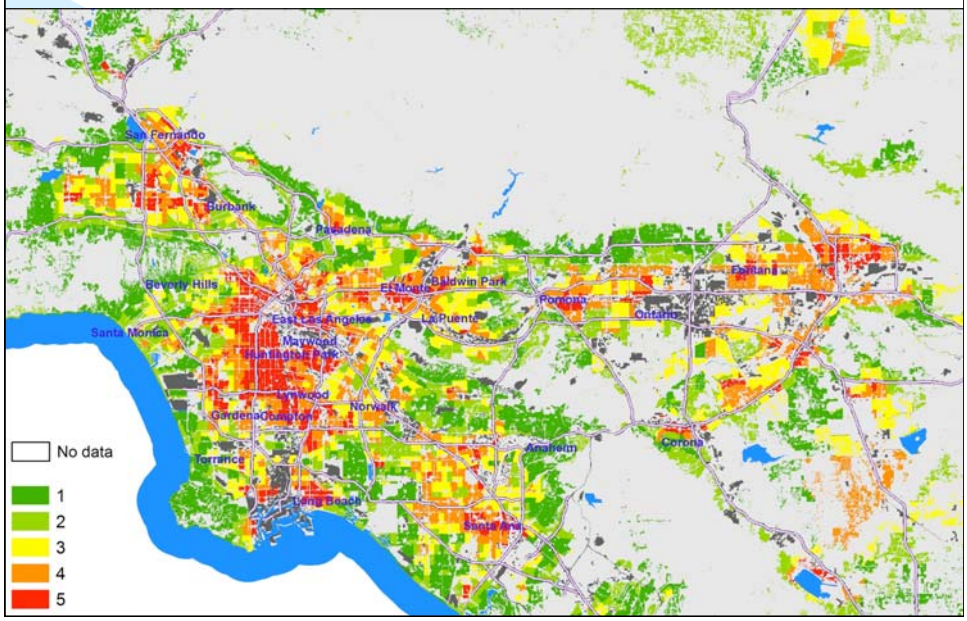
Social Health & Vulnerability Score at the Tract Level

Mapped on CI Polygons (quintile distribution)



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Bringing it all together:

Cumulative Impact (CI) Scores

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Cumulative Impact Scores at the Tract Level

Combine three 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*

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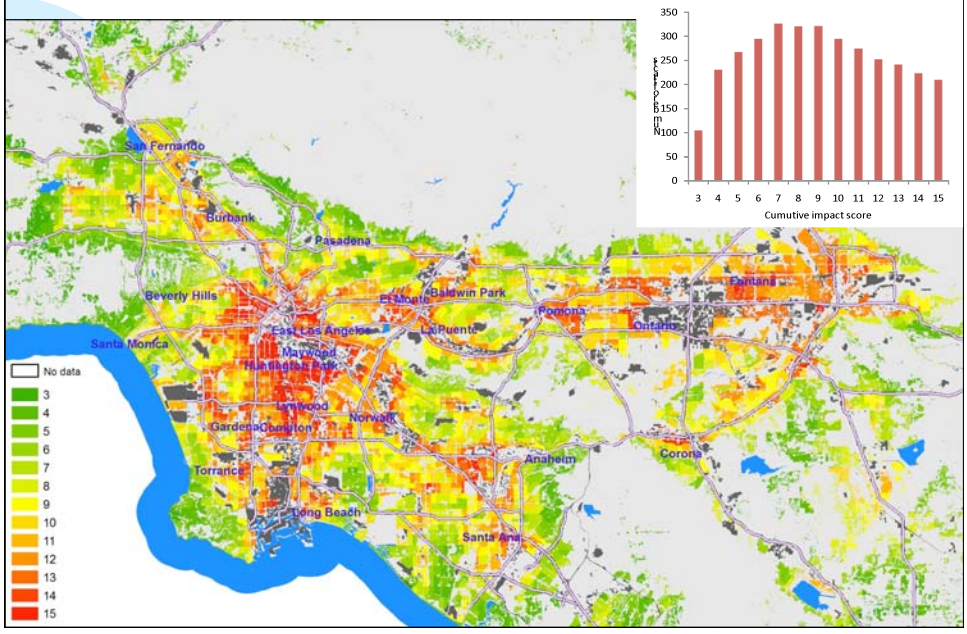
Tract Level Cumulative Impact Score, Los Angeles Area

Distance weighted hazard proximity, mapped on CI Polygons



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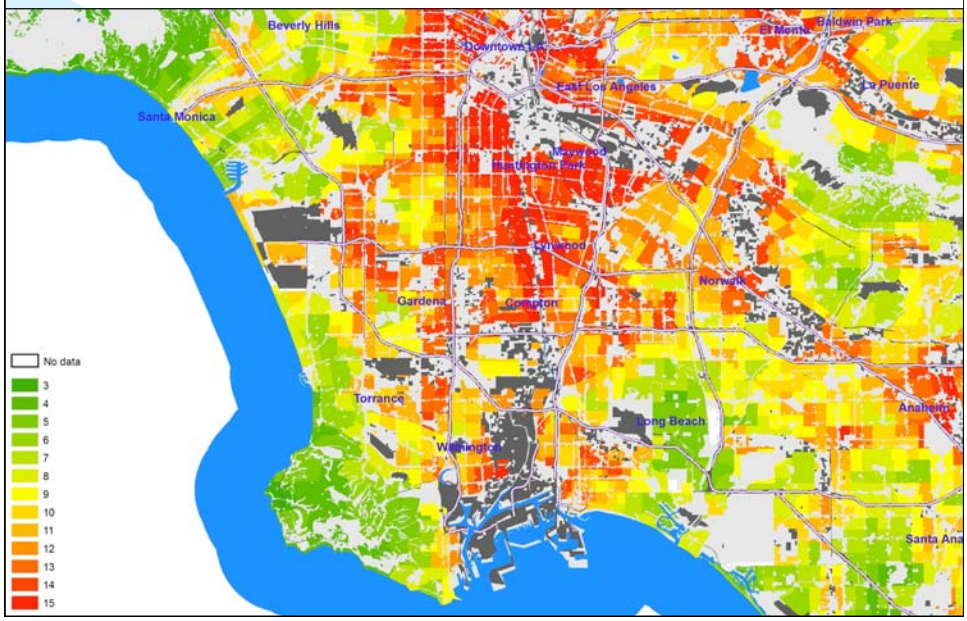
Tract Level Cumulative Impact Score – South LA Area

Distance weighted hazard proximity, mapped on CI Polygons



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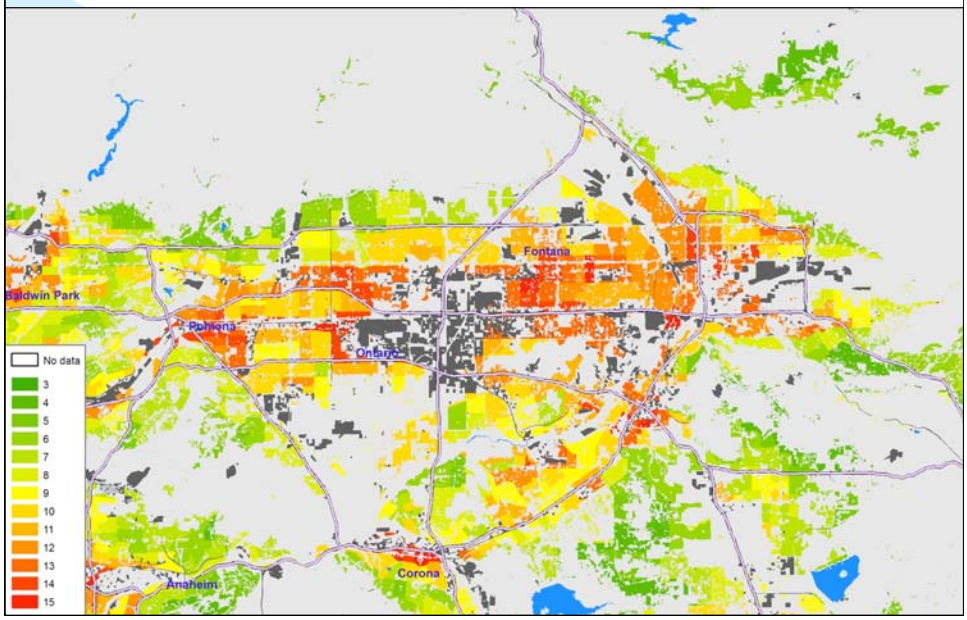
Tract Level Cumulative Impact Score – Inland Empire

Distance weighted hazard proximity, mapped on CI Polygons



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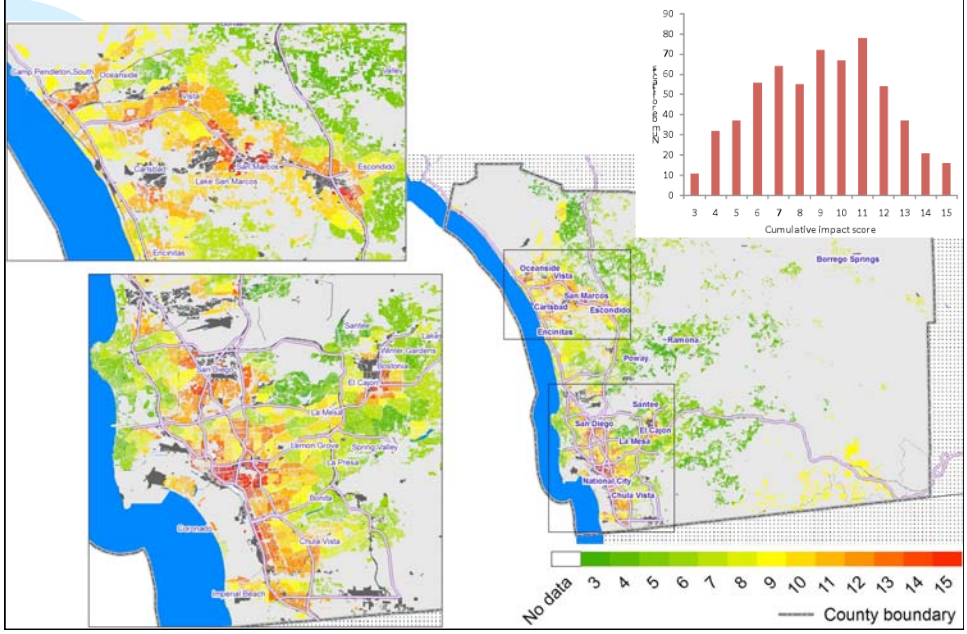
Tract Level Cumulative Impact Score, San Diego County

Distance weighted hazard proximity, mapped on CI Polygons



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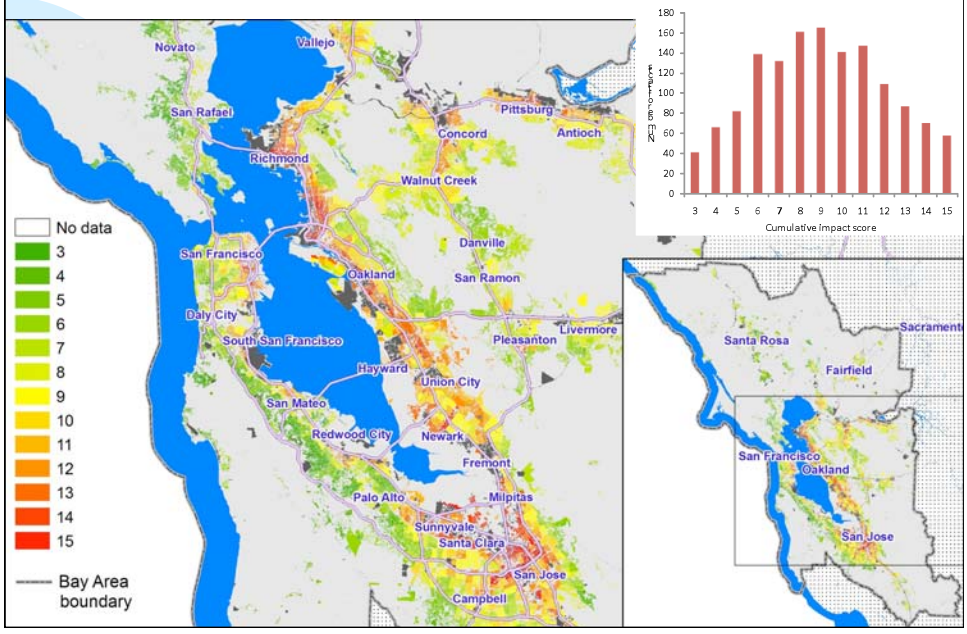
Tract Level Cumulative Impact Score, 9-County Bay Area

Distance weighted hazard proximity, mapped on CI Polygons



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Important Caveats

- The Method was developed with specific reference to air quality and not screening for other concerns (such as water or pesticides)
  - Performs best with high spatial resolution land use data which is not available for all areas of the state
    - Central Valley – lower quality land use data (currently attempting to address this data challenge)
  - *This is screening not assessment, so neighborhood monitoring and ground truth verification is needed.*

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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)