Environmental Justice Screening Method:

Integrating Indicators of Cumulative Impact into Regulatory Decision-making

Source: CBE

Source: David Woo

PERE
USC Program for Environmental & Regional Equity

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The Research Team

- Manuel Pastor, Ph.D. in Economics, responsible for project coordination, statistical analyses, including multivariate and spatial modeling, and popularization
- James Sadd, Ph.D. in Geology, responsible for developing and maintaining geographic information systems (GIS), including location of site and sophisticated geo-processing
- Rachel Morello-Frosch, Ph.D. in Environmental Health Science, responsible for statistical analysis, health end-points, and estimates of risk.

Purpose of Screening Methodology

- 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

- Apply EJ "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

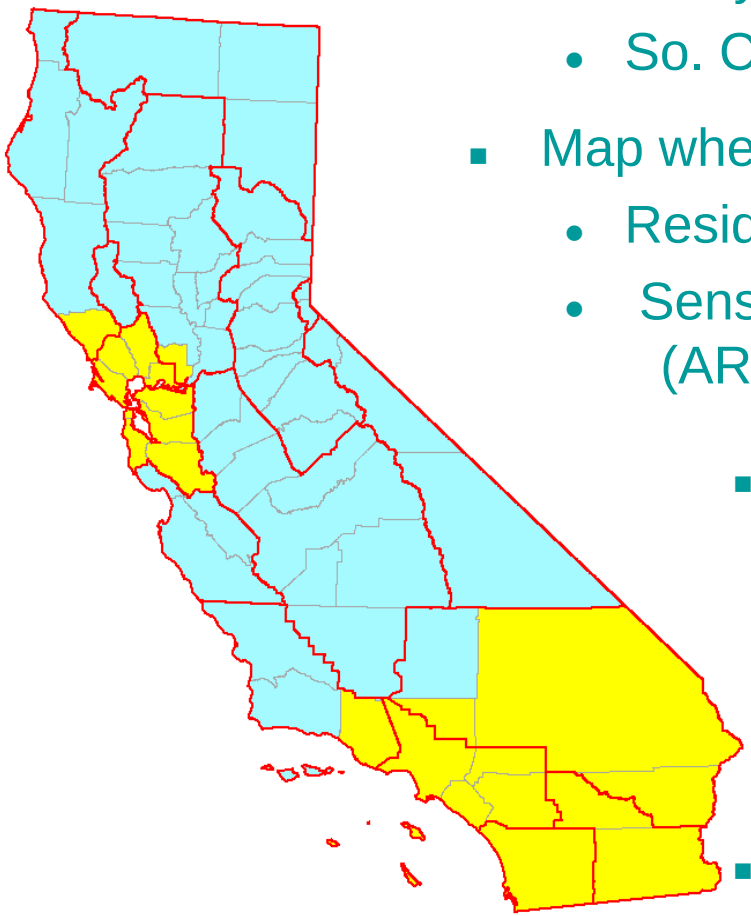
Focus of Screening Method

- 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

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

EJ Screening Method



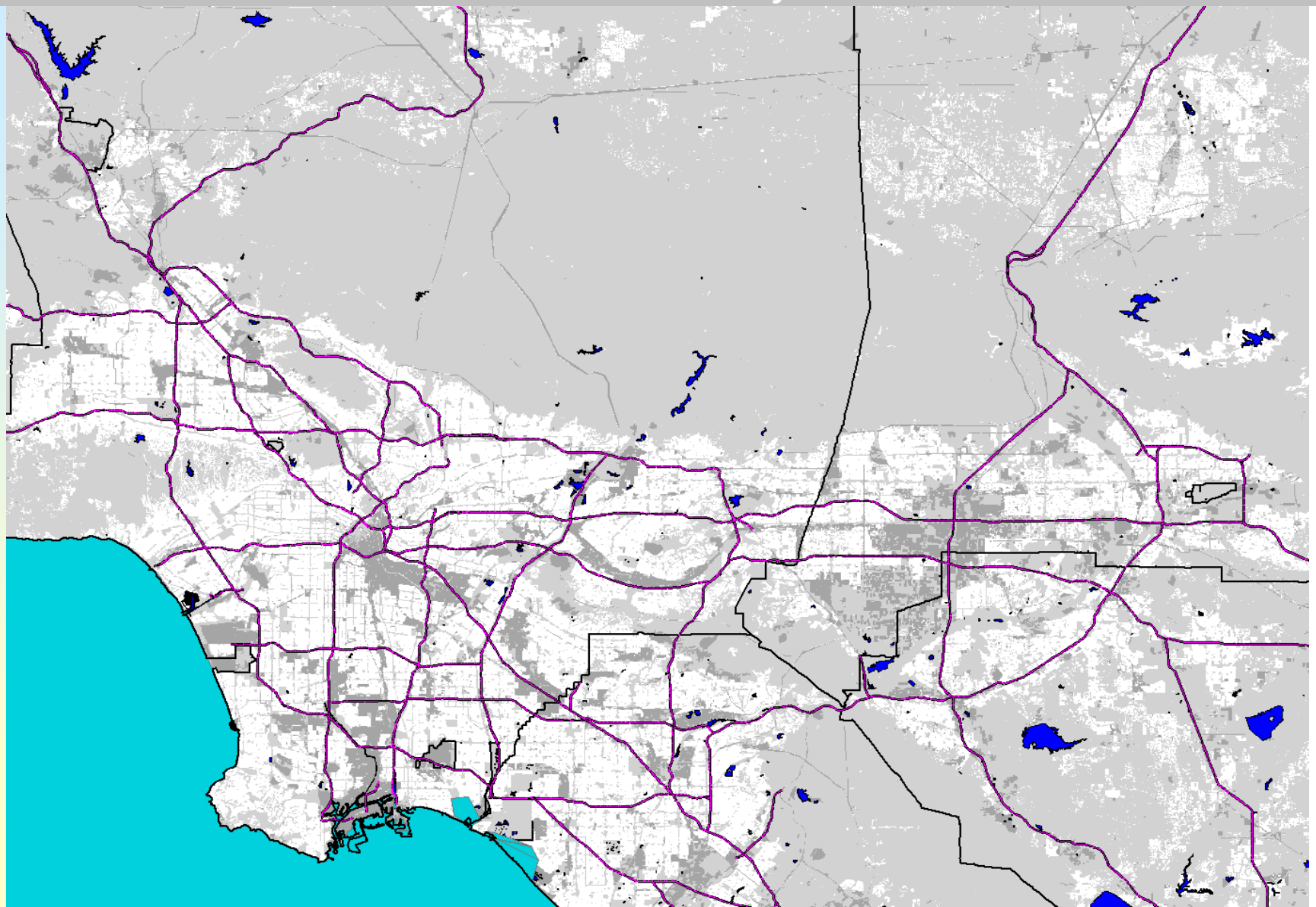
- Two regions; 6 air basins
  - 7 Southern California counties
  - 9 Bay Area counties
  - So. California – higher quality land use data
- Map where people are exposed
  - Residential land use
  - Sensitive land use categories (ARB land use guidelines, 2005)
- Analytical Unit and Base Map
  - Other efforts map at tract level or as grid
  - Intersect land use polygons with census blocks
  - Developing tract level method for areas with low quality land use data
- Scoring System – each polygon receives "points" related to indicators

Land Use – Focus screening on where people live

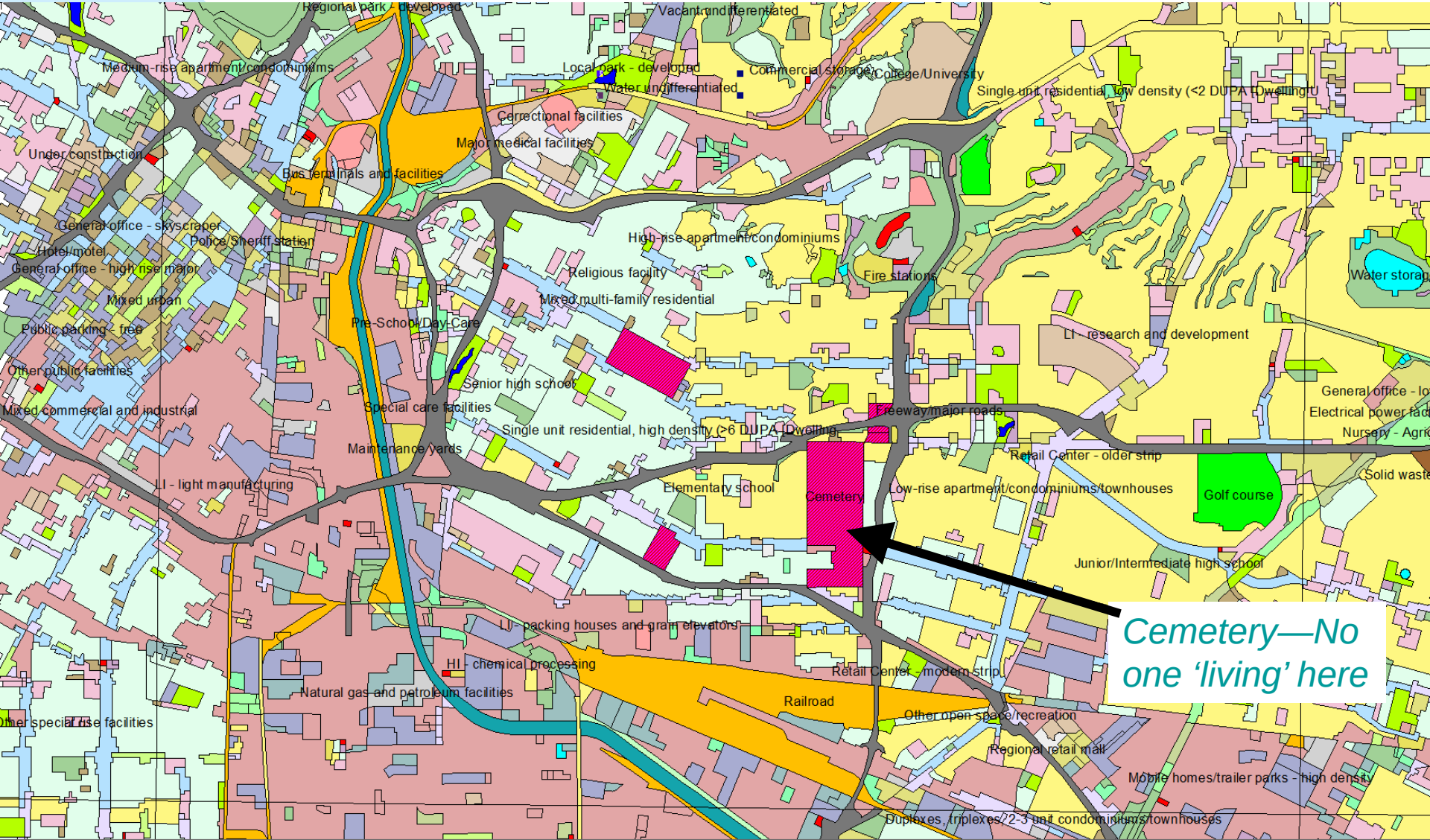
Dark Gray = Industrial, Transportation, etc.;

Light Gray = Open Space, Vacant, etc.

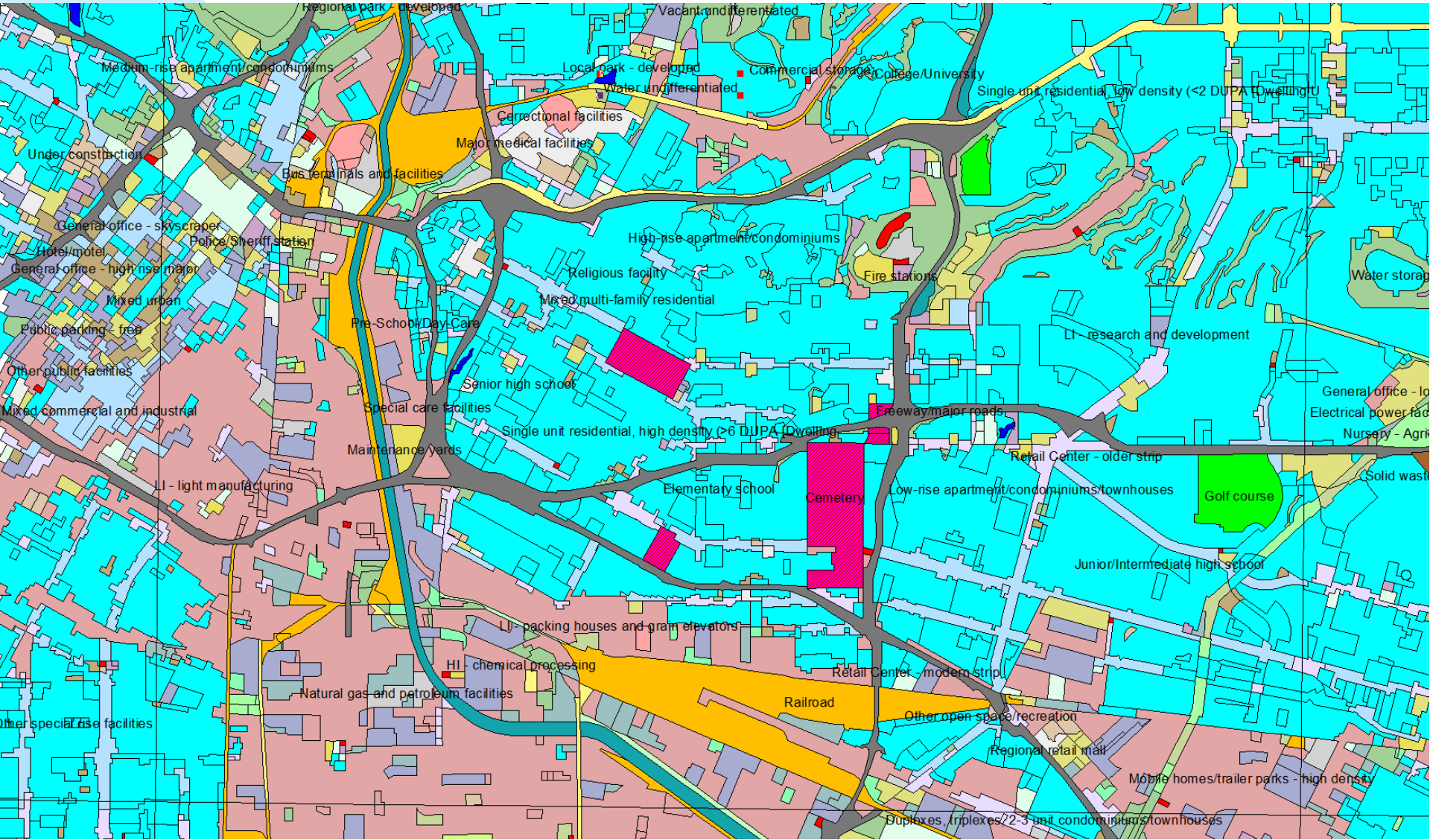
White = Residential and Sensitive Land Uses – only these areas are scored



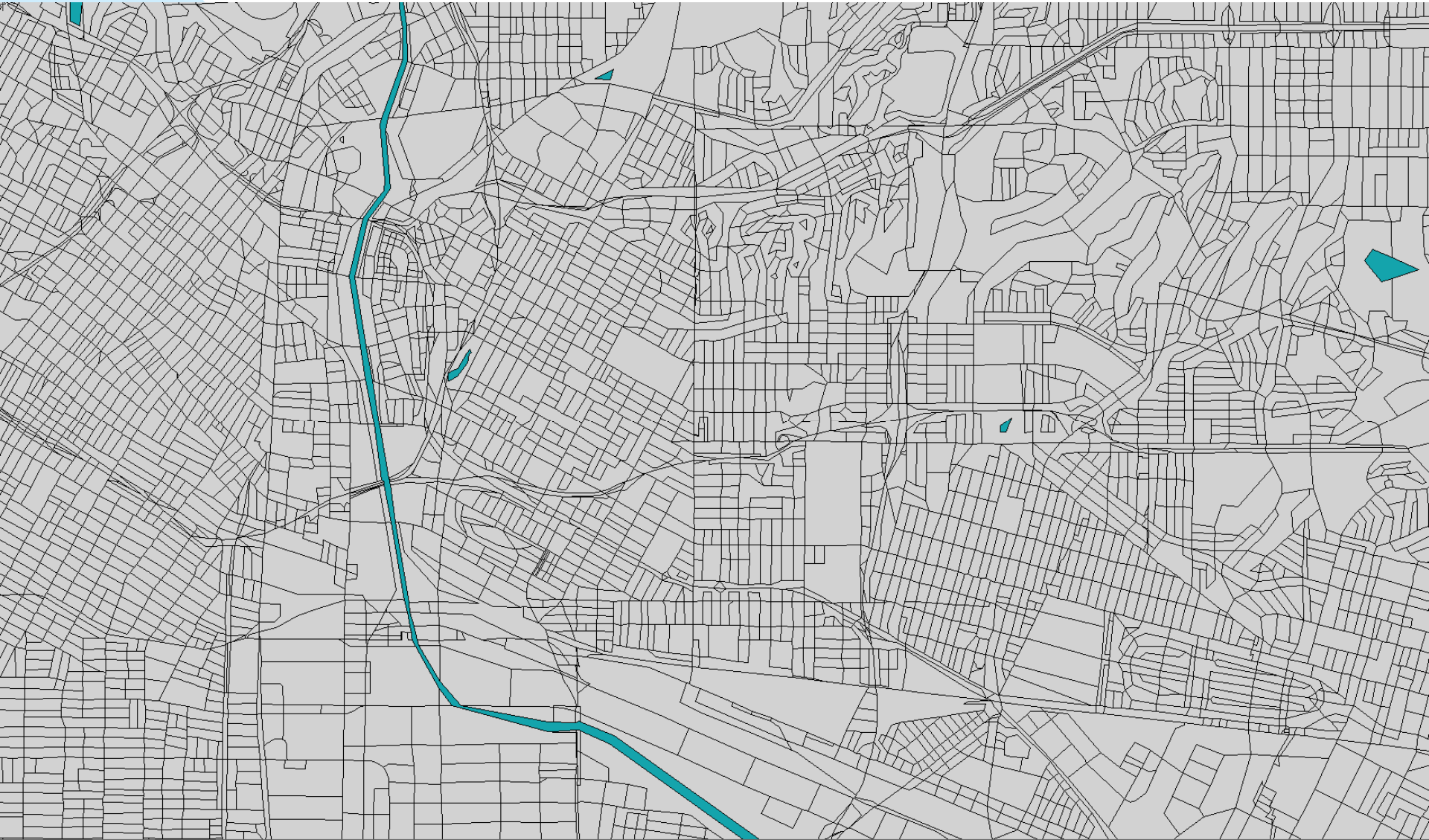
Southern California Assoc. of Governments (SCAG) 2005 Land Use Polygons



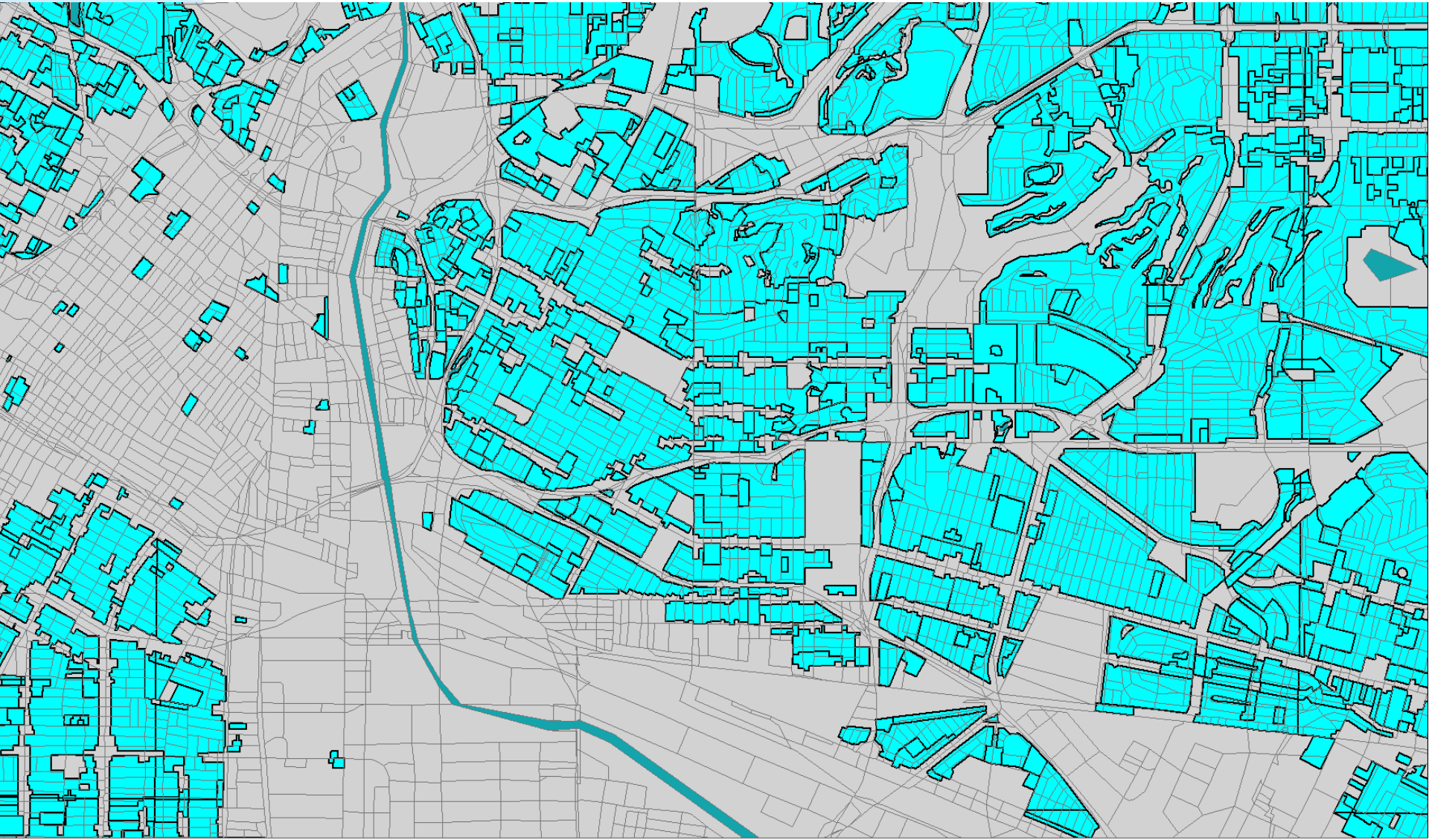
Select Residential & Sensitive Land Uses



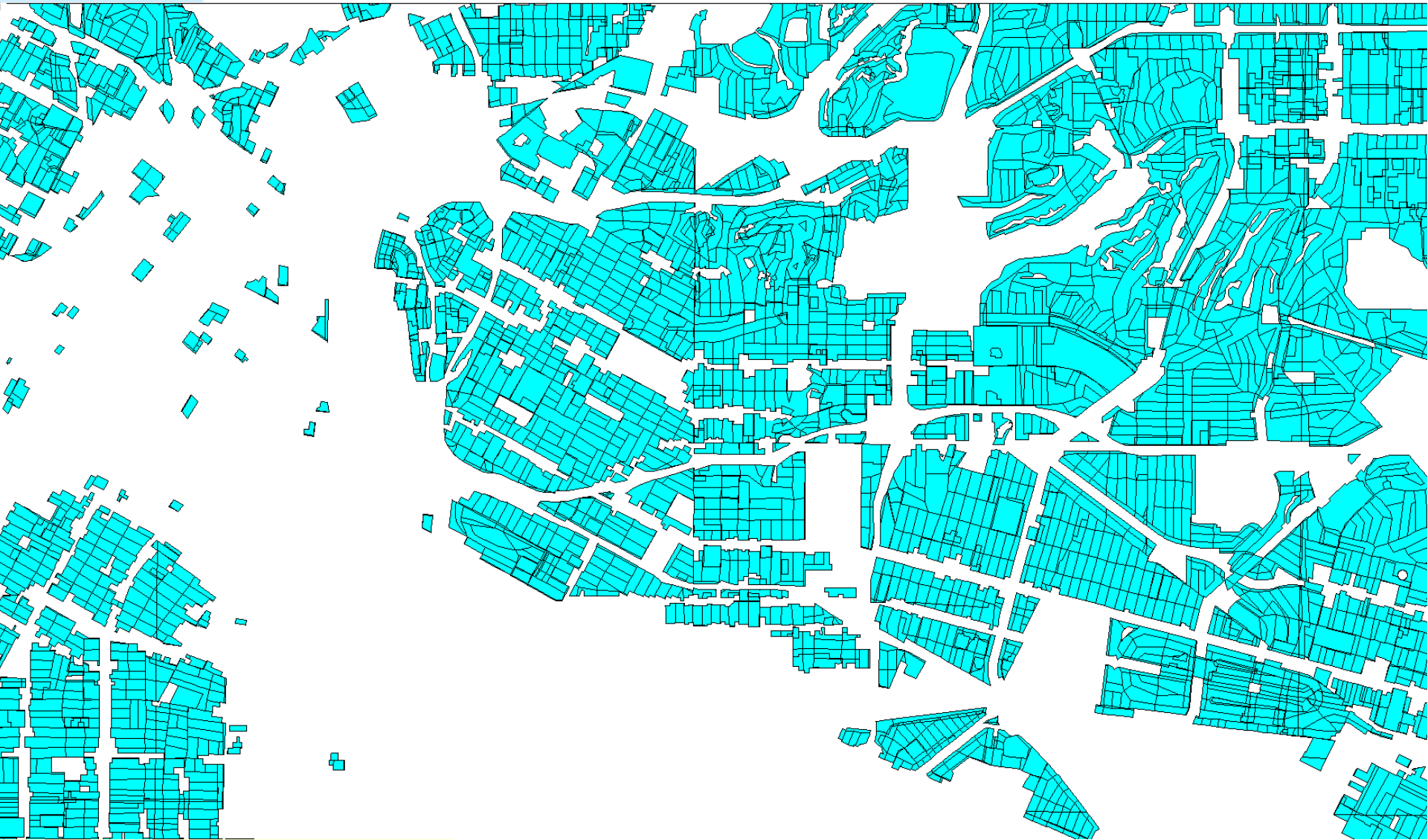
2000 Census Blocks



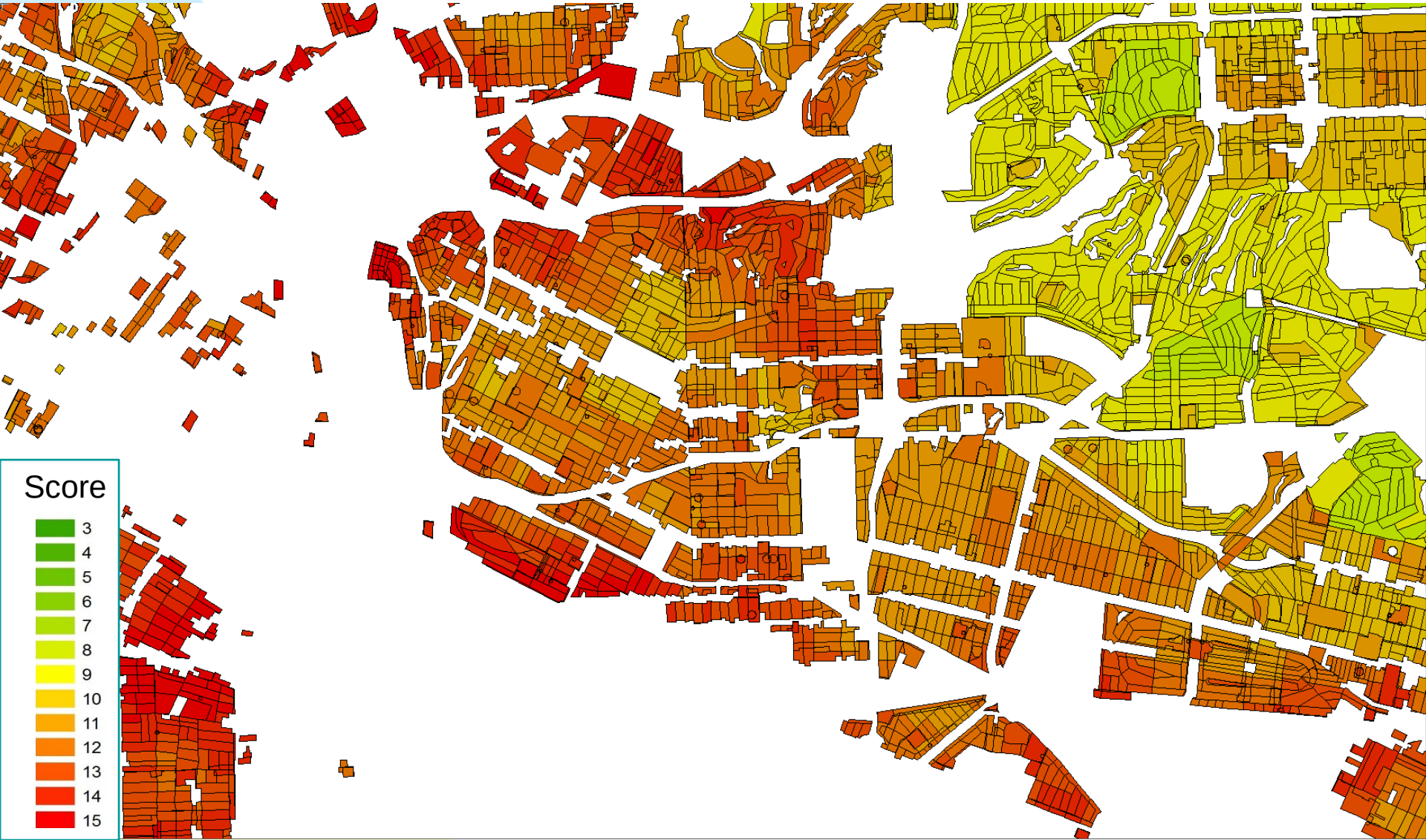
Intersect Land Use Polygons with Blocks



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



Each CI Polygon receives a Cumulative Impacts Score



Sensitive (Non-residential) Land Use

- 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*

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

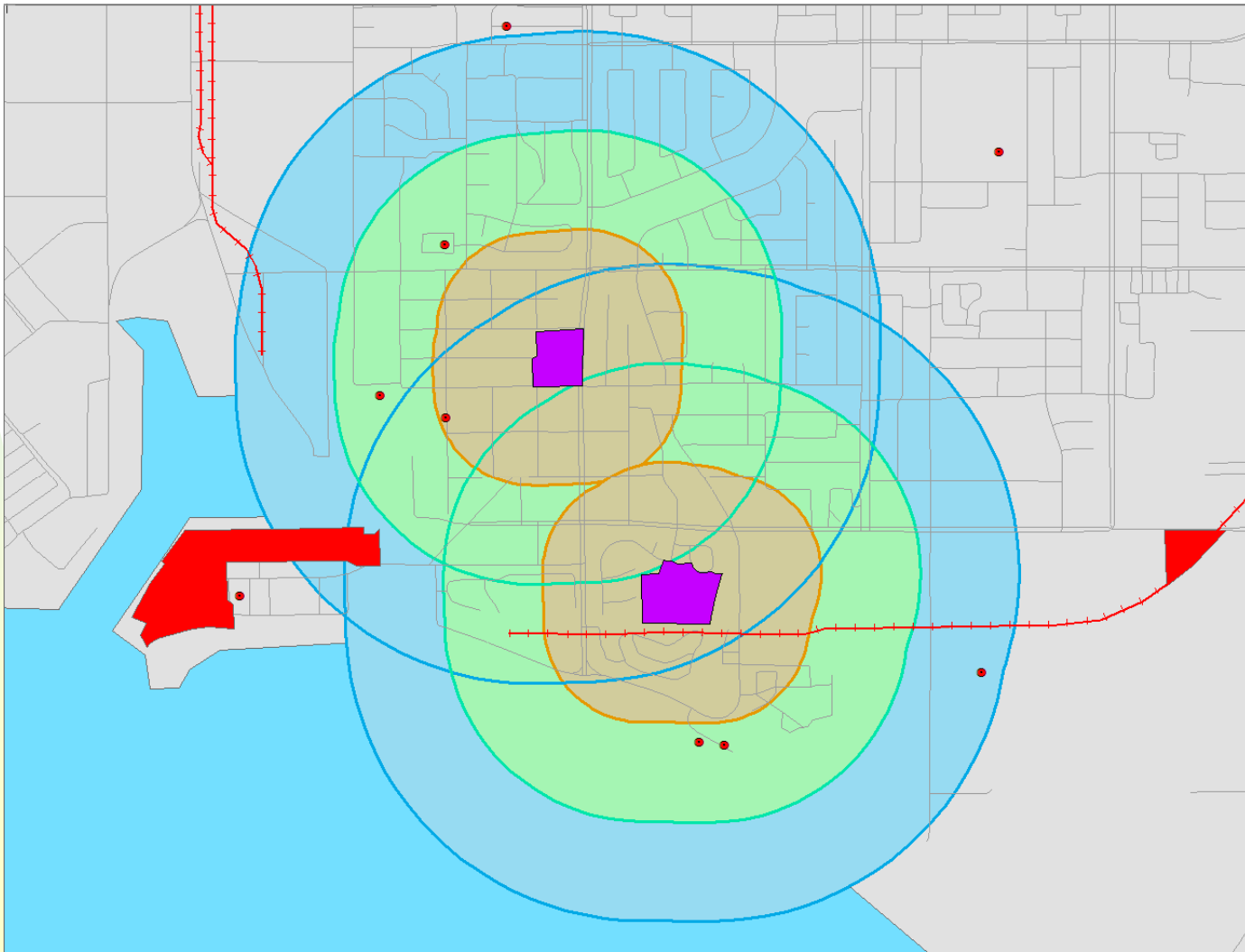
From ARB's "Air Quality and Land Use Handbook" (2005)

- *Number of sites within buffers of polygon edge is derived for each CI polygon*
  - *basic 1,000 ft approach*
  - *distance weighted approach*

Defining Proximity – Distance Buffers

1000-3000 Foot Buffers

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



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*

Defining Proximity – Distance Buffers

1000-3000 Foot Buffers, Distance Weighted Hazard Count

- Buffer CI polygon boundaries <u>at different distances</u>
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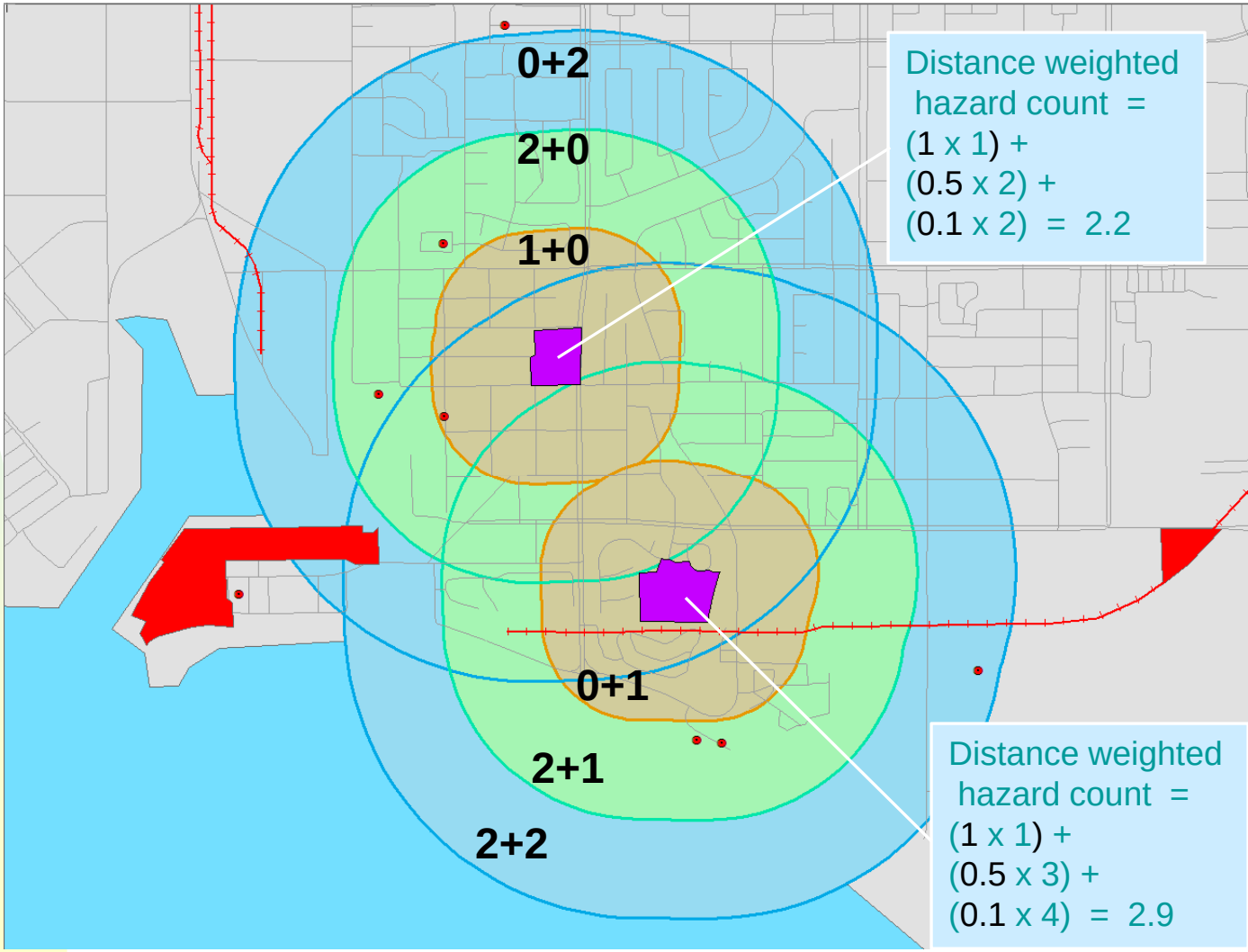
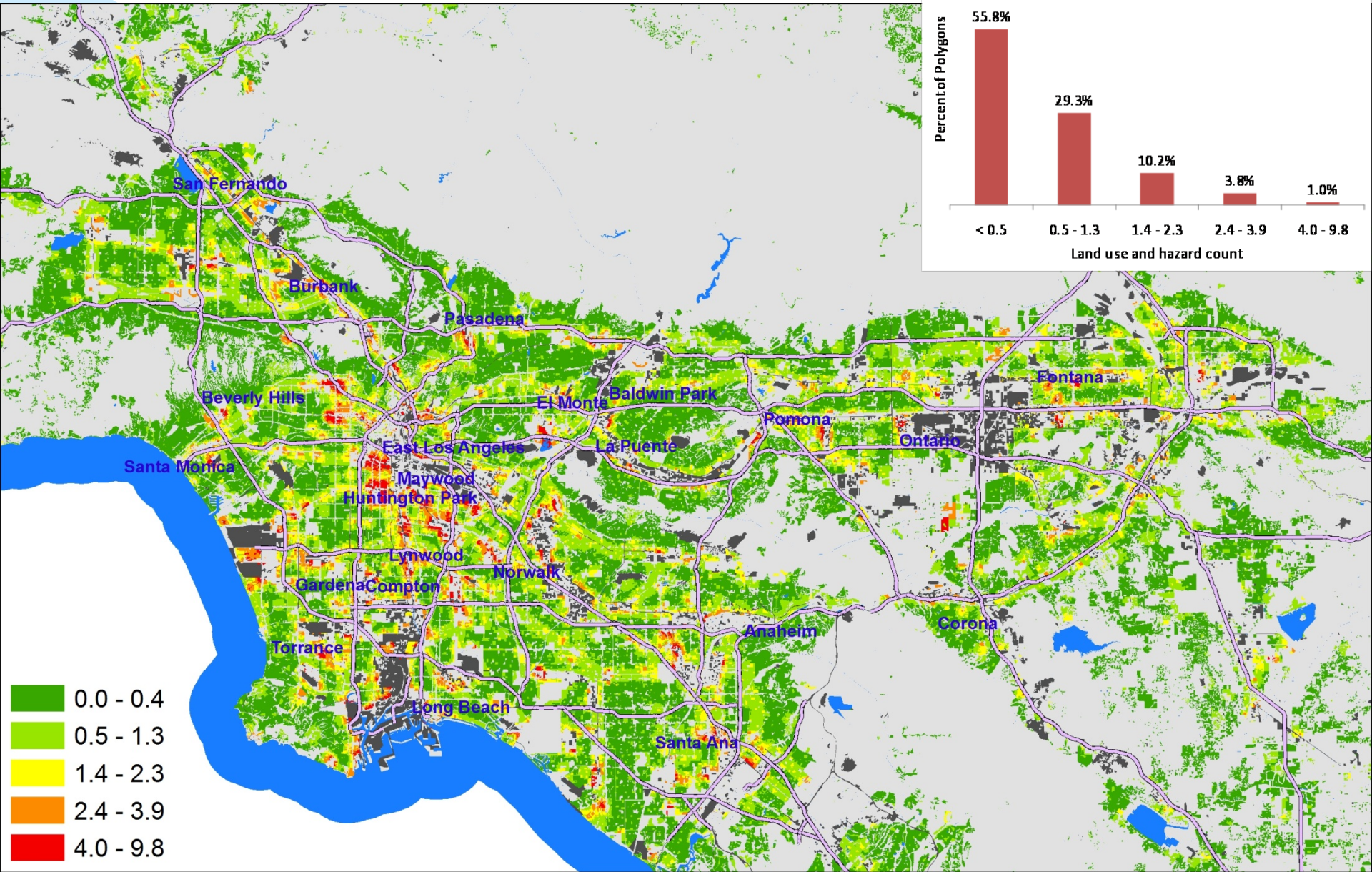


Distance weighted hazard count around CI Polygons **+ 1 if sensitive land use** (Jenks natural breaks)



Hazard Proximity & Sensitive Land Use Counts at 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

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

Hazard Proximity & Sensitive Land Use Scores at the Tract Level

- Finally, the tract-level hazard and sensitive land use counts are ranked into quintiles (1-5) across all tracts in the region to get the final hazard proximity and sensitive land use **score** at the tract level

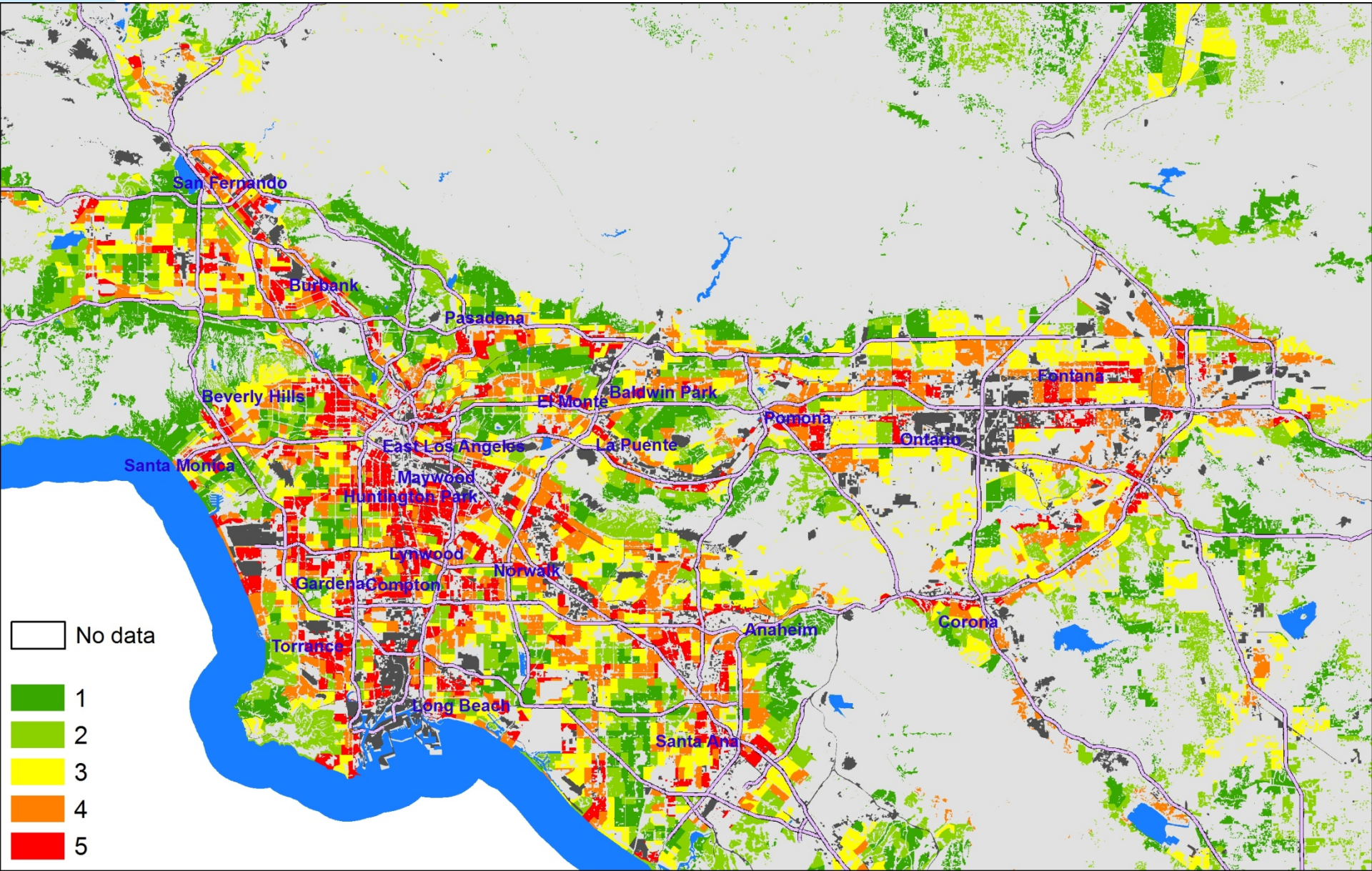
- Quintile distribution is used here and throughout the EJ Screening Method because it is an accessible and normal ranking procedure

  - No “right” distribution to follow (magnitudes of hazards unknown)

  - Other distributions could easily be applied

Hazard Proximity & Sensitive Land Use Score at the Tract Level

Mapped on CI Polygons (quintile distribution)



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

Health Risk & Exposure Scores
(Tract Level)

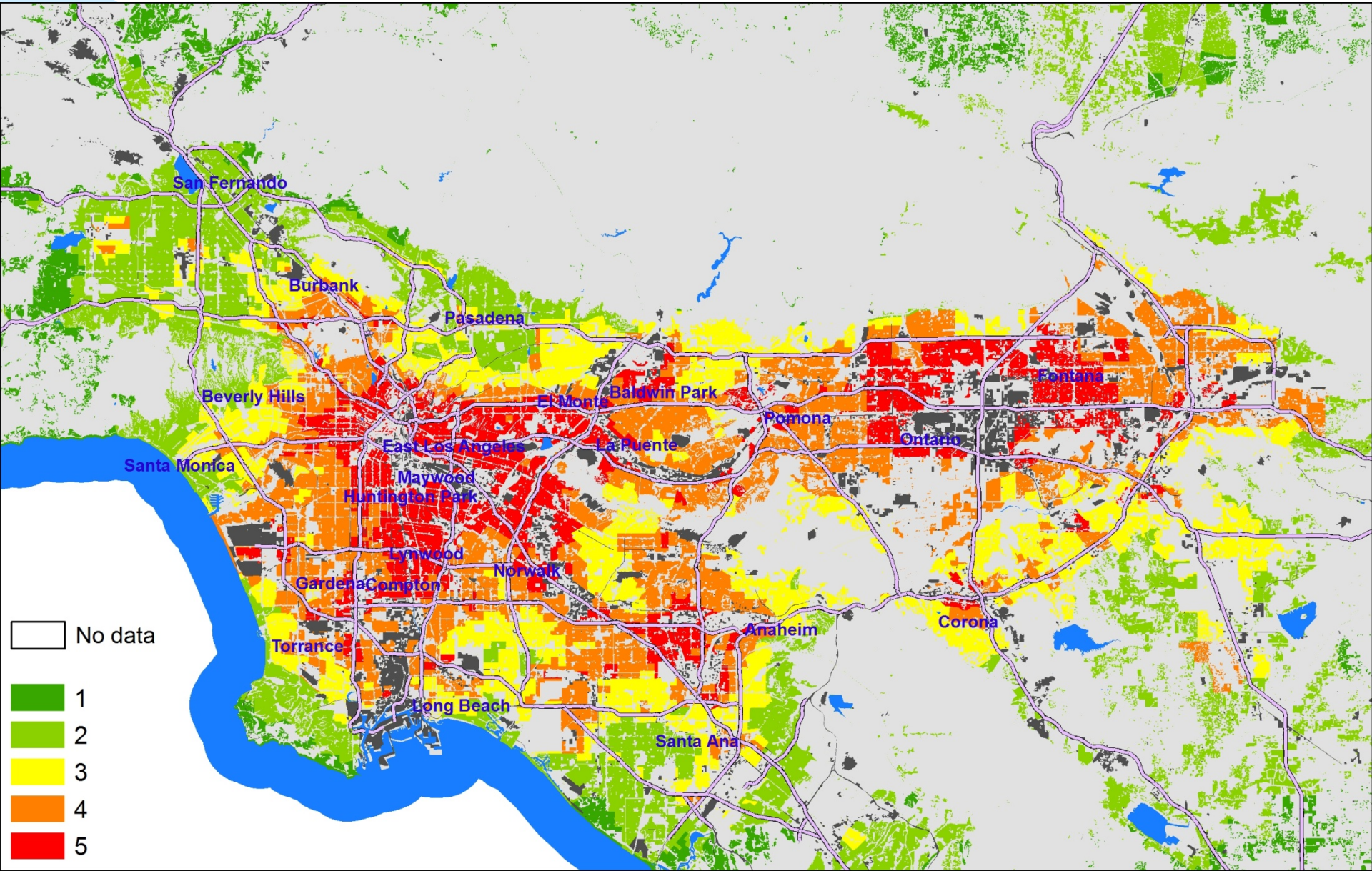
- Each health risk indicator is ranked into quintiles (1-5) across all tracts in the region

- 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

Health Risk & Exposure Score at the Tract Level

Mapped on CI Polygons (quintile distribution)



Social & Health Vulnerability Indicators

Census Tract Level Metrics (2000)

- % residents of color (non-White)
- % 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
- Age of residents (% <5)
- Age of residents (% >60)
- 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
- Birth outcomes – % preterm or SGA infants 1996-03

Social & Health Vulnerability Scores

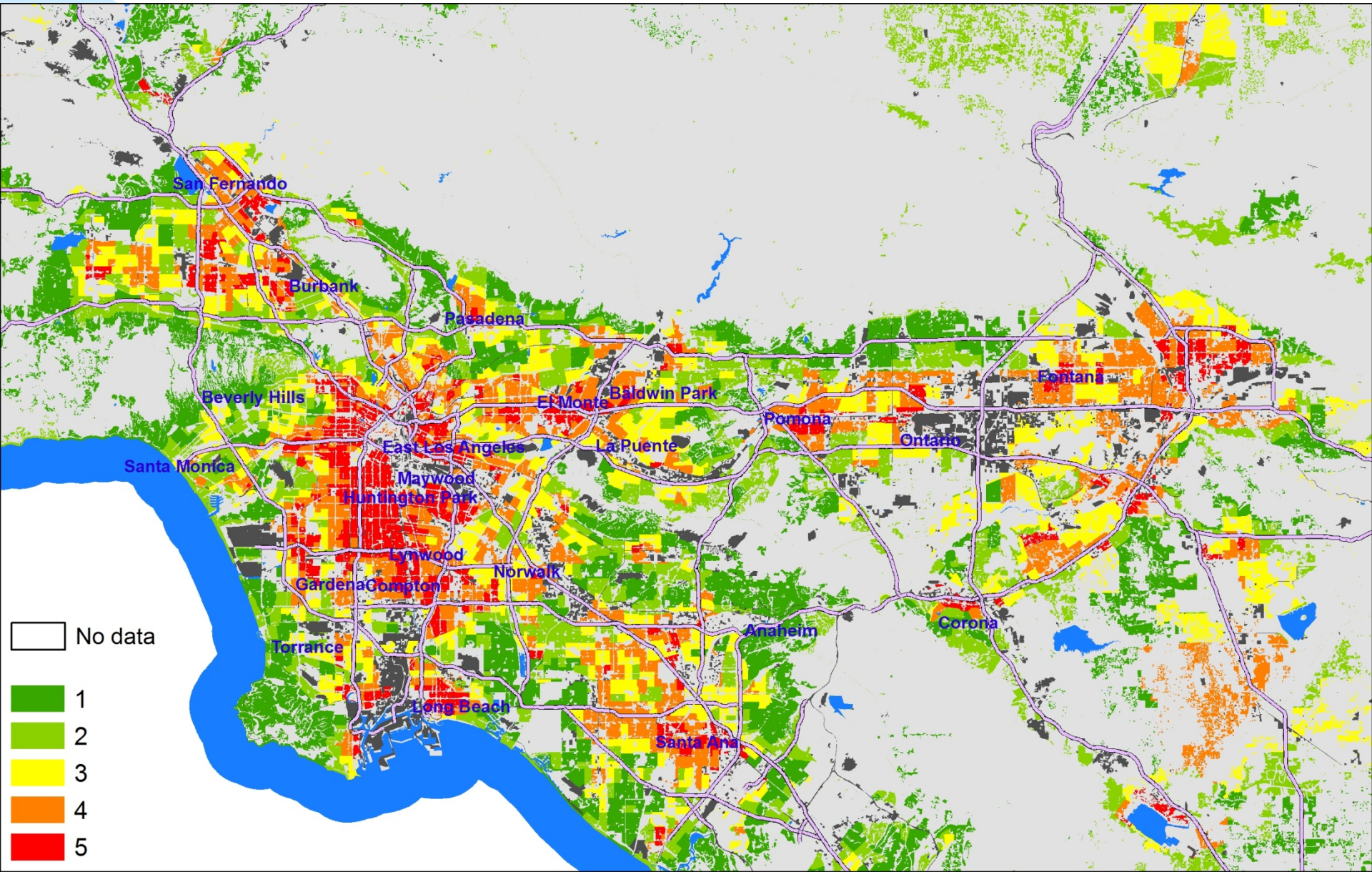
- Each social and health vulnerability metric is ranked into quintiles (1-5) across all tracts in the region

- Final score is derived by taking average ranking (across all metrics) for each tract, and ranking the average once again into quintiles (1-5)

A note on missing values:
To help ensure that the social and health vulnerability scores are reliable, we exclude tracts with less than 50 people, and those with 5 or more missing values among the 10 metrics considered. To account for missing values in tracts with 1 to 4 missing metrics, the average quintile ranking is taken across the non-missing metrics only.

Social Health & Vulnerability Score at the Tract Level

Mapped on CI Polygons (quintile distribution)



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) +

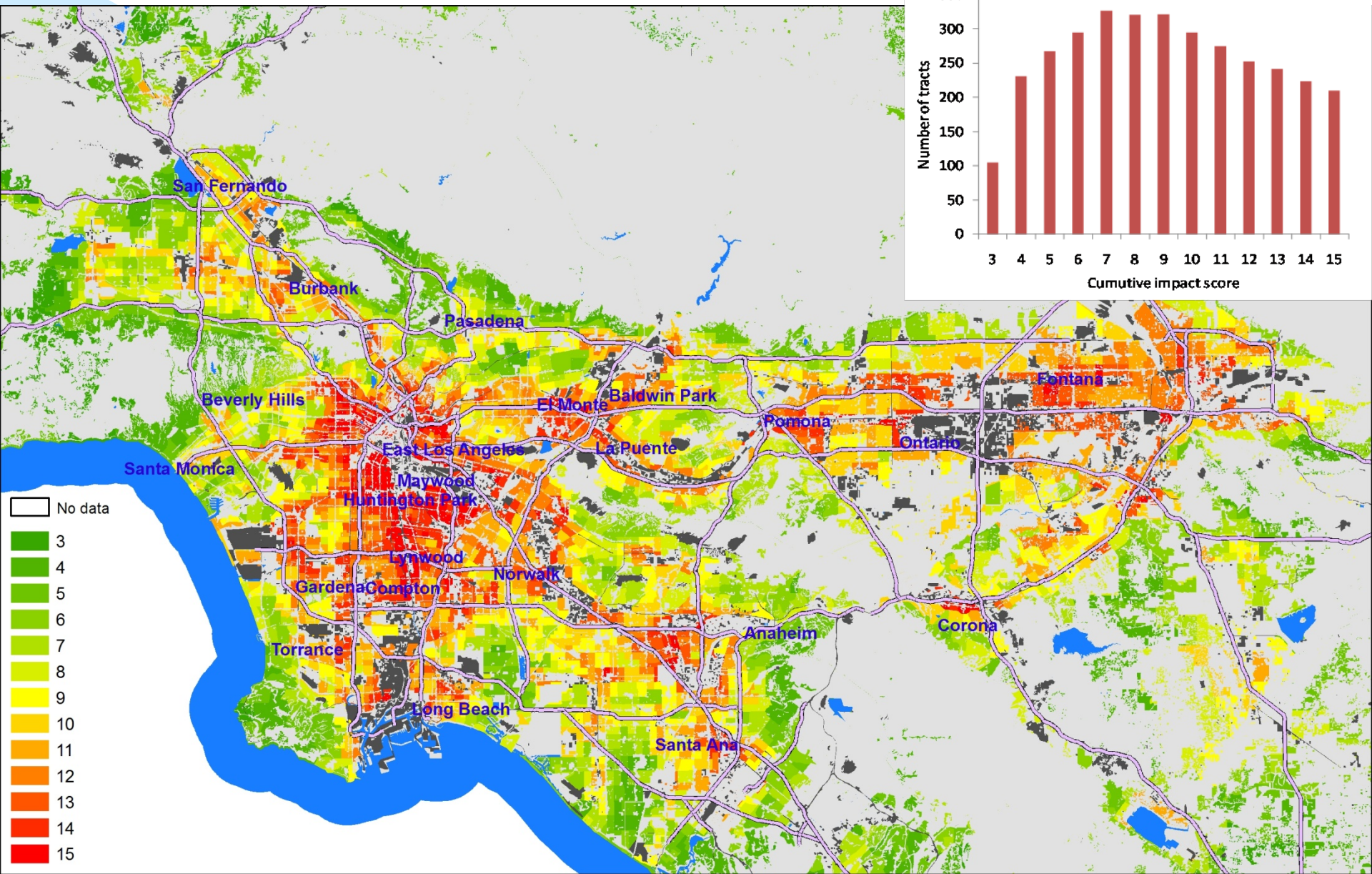
Health Risk and Exposure Score (1-5) +

Social and Health Vulnerability Score (1-5)

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

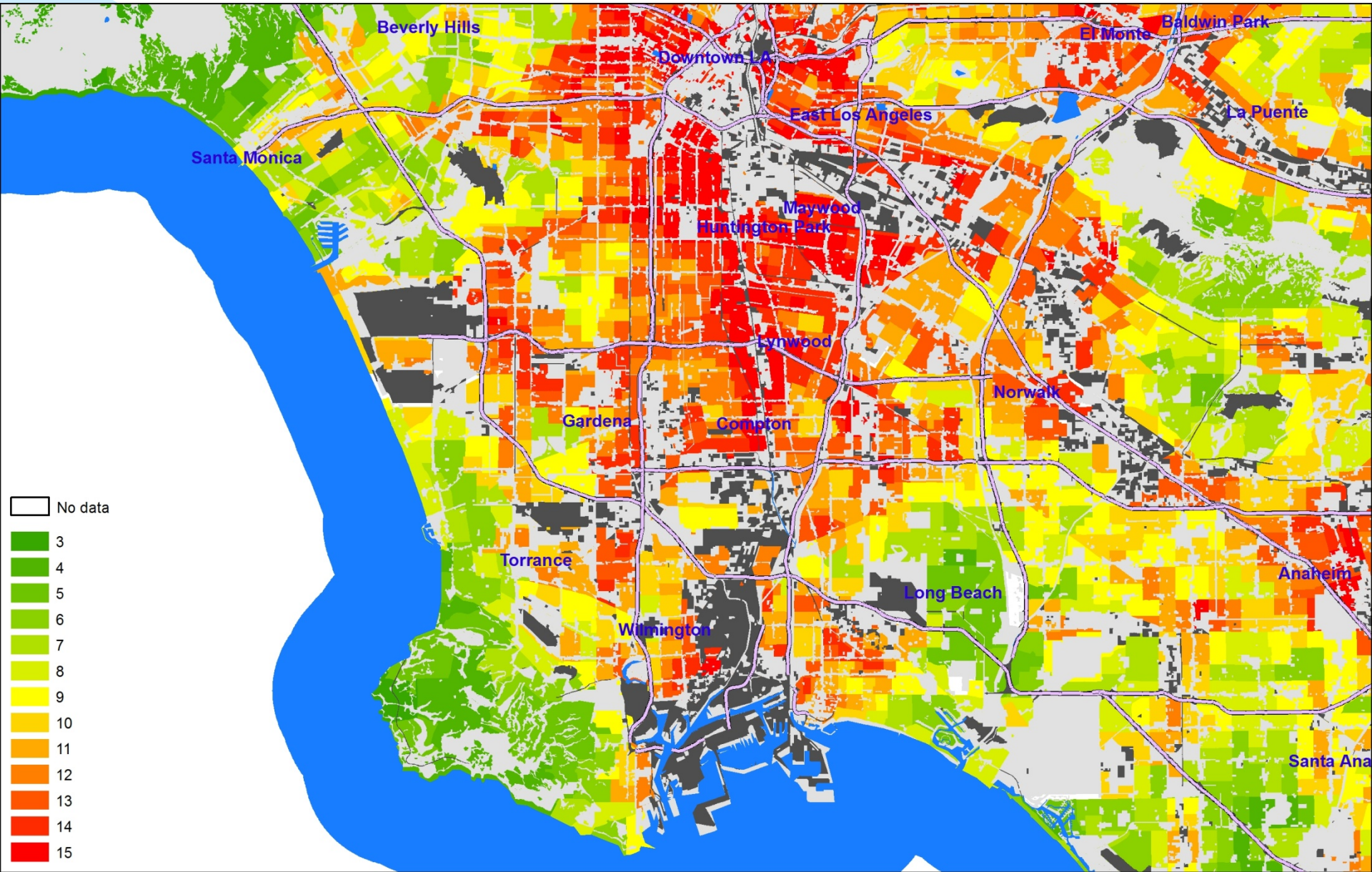
Tract Level Cumulative Impact Score

Distance weighted hazard proximity, mapped on CI Polygons



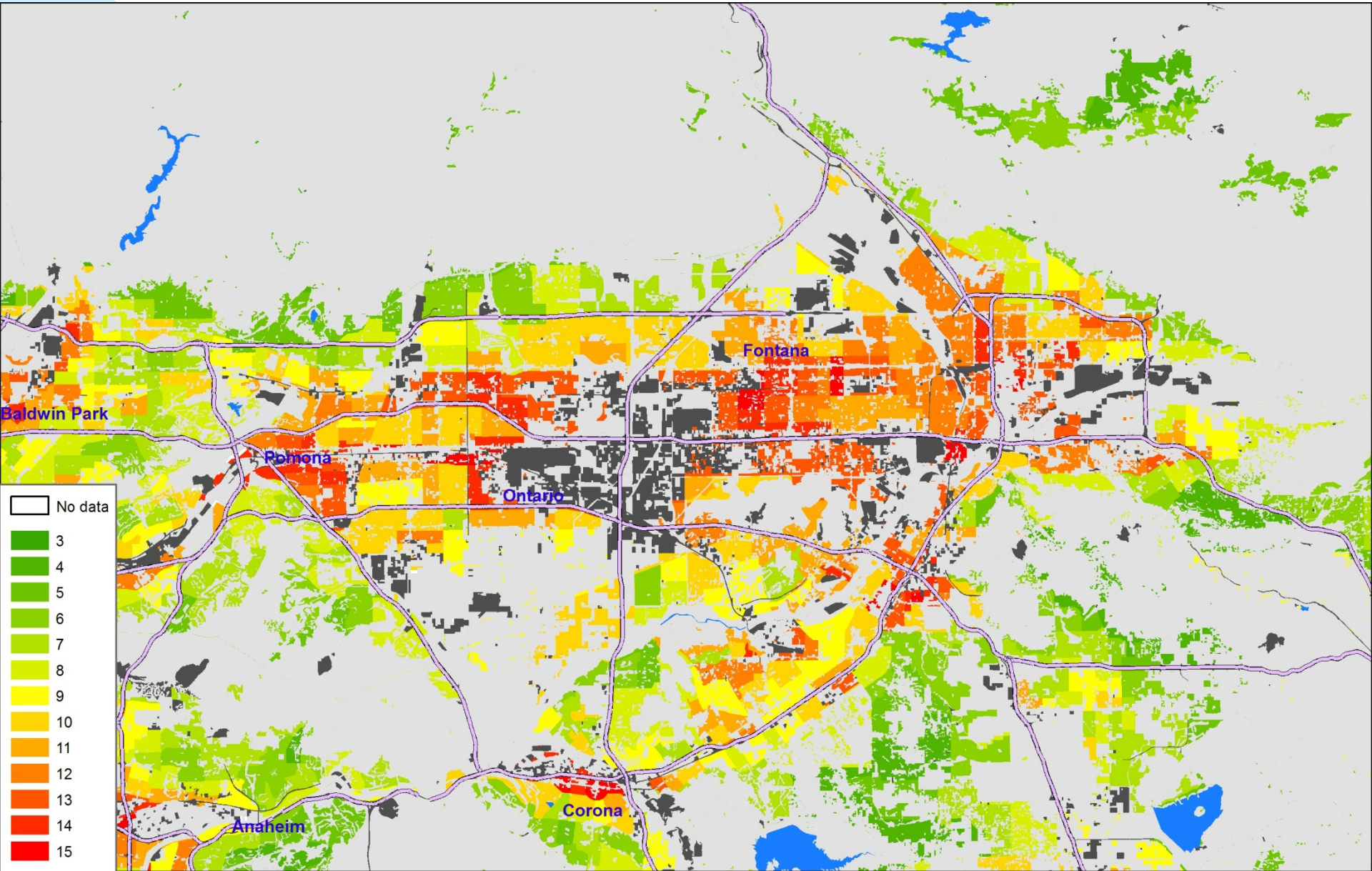
Tract Level Cumulative Impact Score – South LA Area

Distance weighted hazard proximity, mapped on CI Polygons



Tract Level Cumulative Impact Score – Inland Empire

Distance weighted hazard proximity, mapped on CI Polygons



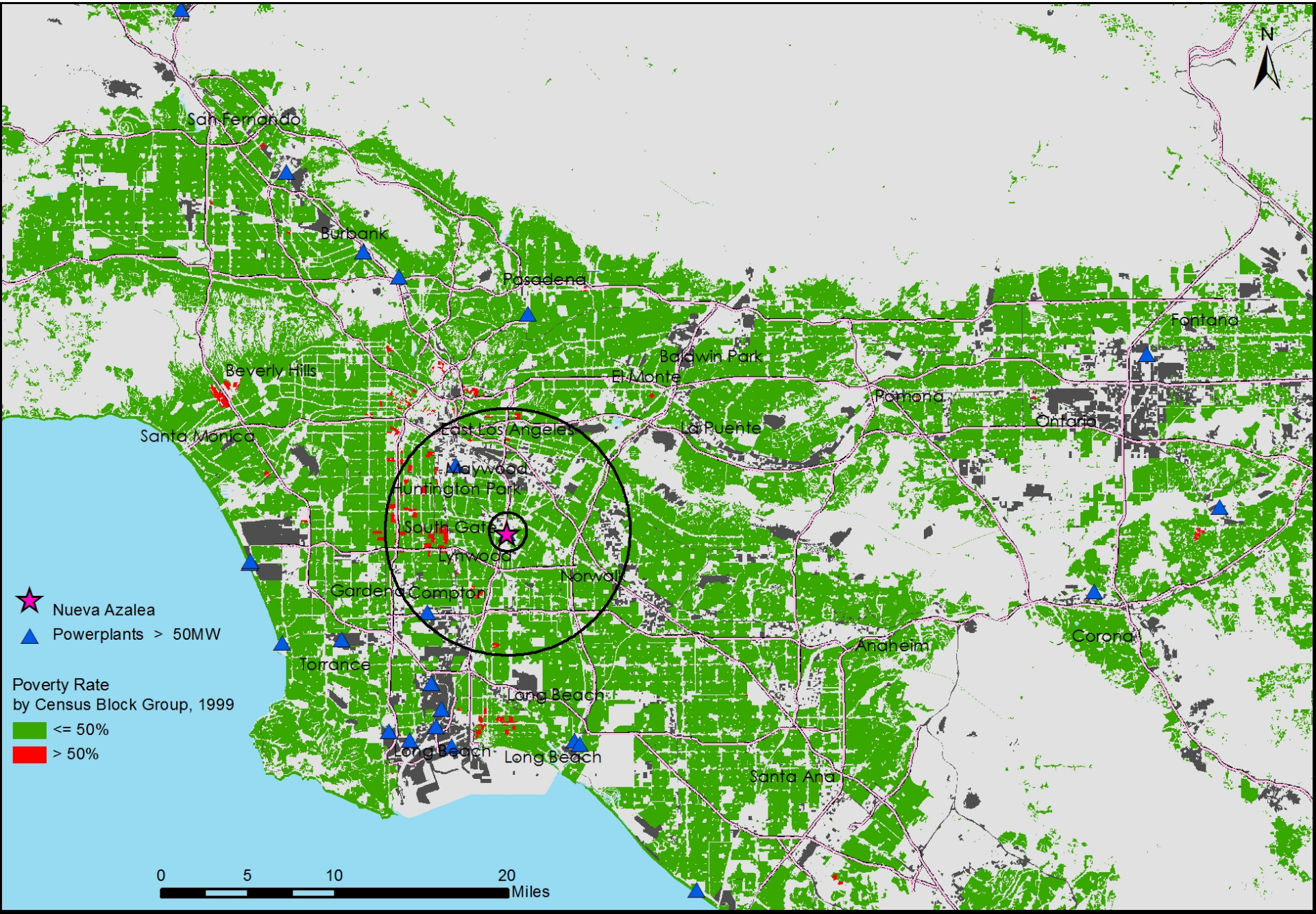
How Is This Different?

- Consider the Nueva Azalea plant which was proposed in 2000 by Sunlaw Energy Corp.
- City of Southgate, 8 miles SE of downtown LA
- Support from some environmentalists and labor unions
  - Cleaner technology; jobs
- Local opposition from mayor and community organizations
  - Additional source of pollution in an already overburdened neighborhood
- Voted down in referendum; project withdrawn

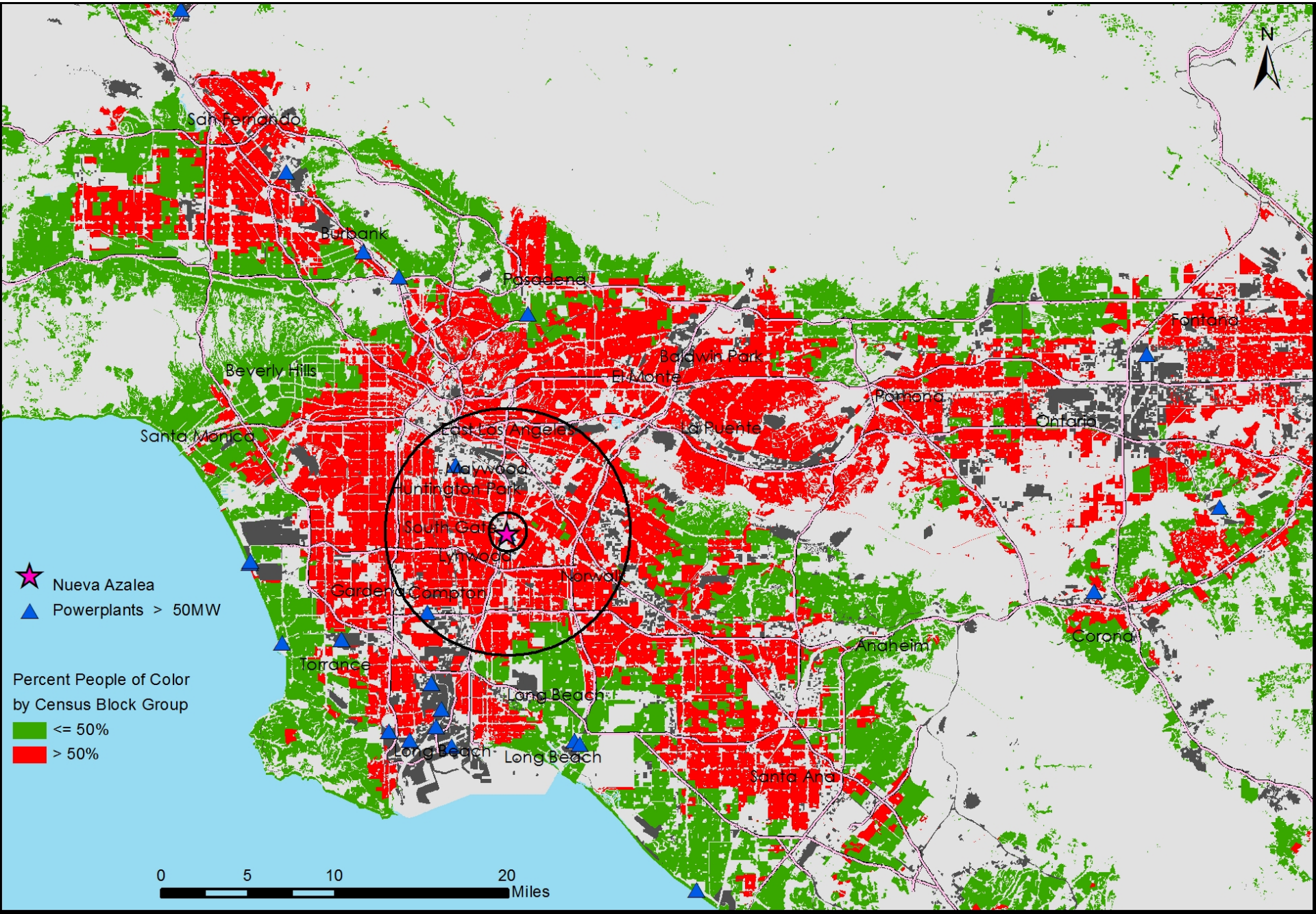
CEC EJ Analysis

- Follows US EPA guidance
- Demographic Screen
  - Uses EPA definition of EJ community
  - Blocks >50% “minority” or “low income”
  - 1 and 6 mile buffers; centroid capture
- Public Outreach
  - Dissemination of information on proposed project
- Impact Assessment
  - Analysis of “unique circumstances”
  - Identify project’s cumulative impacts
  - Recommendations for mitigations

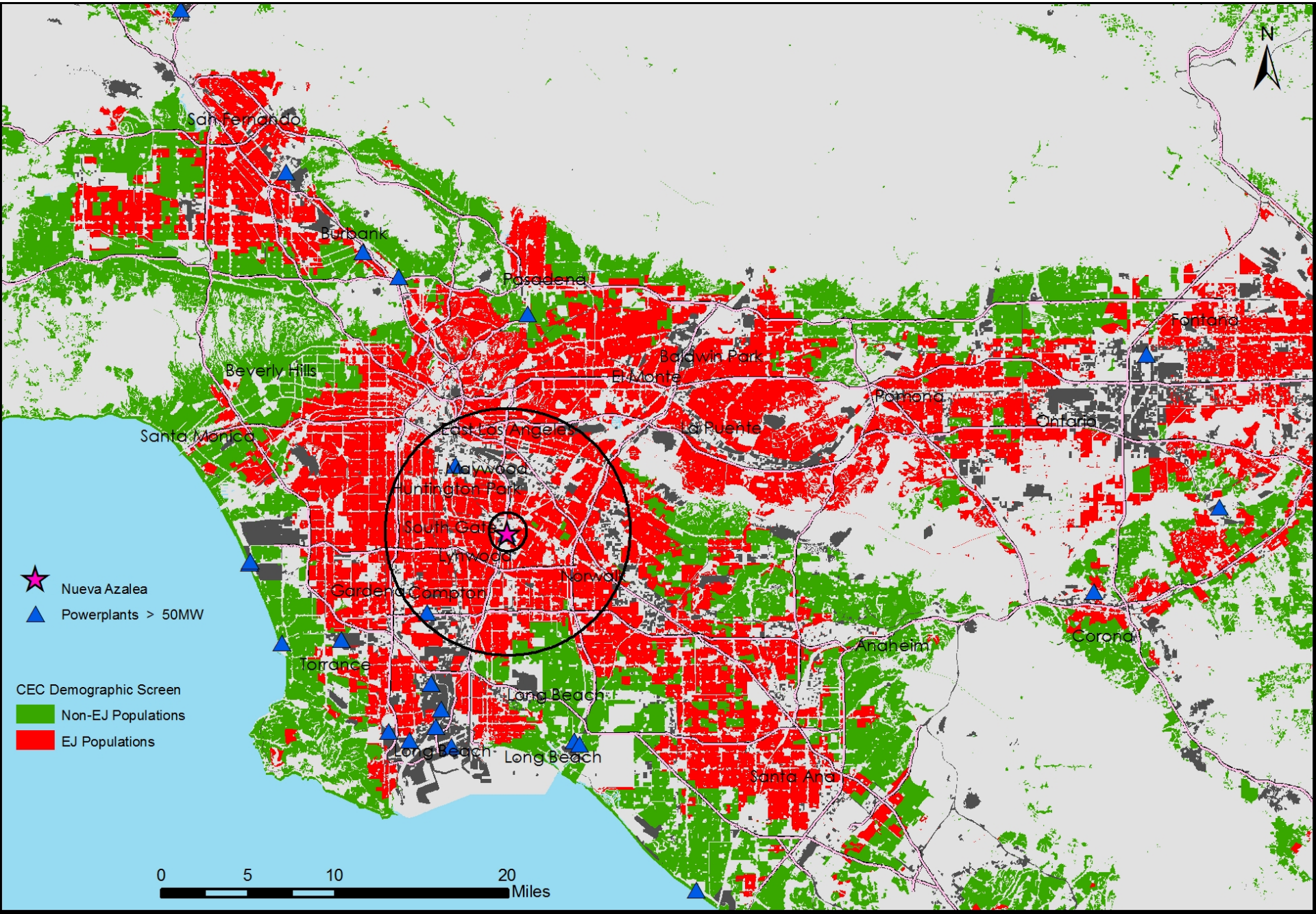
CEC EJ Demographic Screen



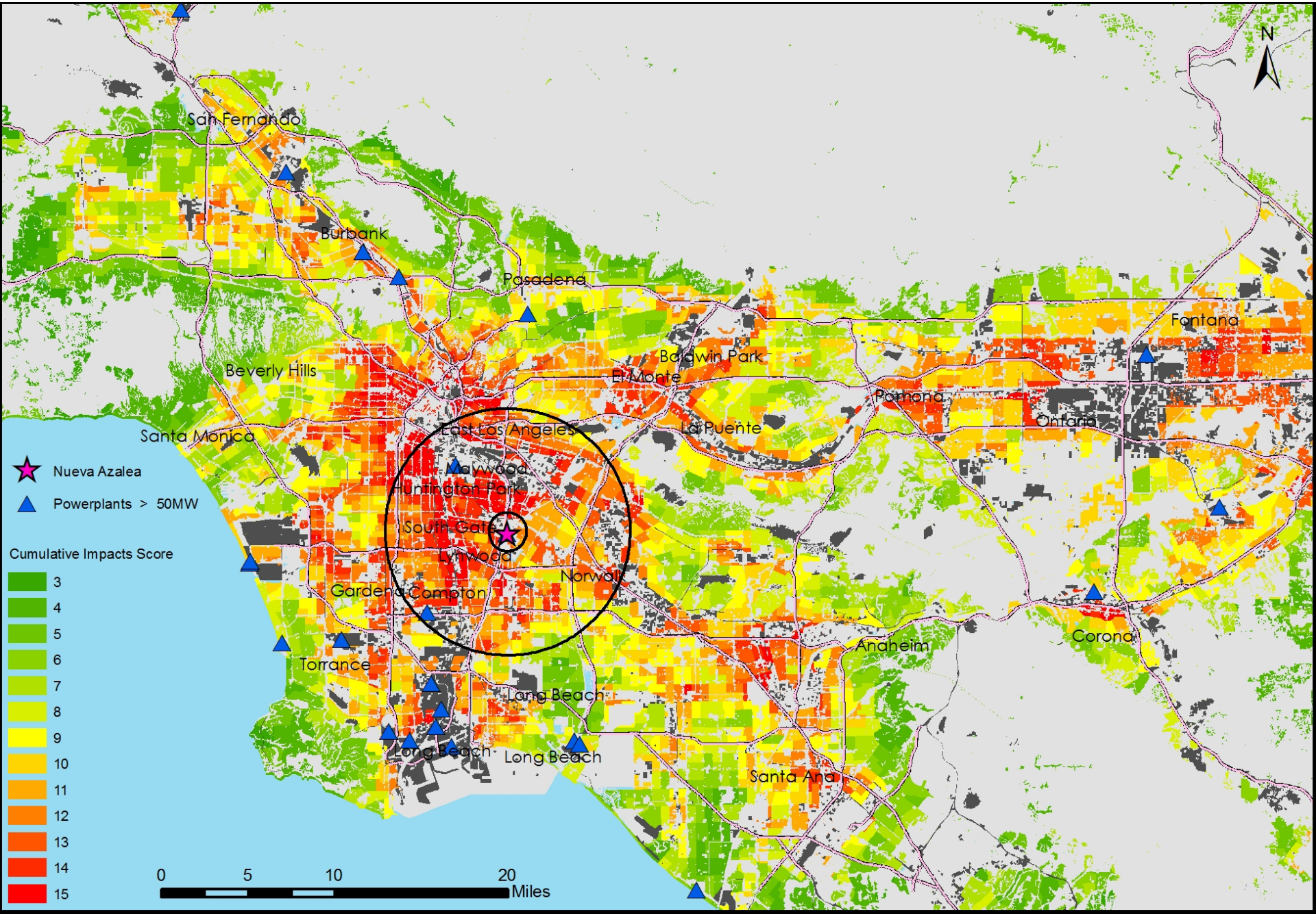
CEC EJ Demographic Screen



CEC EJ Demographic Screen



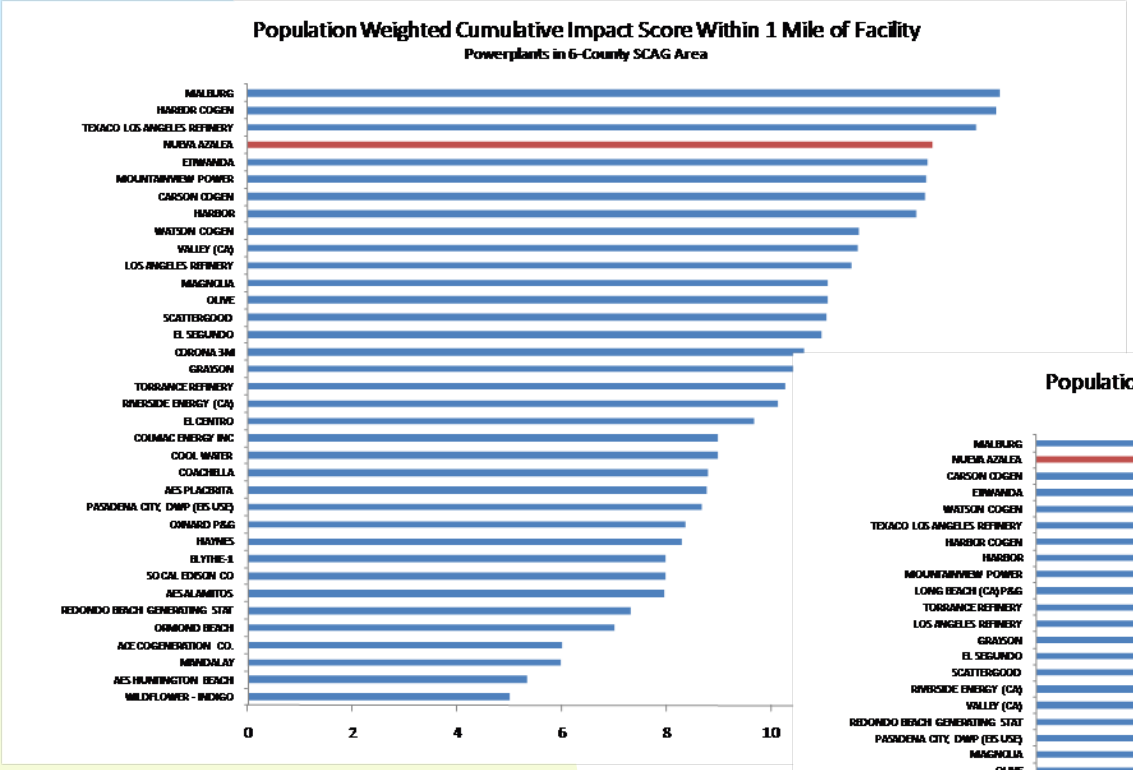
The EJ Screening Method

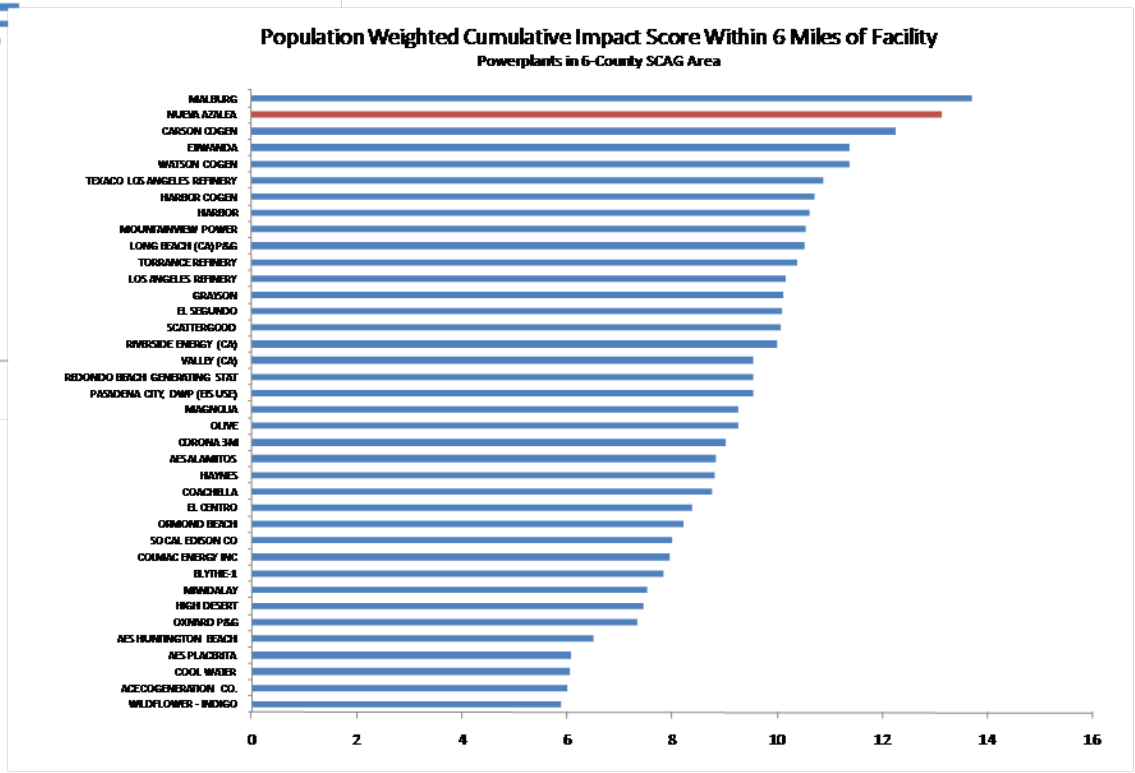


Comparison of
EJ Screening Method vs. CEC screen

- CEC Method also suggests that Nueva Azalea was in is an EJ area but so is virtually everywhere in Southern Cal.
- EJSM: very high CI scores surrounding NA site
  - population-weighted average CI score within 1- and 6-mile buffers
  - Nueva Azalea among highest CI in the region
    - Malberg (city of Vernon) powerplant also has very high CI scores - community opposition led to recent withdrawal of new facility
    - 1-mile NA site to be near the middle regionally.

Average CI Scores Surrounding Powerplants Population-weighted

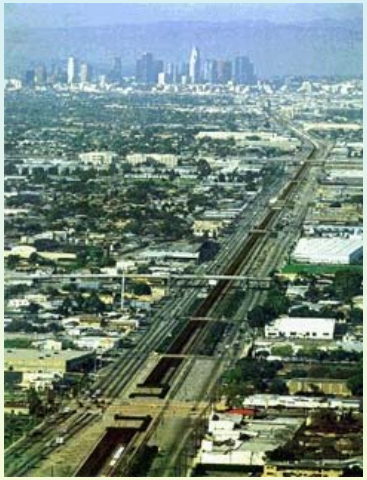


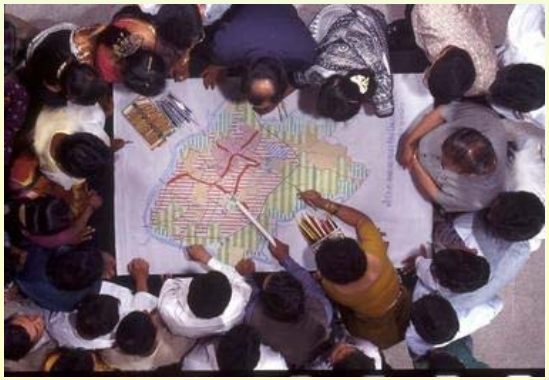


Important Caveats

- Recall that 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
    - So-Cal – good quality land use data
    - Central Valley – lower quality land use data
  - *This is screening not assessment, so neighborhood monitoring and ground truth verification is needed.*

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)