

I-710 Freeway & Schools in Geographic Context:

A spatial analysis on a major freight corridor and its impact on academic performance of schools in its vicinity

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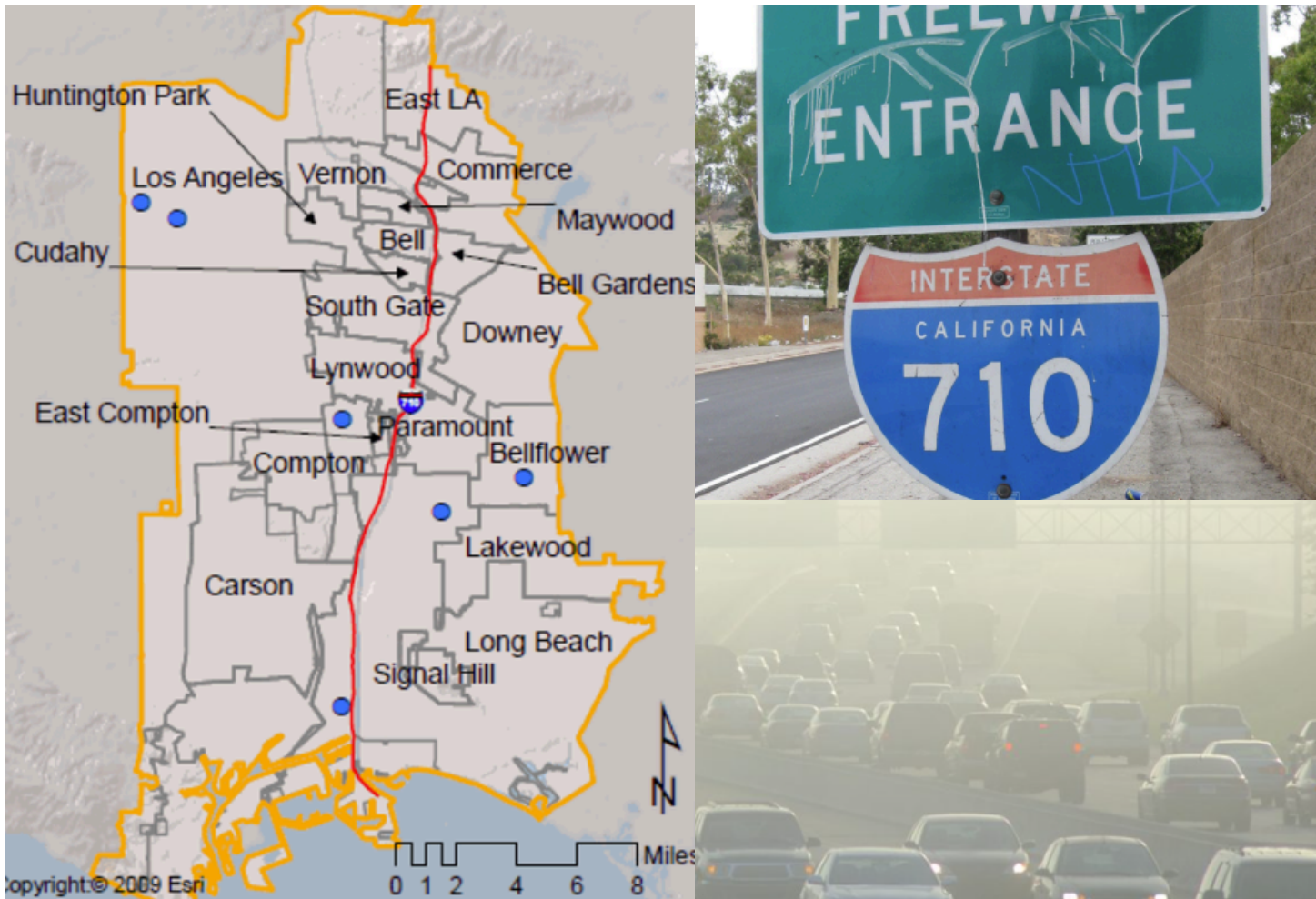
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INTRODUCTION

- Examined the relationship between PM_{2.5} exposure near the I-710 freeway and academic performance among K–12 students in Southeast Los Angeles.
- Used a quantitative, cross-sectional research design.
- Conducted spatial analysis using secondary data sources.
- Data sources included SCAG, EJScreen, CalEnviroScreen, the American Community Survey (ACS), and other GIS datasets.
- Schools located within a one-mile buffer of the I-710 freeway experienced higher levels of PM_{2.5} exposure.
- Schools within the one-mile buffer demonstrated lower academic performance than schools located farther from the freeway.
- The association between PM_{2.5} exposure and lower academic performance remained significant after controlling for socioeconomic factors.
- Findings highlight environmental justice concerns affecting disadvantaged communities located near major transportation corridors.



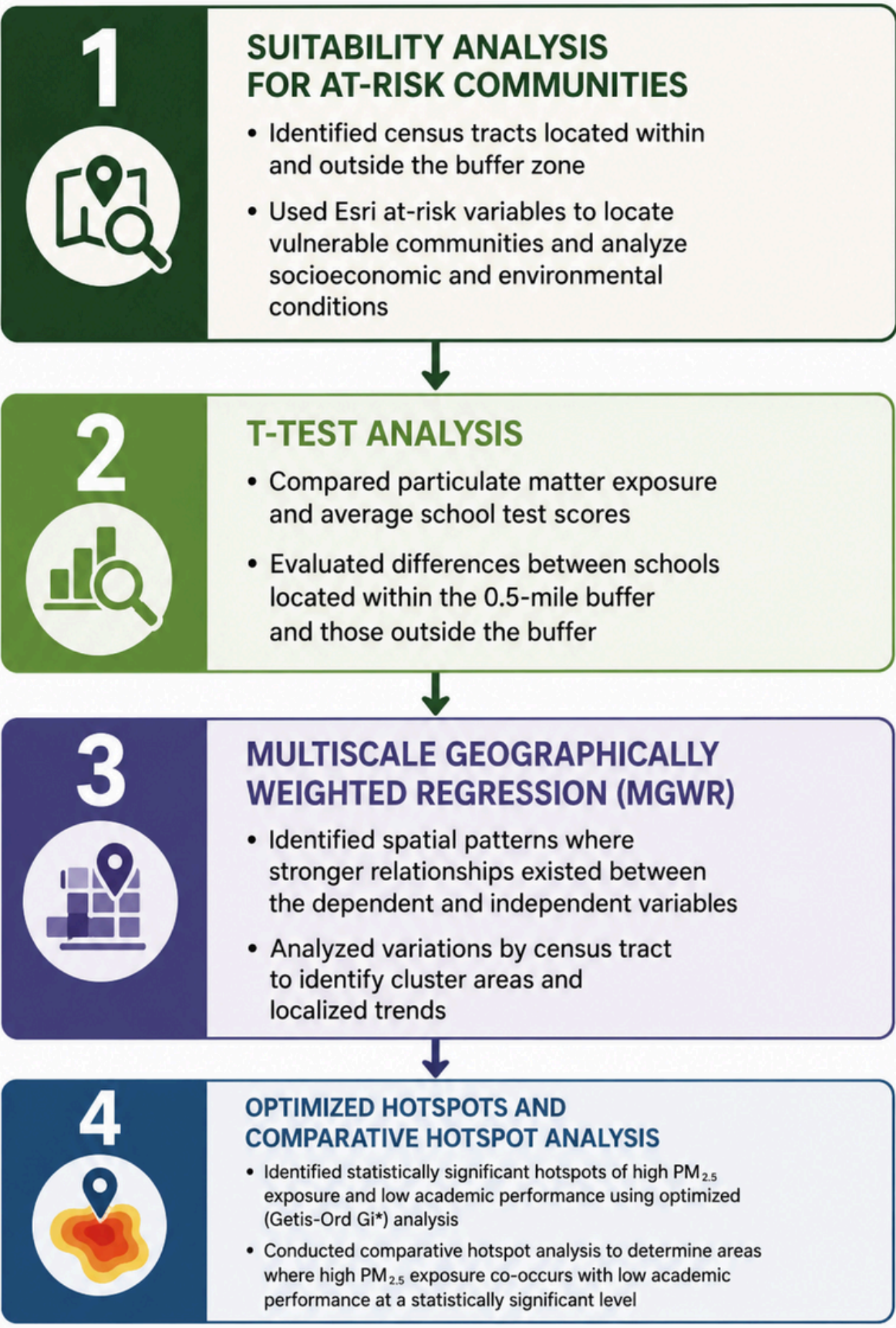
METHODOLOGY

QUANTITATIVE AND GEOSPATIAL ANALYSIS

Data Integration
This study uses secondary datasets from CalEnviroScreen 4.0, ACS 2024, ESRI, EJScreen, and SCAG to evaluate environmental and socioeconomic conditions. ESRI at-risk indicators were used to identify census tracts experiencing higher environmental and social burdens.

Spatial Analysis
GIS technology was used to measure distances between census tracts and the I-710 freeway, evaluate PM_{2.5} exposure, and compare school performance outcomes. Census tracts within the one-mile radius were classified as the “exposure area,” while tracts outside the radius were classified as the “control area.”

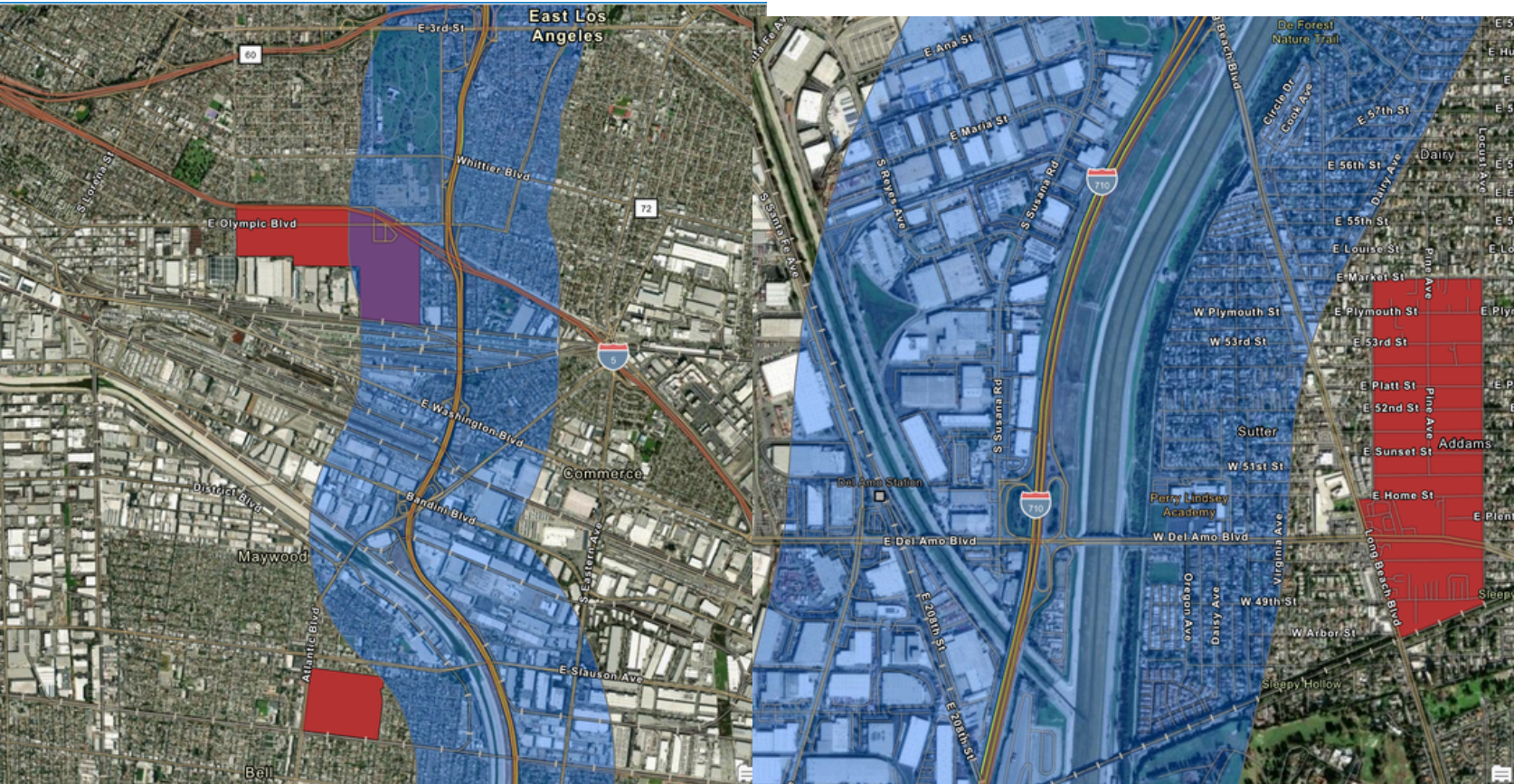
Workflow:



Data Analysis
Suitability Final Scores were determined by:

(Value of A * Weight of A) + (Value of B * Weight of B) + (Value of C * Weight of C)

T-Test for particulate matter and average school score for those within the half mile buffer and those outside of it suitability analysis using at risk variables, data provided Esri and locate vulnerable community



These are results of a ranking of the top 10 most socioeconomically vulnerable census tracts along the I-710 freeway

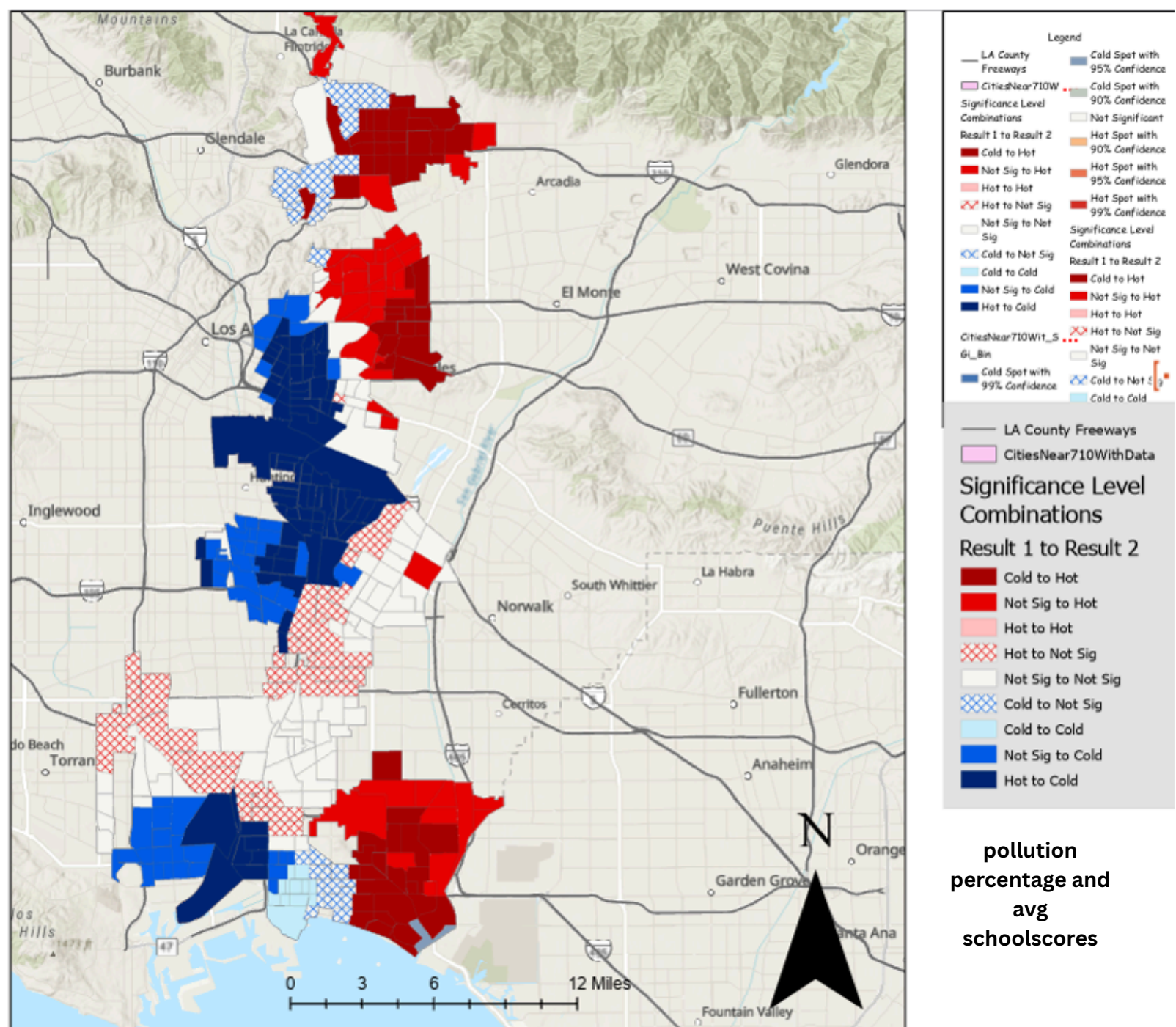
RESEARCH QUESTION

Are average school test scores impacted by proximity to a major freight corridor like the I-710 and its emmissions?

KEY FINDINGS

Y-axis variable	X-axis variable	Direction	R ²	Strength
asthmaP	AvgSchoolScore	Negative	0.36	Moderate-strong
povP	AvgSchoolScore	Negative	0.31	Moderate
leadP	AvgSchoolScore	Negative	0.23	Weak-moderate
pmP	AvgSchoolScore	Negative	0.14	Weak

- Asthma prevalence and poverty exhibited the strongest explanatory power ($R^2 = 0.36$ and 0.31 , respectively), suggesting that underlying health and socioeconomic conditions were more closely associated with academic performance than direct pollution measures alone. This indicates that educational outcomes are shaped by the cumulative effects of environmental exposure and social vulnerability rather than by a single factor.
- Lead burden and PM_{2.5} exposure showed weaker, yet consistently negative relationships with average school scores ($R^2 = 0.23$ and 0.14), implying that air pollution may influence student performance indirectly through health pathways such as respiratory illness, absenteeism, and cognitive impairment. Together, these findings suggest that communities facing multiple environmental and socioeconomic stressors experience compounded disadvantages that are reflected in lower academic achievement.



Comparison of Standardized Academic Test Scores

Statistic	Schools Not Within 0.5 Miles (n = 277)	Schools Within 0.5 Miles (n = 112)
Mean	45.20	37.10
Variance	676.60	334.32
Pooled Variance	578.41	
Hypothesized Mean Difference	0	
Degrees of Freedom (df)	387	
t Statistic	3.08	
PT(tst) One-Tail	0.0014	
t Critical One-Tail	1.649	
PT(tst) Two-Tail	0.0028	
t Critical Two-Tail	1.966	

Descriptive Statistics Summary

Statistic	Value
Mean	75.06
Standard Error	0.54
Median	77.72
Mode	64.52
Standard Deviation	10.69
Sample Variance	114.22
Kurtosis	-1.32
Skewness	-0.21
Range	41.24
Minimum	52.35
Maximum	93.59
Sum	29,200.35
Count	389

112 census tracts intersect with the Long Beach Fwy.

- Descriptive Statistics
- Average school performance across the study area
- School scores showed meaningful variability between locations (SD = 10.69), indicating uneven academic outcomes across the corridor.
- Scores ranged from 52.35 to 93.59, suggesting substantial differences in school performance among communities.

Comparison of pmP Scores by Freeway Proximity

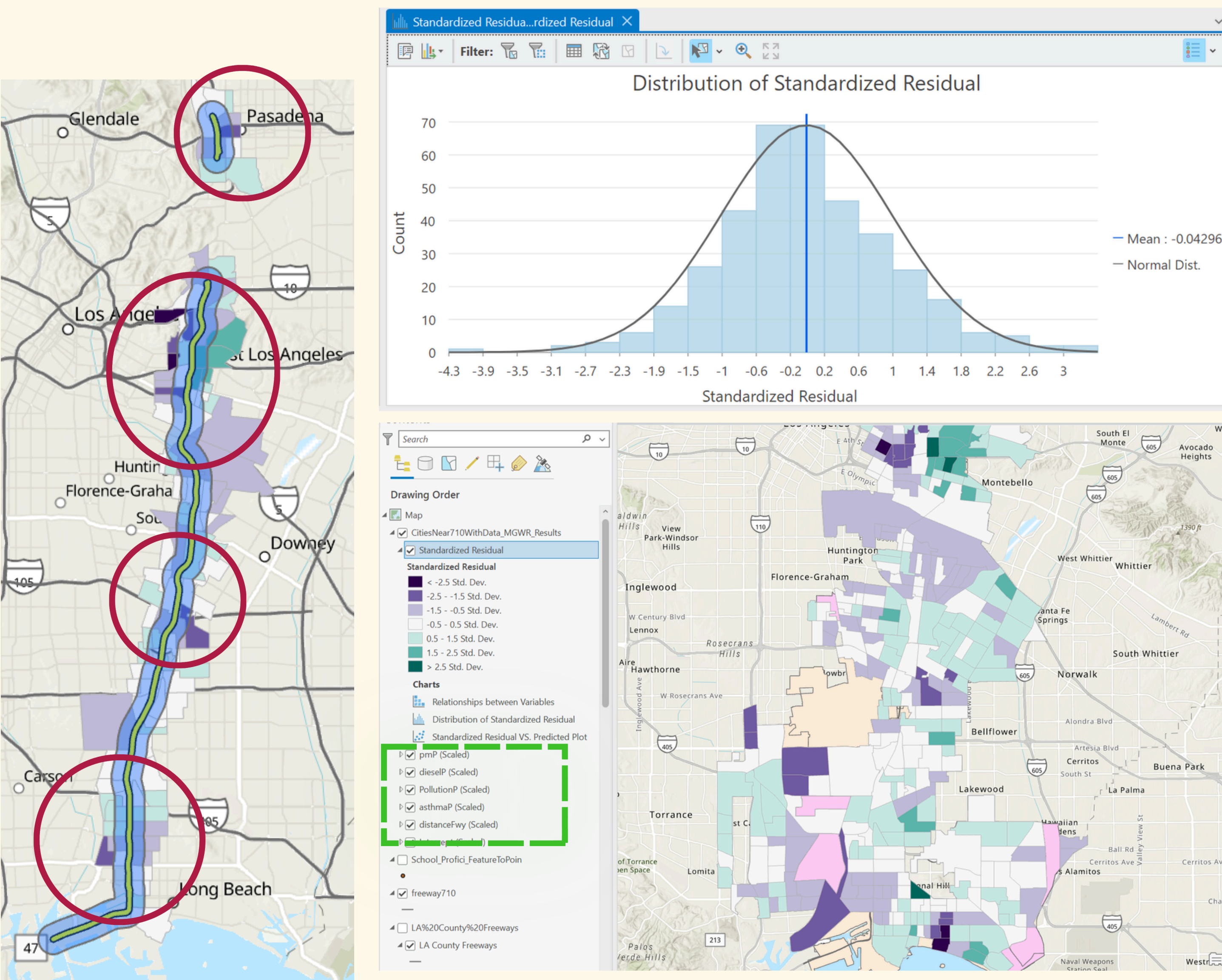
Statistic	Schools Not Near Freeway (No. n = 277)	Schools Near Freeway (Yes. n = 112)
Mean	73.98	77.74
Variance	111.44	112.03
Pooled Variance	111.61	
Hypothesized Mean Difference	0	
Degrees of Freedom (df)	387	
t Statistic	-3.17	
PT(tst) One-Tail	0.0008	
t Critical One-Tail	1.649	
PT(tst) Two-Tail	0.0016	
t Critical Two-Tail	1.966	

- Results indicate sufficient variation in academic performance to warrant further spatial and environmental regression analysis through an MGWR.
- Schools located within 0.5 miles of the freeway had significantly higher PM_{2.5} concentrations (mean = 77.74) than schools located farther away (mean = 73.98). The difference of approximately 3.8 points was statistically significant ($t = -3.17$, $p = 0.0016$), indicating that proximity to the freeway is associated with elevated particulate matter exposure.
- The nearly identical variances between the two groups (112.03 vs. 111.44) show that the higher pollution levels observed near the freeway exposure. This supports the conclusion that freeway-adjacent schools experience systematically greater environmental burdens.

Why a T-test?

This study used an independent two-sample t-test to compare particulate matter (PM_{2.5}) concentration levels between the “YES” and “NO” groups. The results showed a statistically significant difference in average PM_{2.5} levels, suggesting disparities in air quality between the two groups. Data from the California Office of Environmental Health Hazard Assessment (OEHHA) was used to conduct the analysis.

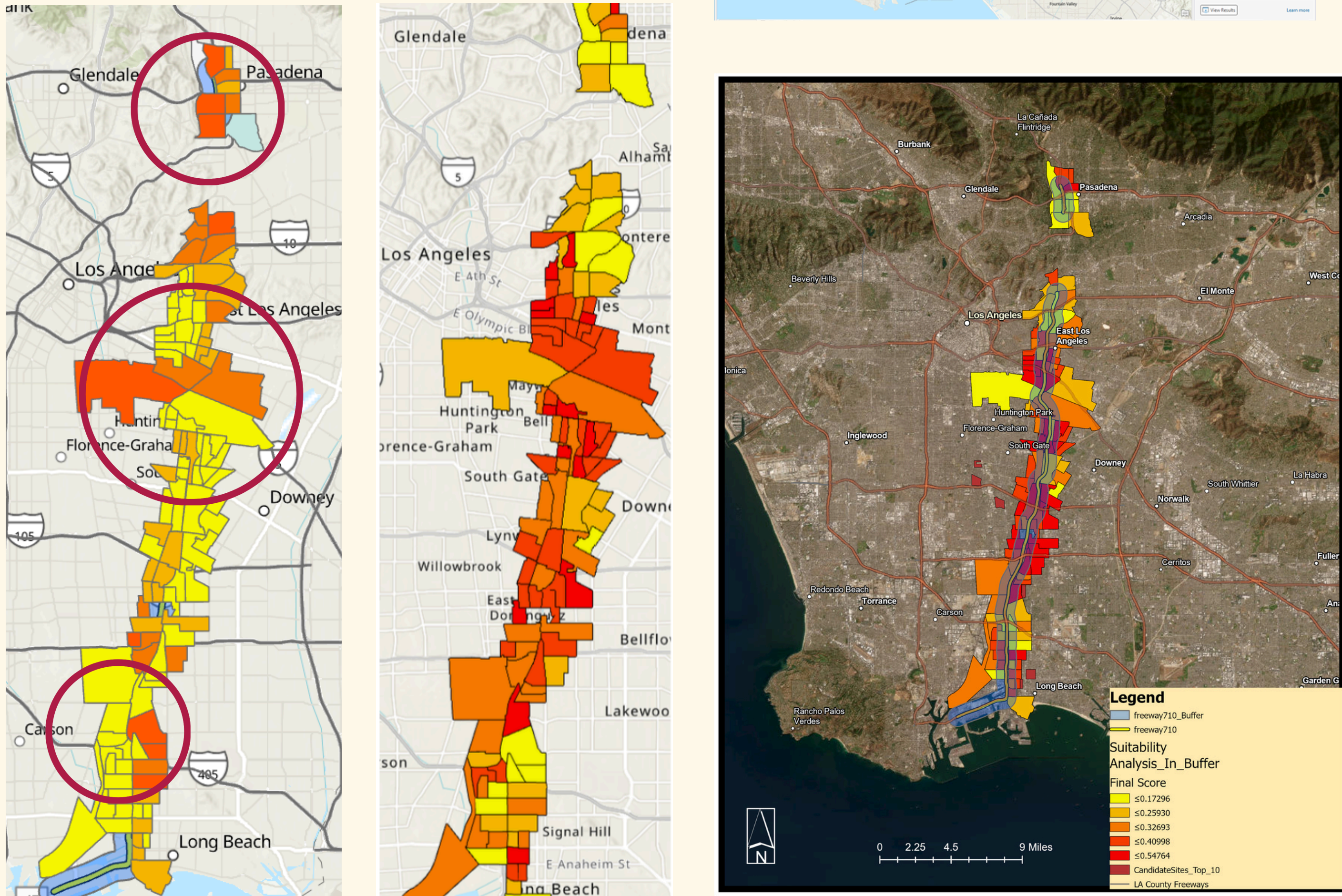
MGWR GRAPHIC



SUITABILITY ANALYSIS GRAPHIC

3 suitability analysis

suitability analysis explains at risk vulnerabilities differently the one the left shows esri's at risk vulnerabilities without health insurance, the one in the right shows with health insurance accessibility issues



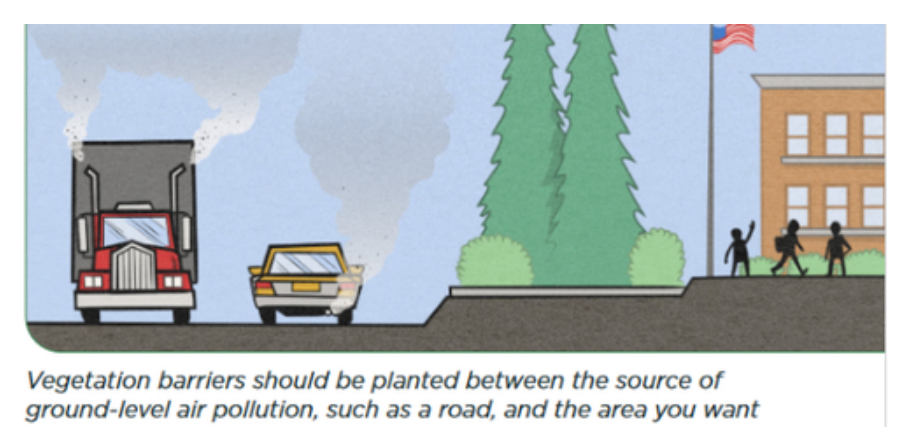
CONCLUSIONS

This study highlights that academic performance is influenced not only by student effort or school quality, but also by environmental and socioeconomic conditions. Traffic-related air pollution (TRAP) presents significant risks to cognitive development and learning outcomes, particularly in disadvantaged communities located near major transportation corridors. Addressing these challenges requires integrated approaches that combine environmental mitigation, educational support, and equitable urban planning strategies. The findings support the need for collaboration among policymakers, educators, urban planners, and environmental agencies to improve both environmental justice and educational equity. The following recommendations are proposed:

RECOMMENDATIONS

1. IDENTIFY PARTNERSHIPS

- Partner with local community organizations, LAUSD, and environmental nonprofits such as East Yard Communities for Environmental Justice to advocate for and fund freeway-adjacent school interventions in Southeast LA.



Vegetation barriers should be planted between the source of ground-level air pollution, such as a road, and the area you want

2. CONNECT STAKEHOLDERS AND THE EPA

- Convene a task force including LAUSD administrators, LA County officials, CalTrans, and EPA Region 9 representatives.
- Present research findings to the CA Air Resources Board to push for stricter freeway buffer mandates near schools.
- Engage parent and community groups in Southeast LA, a majority Latino community disproportionately bearing the burden of freeway pollution.

3. COMBINE RESOURCES

- Apply the Morton Arboretum's Vegetation Barrier for Schools and Communities Toolkit, developed from the Jensen Elementary pilot project in Chicago where dense tree plantings along the I-290 reduced highway pollution exposure, to implement green buffers at schools along the 710 corridor that exist in vulnerable communities (e.g., Huntington Park, Cudahy, South Gate, Compton, Carson, and Lynwood).
- Prioritize schools within 0.5 miles of the freeway based on demonstrated academic performance gaps and apply for EPA Environmental Justice grants to fund installation and maintenance.