Does Bike Lane Infrastructure Influence Environmental Outcomes in LA County?

DSCI 510 FINAL PRESENTATION

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01 Introduction

- Los Angeles faces environmental inequities, with pollution burdens concentrated in vulnerable, low-income neighborhoods (NDSC, 2025)
- Due to high initial costs, bike planning projects struggle to get approved. Policy makers rarely project and accurately quantify benefits of bike lane construction proposals
- This analysis attempts to expand on extensive literature that suggests bike infrastructure has a significant influence in alleviating pollution burden
- Geographic context of LA County's mobility and environmental justice goals: Measure M, Vision Zero, and the State's SB 535
- Exploring patterns on bikeway infrastructure and environmental burden can inform more equitable mobility planning

DATA SOURCES AND APPROACH

Data Source	Variables used	Data Type	Rows
LA Metro ATSP Bikeways (2024)	1. **bikeway_miles_per_1000=** bikeway_miles/population/1000 2. **bike_lane_density_sq_mi**=bikeway_milesarea_sq_mi/area_sq_mi	Shapefile	**2,837 rows**
LA Census Tracts	Geographic boundaries for each LA County census tract.	GeoJSON	**2,496 rows**
CalEnviroScreen Dataset	Environmental indicators **(PM2.5,, CES score)** at tract level.	CSV or Excel	**7892 rows**
ACS 2023 5-Year Estimates	**Population, median income, vehicle access, households.**	API	**2,067 rows**

- First I cleaned and combined ACS, CalEnviroScreen, and LA County bikeway data by standardizing tract-level GEOIDs
- Bikeway mileage was assigned to tracts using a spatial join and normalized by population and land area.
- Final variables including bikeway density, vehicle access, and pollution indicators were cleaned, validated, and prepared for analysis.

Results: 1. OLS

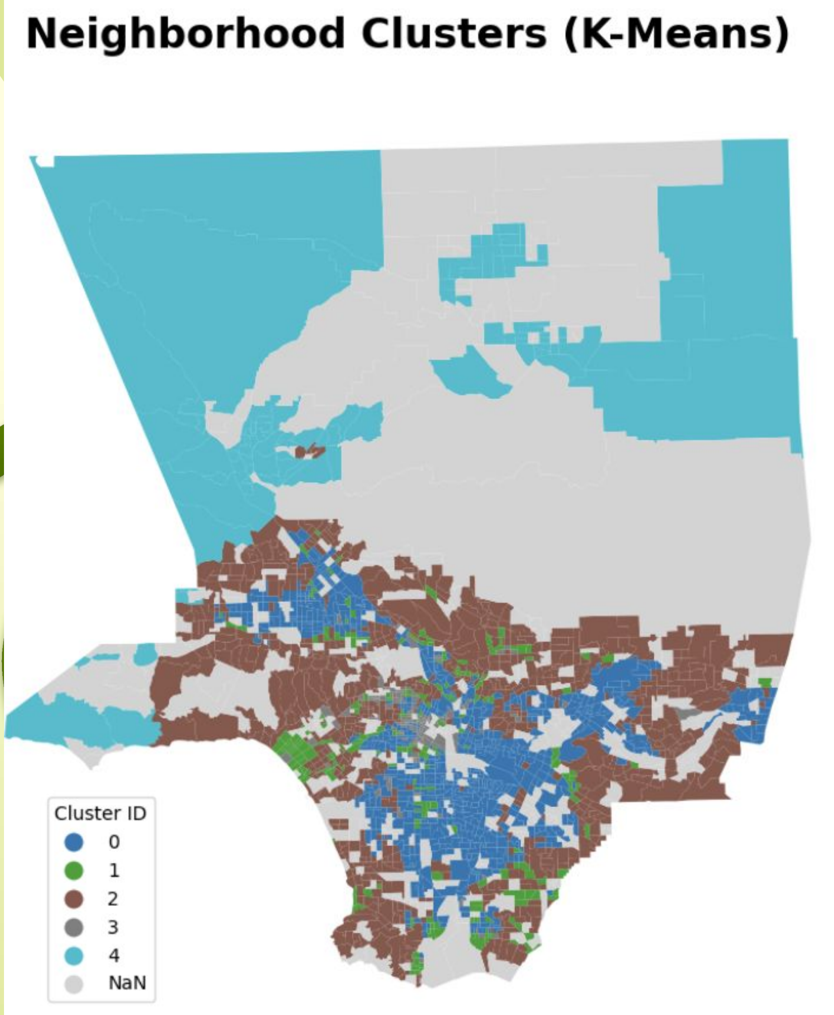
Variable	Coefficient	Significance	Interpretation
Bike Lane Density (miles per sq. mi.)	**–0.571**	**p = 0.003** (significant)	1 mile increase in bike lanes per square mile associated with a **0.57-point decrease** in CES score.
Vehicle Rate (% of households without a vehicle)	**123.86**	**p < 0.001** (very significant)	A 10-percentage-point increase in households with no car (0.10 increase) associated with a **12.4-point increase** in CES score

Model Observations:

1. **R-squared (0.062):** Model explains only **6.2%** of the variation in CES Scores
2. Median income is **not statistically significant** with CES score once vehicle access is included.
3. **Durbin-Watson = 0.476** suggests positive autocorrelation. Multicollinearity also detected

Cluster	Bike Lane Density (mi / sq mi)	CES Score	PM2.5	Vehicle Rate
0: High Environmental Burden, low bike infrastructure	0.84	52.57	12.03	0.03
1: Lower environmental burden,moderate bike lane access	1.14	23.67	11.70	0.02
2. High environmental burden, but moderate-high bike lane presence.	1.61	44.62	12.06	0.13
3: Strong bike infrastructure , Moderate environmental burden	5.82	37.76	11.81	0.04
4: High vehicle access Low pollution levels.	1.04	22.90	8.61	0.01

2. K-Means Clustering



2. K-Means Clustering MAP

Most tracts fall into brown cluster 2:
High environmental burden, but moderate-high bike lane presence.

However, Low income areas in South LA fall into dark blue cluster: **High Environmental Burden, low bike infrastructure**

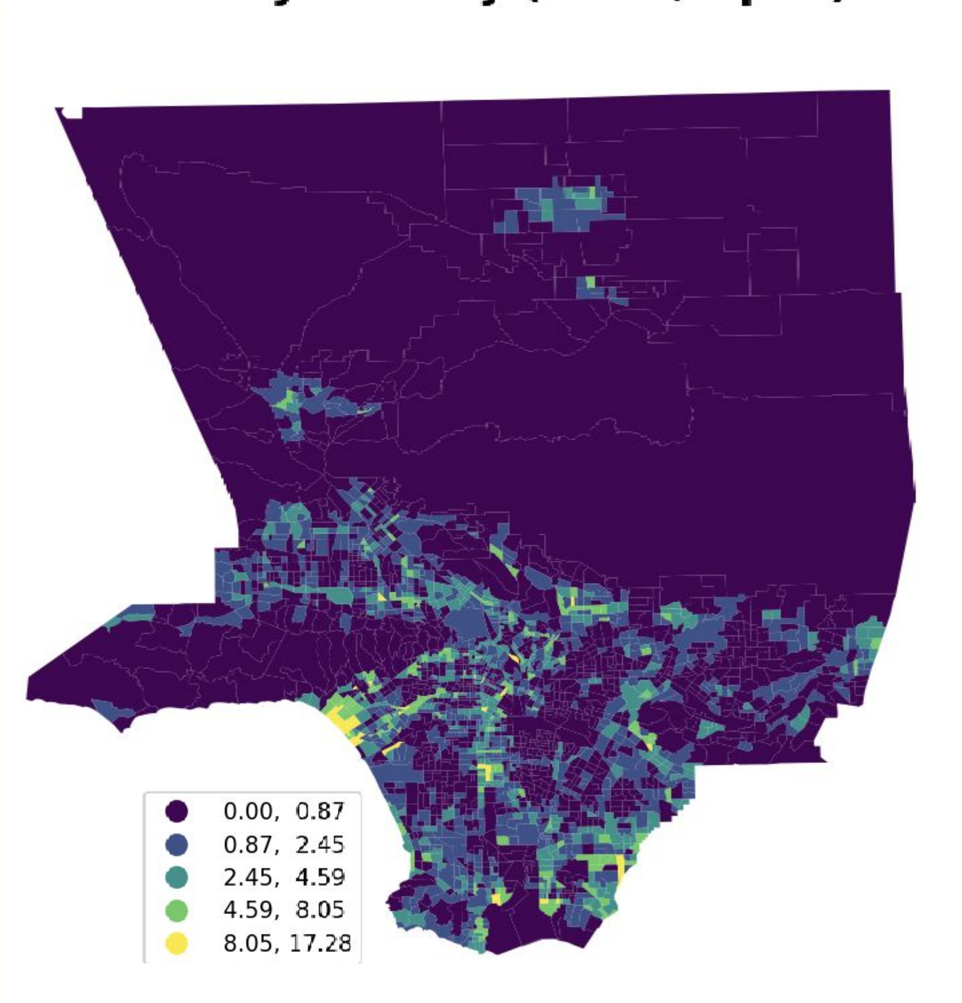
Map highlights priority zones for future investment in active transport projects.

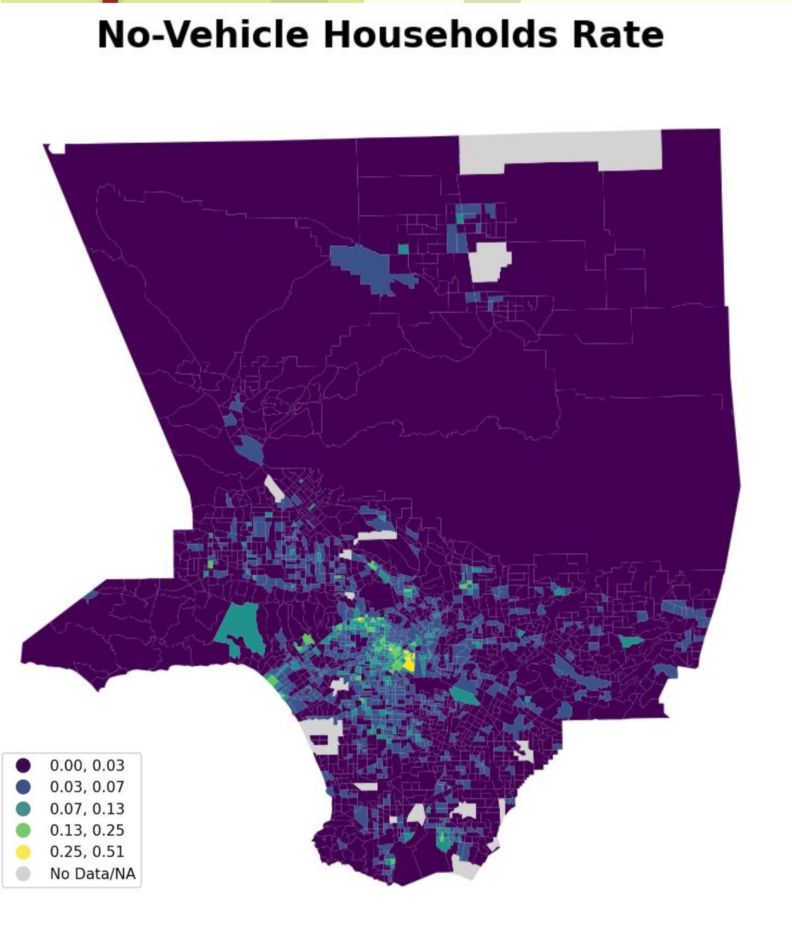
3. LA County Spatial Mapping

- Density in Downtown LA (matching the No-Vehicle map).

- There is also density in Santa Monica/Venice (matching Low CES/Wealthier areas).

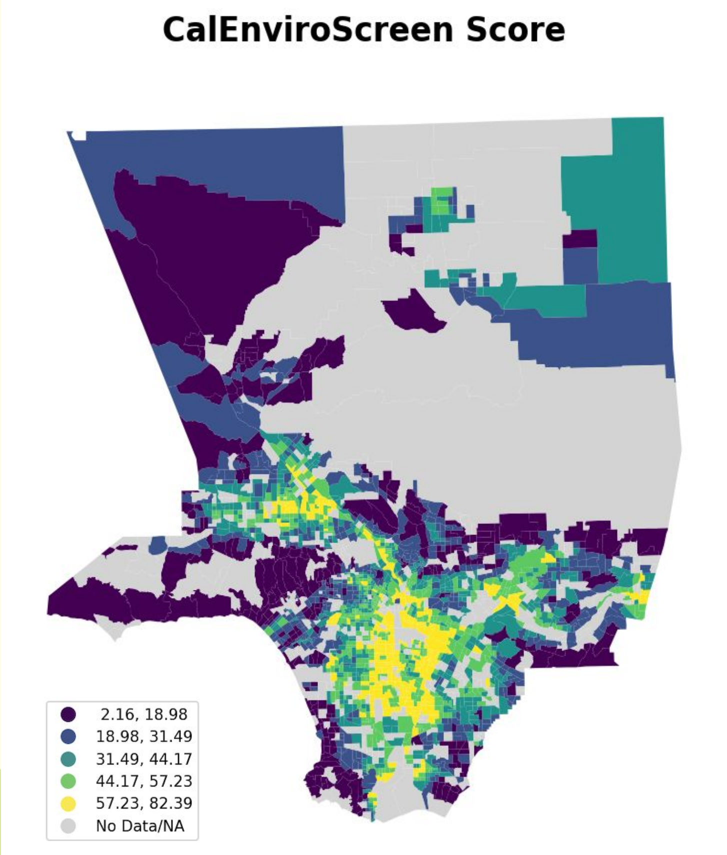
- Large parts of South LA (the High CES zones) have lower density but fragmented networks present : due to central business district in DTLA





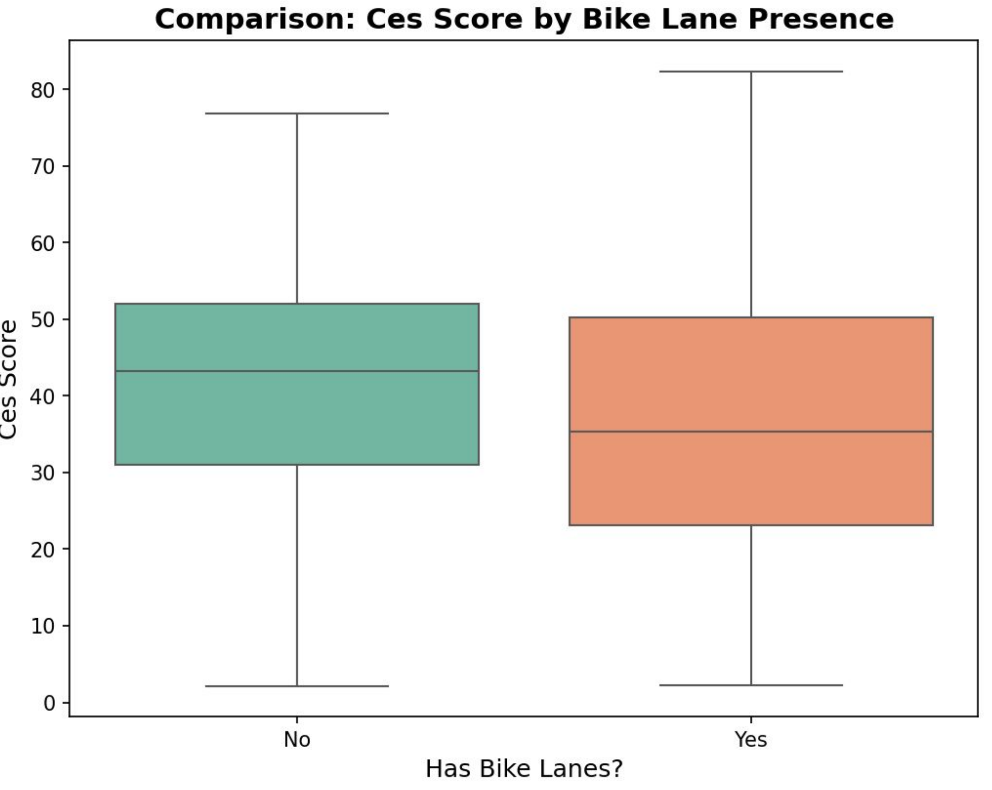
Observations:

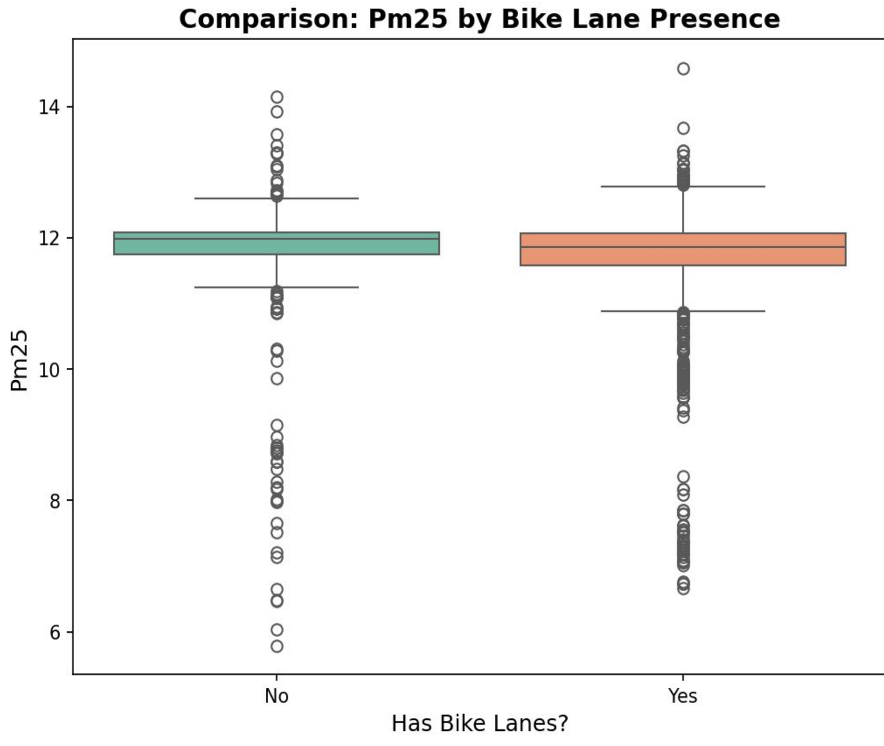
- Area of highest transit dependency is the concentration of households without vehicles (Yellow/Green spots) in Downtown LA and Westlake.
- Low income communities in South Central LA and Parts of the valley face largest pollution burden
- Rest of the county is deep purple -very low rates of households with no vehicles



4. Box plot: Environmental performance of tracts with bike lanes versus without

- No Bike Lanes = Higher CES Score (Median 45)
- Bike Lanes Present = Lower CES Score (Median 35), shows inequity in infrastructure distribution
- No significance in bike lane presence and particulate matter.





CHALLENGES

1. Spatial data integration and computing bike_lane_density_sq_mi - pipeline returned 0 for all bikeway data

2. Standardizing GEOID across different sources- caused KeyError issues in during merging

3. Interpretation issues due to different levels of analysis (Tract level data for CalEnviroScreen scores and ACS population data, but county level data for Bikeways)

4. Multicollinearity in Statistical Modeling

THANK YOU!