Utilizing AI-Driven Technology and Geospatial Analysis to Explore Landscape Morphology, Social Vulnerability, and Child Neglect in Los Angeles

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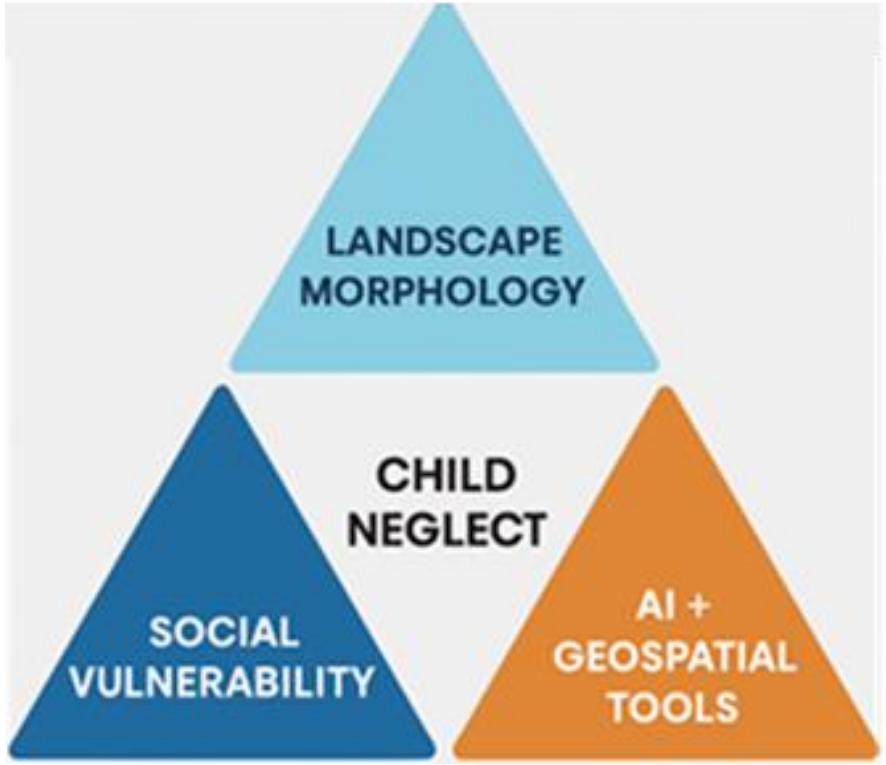
Understanding Child Neglect: Definition, Importance, and Research Gaps

- **What is Child Neglect?**
  - Defined under **Penal Code §270**: Failure to provide food, shelter, clothing, or medical care without lawful excuse.
  - **Distinct from Physical Abuse**: Requires separate focus.
- **Why is it Important?**
  - Neglected children are **socioeconomically vulnerable**—neglect and poverty are often intertwined.
  - Decades of research highlight the **social environment's impact** on neglect.
- **Knowledge Gap**
  - **Critical Question**: Can features of the **built environment** (e.g., green spaces) reduce child neglect?
  - Research on this connection is limited but crucial

Current Research: The Built Environment Gap

- **Current Research Focus**
  - Mainly on behavioral and psychological causes of neglect.
  - Recognizes a spatial dimension in child maltreatment patterns.
- **Socio-Environmental Influences**
  - Linked to social deprivation and community disorganization.
- **Key Knowledge Gap**
  - No research yet on how the built environment affects neglect locations.
- **Why This Matters**
  - Understanding this link can improve resource connection for parents.
  - Helps support children’s social, emotional, and physical well-being.

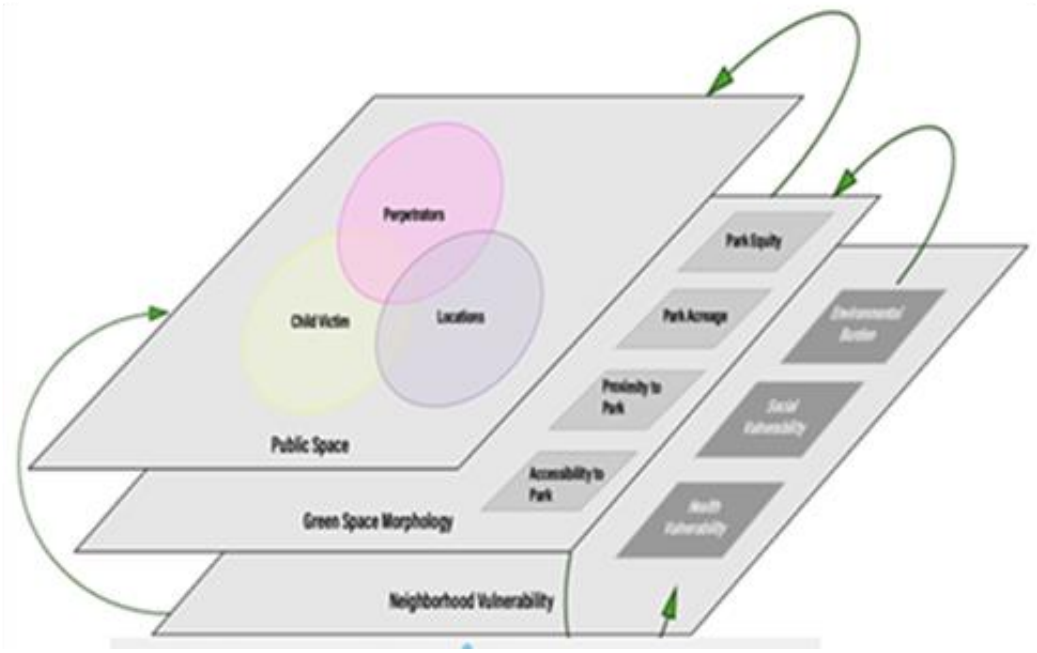
Research Question: Landscape Morphology & Structural Vulnerability



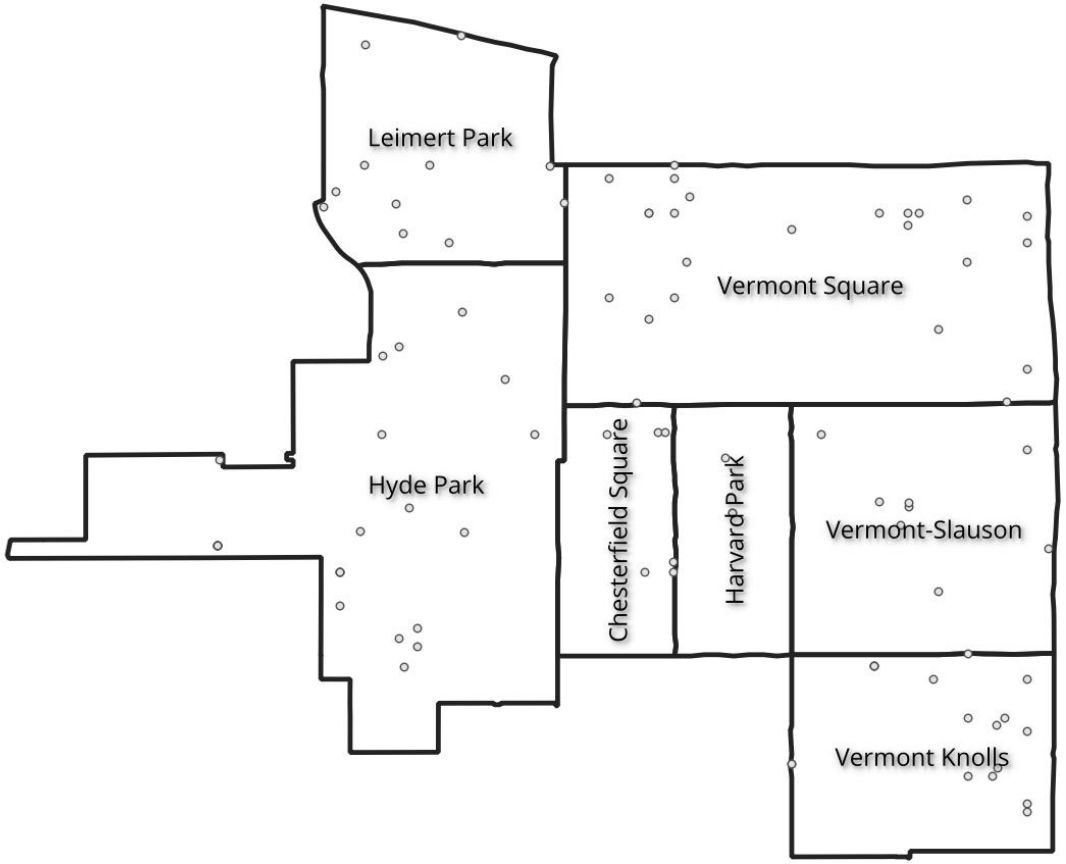
- **RQ:** To what extent does landscape morphology interact with structural vulnerabilities to affect child neglect risk?
- **Goal**: Understand how the physical environment and social factors combine to influence neglect likelihood.

Conceptual Framework: Environmental and Social Interactions in Child Neglect

- **Core Hypothesis:**
  - Landscape morphology and social vulnerability interact to influence child neglect risk.
- **Key Points:**
  - Multiple overlapping social, economic, and physical environments combine with individual factors to elevate neglect risk.
  - Environmental Stress Theory underpins the model linking neighborhood conditions to neglect outcomes.
  - The framework integrates Ecological Systems Theory and Social Deprivation perspectives.
  - Our model examines these interacting environmental layers and their joint impact.

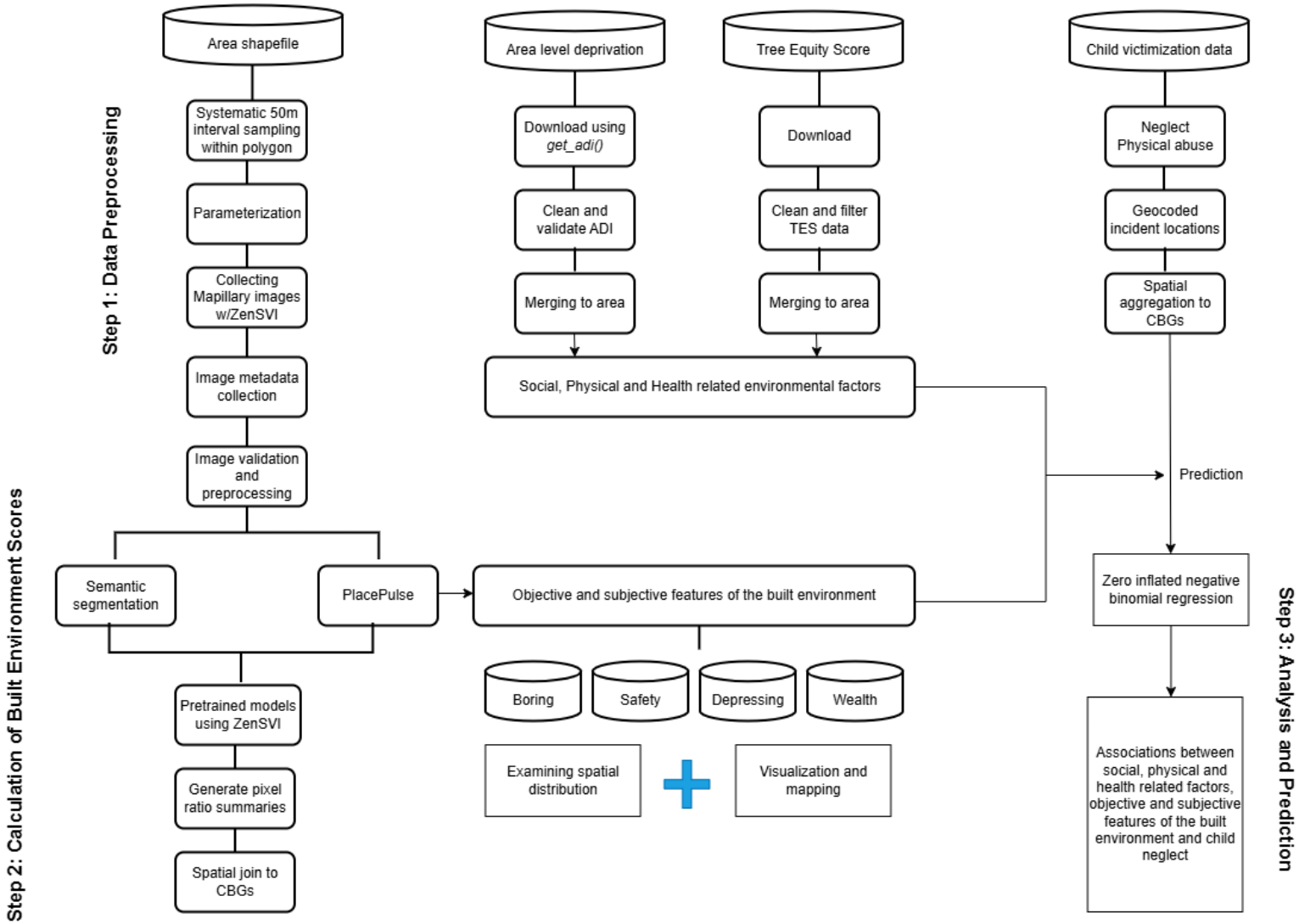


Spatial Distribution: Neglect Incidents in Focal Area



- **Concentration and Clustering**
  - Hyde Park, Vermont Square, and Vermont Slauson exhibit a higher concentration of neglect and more clustering.
- **Neighborhood Variation**
  - Leimert Park and Chesterfield Square show relatively fewer neglect incidents
- **Peripheral and Central Spread**
  - In some neighborhoods, neglect points are dispersed throughout, while in others they appear concentrated toward specific blocks or streets
- **Spatial Gaps**
  - Certain parts within neighborhoods, such as Harvard Park, have few or no neglect incidents, indicating potential heterogeneity in risk factors

Data Processing and Analysis Workflow



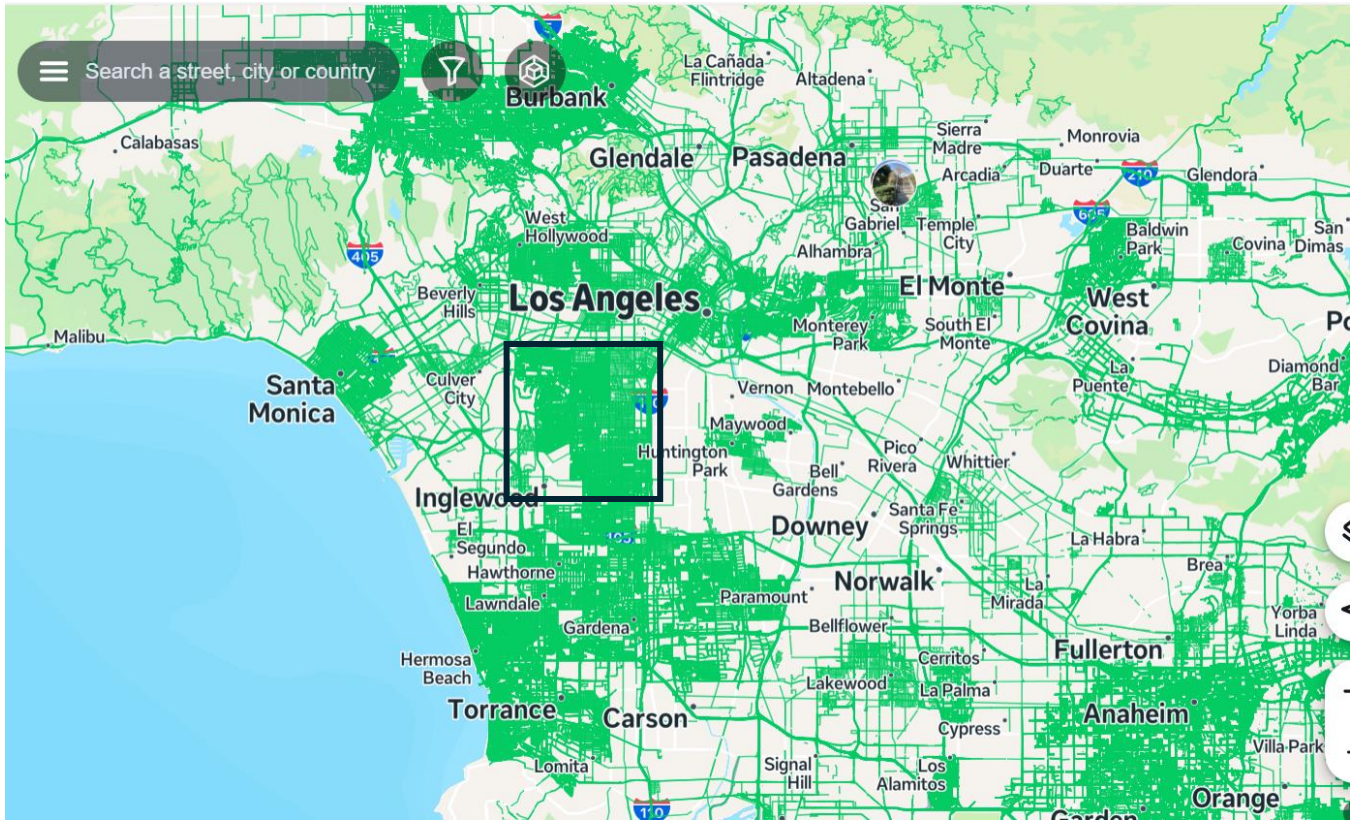
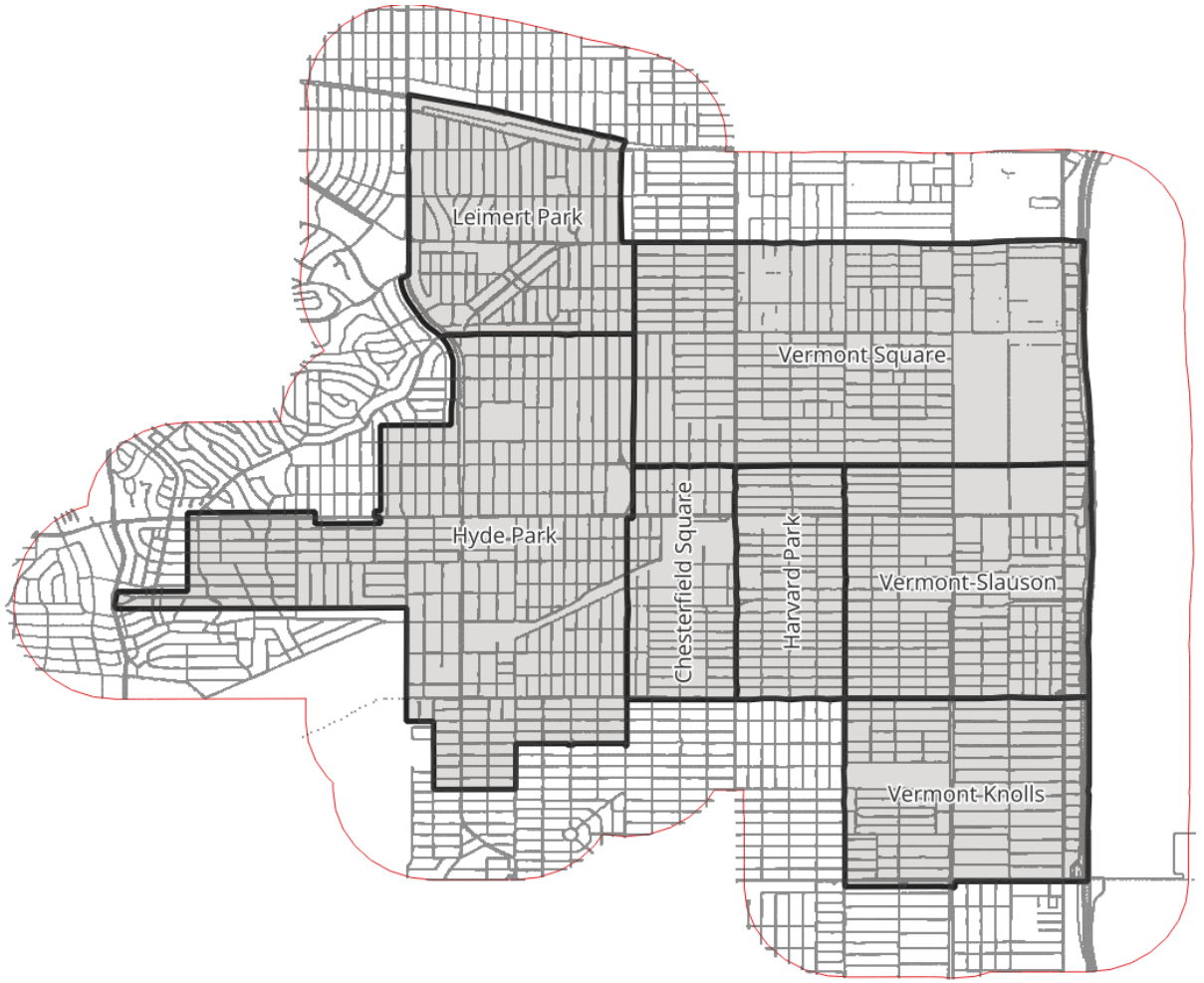


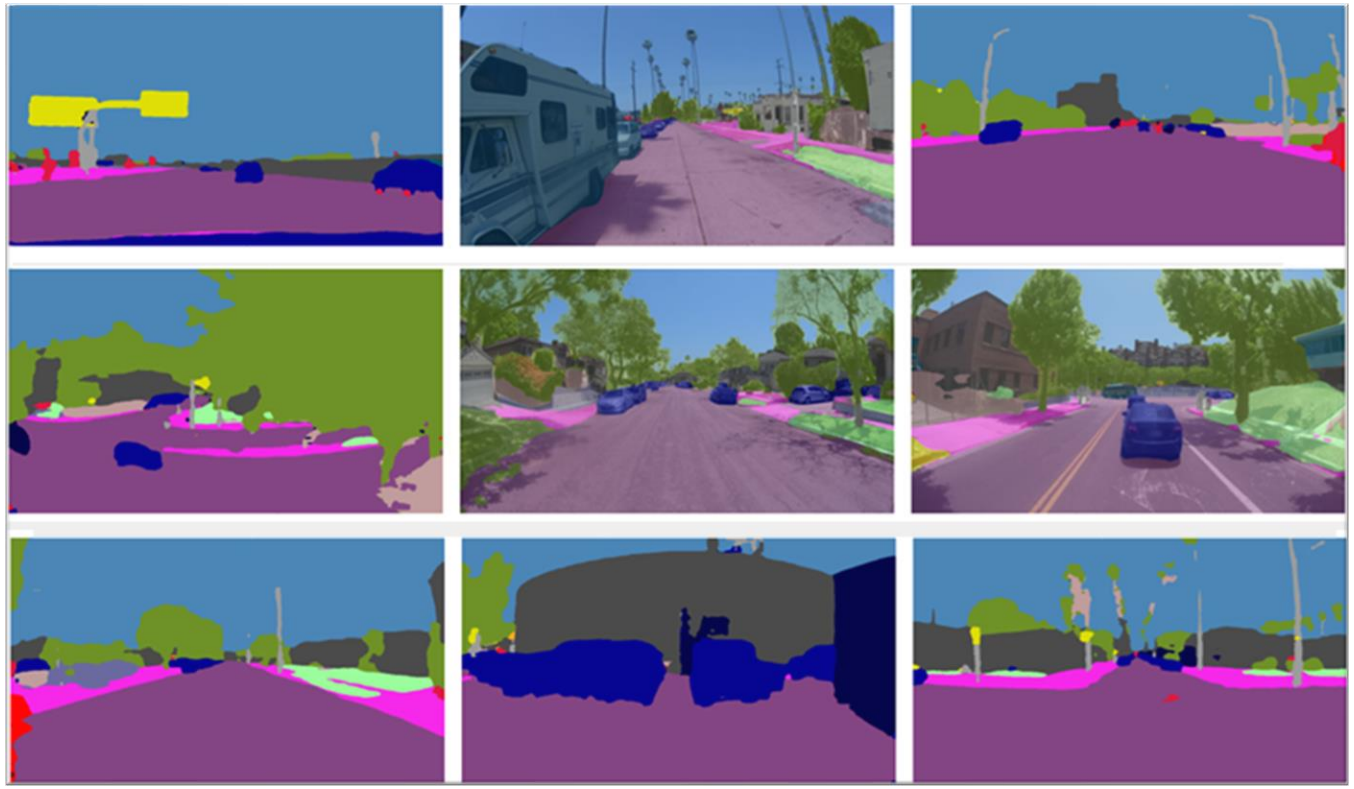
Image Retrieval: Download imagery from Mapillary

```python
import os
from zensvi.download import MLYDownloader

# Path to your shapefile
input_shp_file = "area.geojson"

# Output folder
output_folder = "images"
os.makedirs(output_folder, exist_ok=True)

# Initialize downloader
downloader = MLYDownloader(mly_api_key)

# Download images using the shapefile
downloader.download_svi(
    dir_output=output_folder,
    input_shp_file=input_shp_file,
    # meters around the polygon/points
    buffer=800  )
```



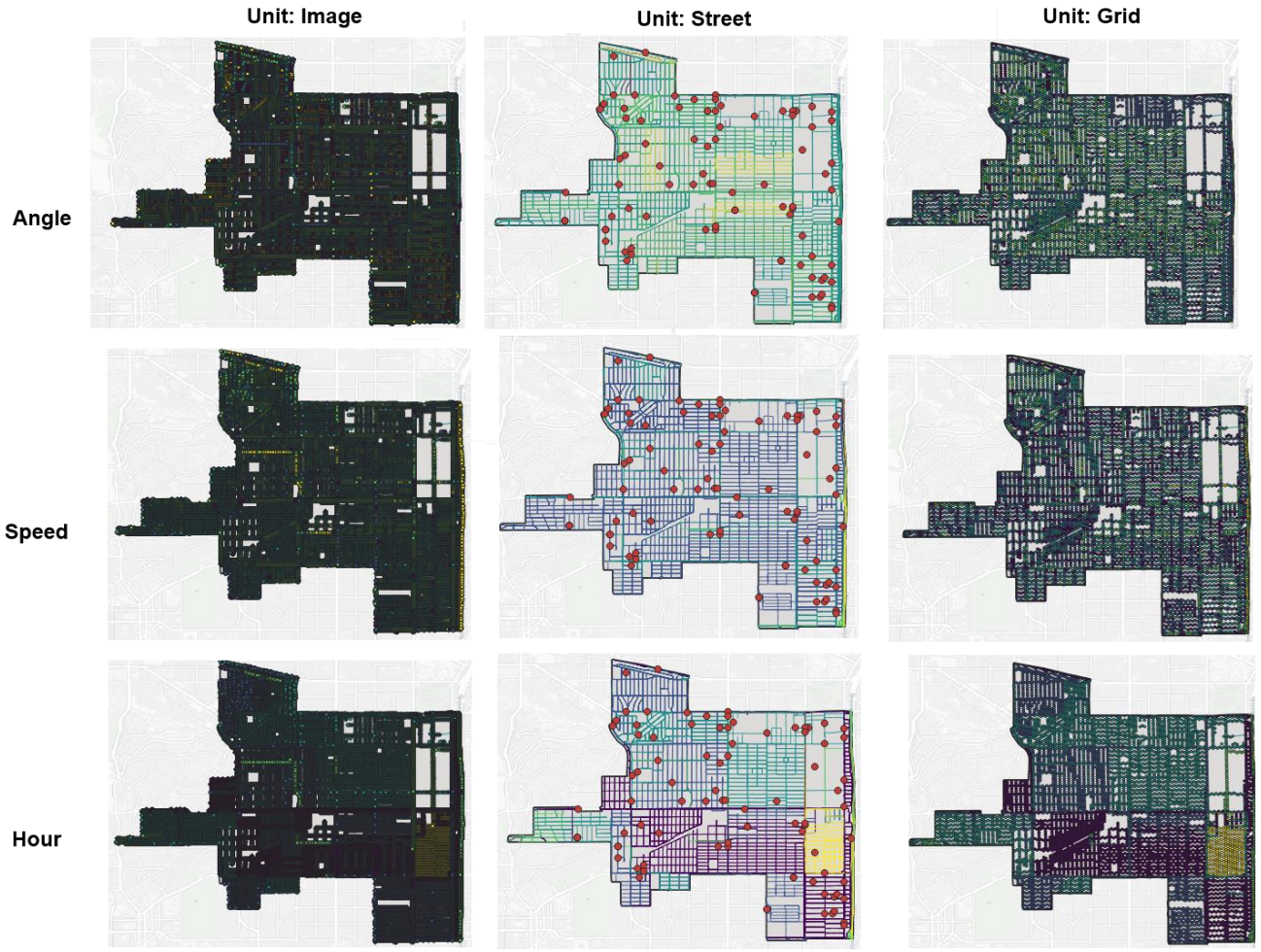
Classification: Semantic Segmentation Examples of Built Environment

- We use AI models trained on datasets like Mapillary Vistas for accurate labeling.
- Extracted features include vegetation, road, buildings, sidewalks, traffic signs, and lighting proxies.
- These pixel-level classifications feed into indices quantifying built environment quality and safety.
- The approach enables objective, scalable analysis of neighborhoods and environmental risk factors.



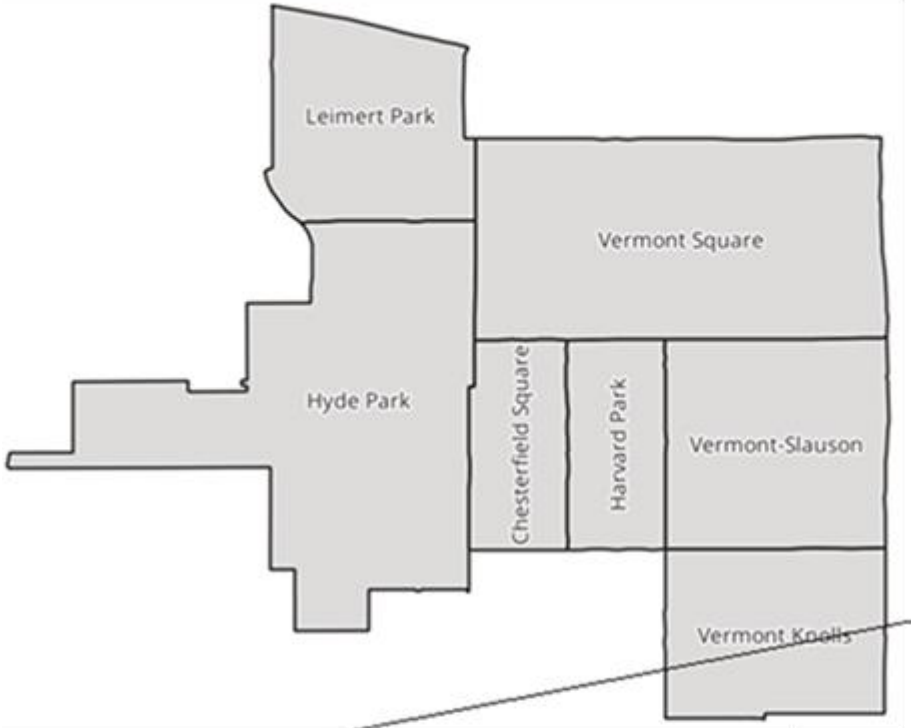
Classification: Built Environment Quality Gradient

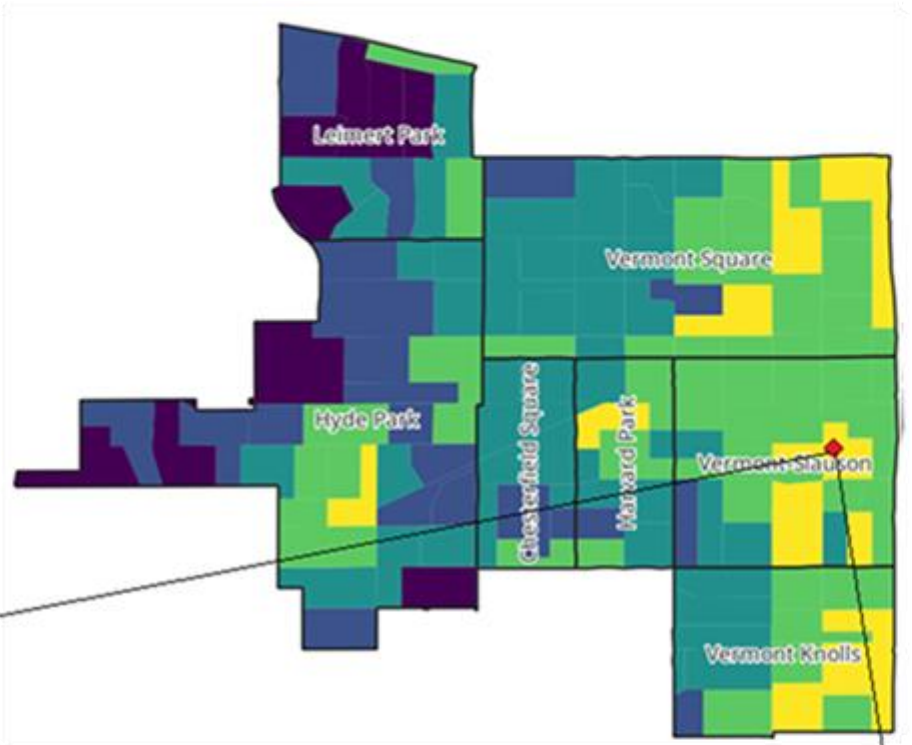
These images represent a spectrum of environmental quality from low to high based on visual and structural cues.



Metadata: Image, Street, and Grid data

- This slide shows a matrix of maps displaying important metadata from our imagery dataset.
- The columns represent different spatial units: single images, aggregated street segments, and grid cells.
- The rows highlight key metadata types—camera angle, capture speed, and image capture time.
- Viewing metadata across these scales helps us understand spatial and temporal patterns in data collection quality and context.
- This informs data cleaning and analysis steps to ensure robust, reliable results.





Social Vulnerability
Area Level Deprivation: 138.33

Physical Vulnerability
Road: .260
Sidewalk: .035
Building: .063
Fence: .030
Pole: .002
Traffic sign: .001
Vegetation: .433
Terrain: .039
Sky: .037
Person: .000
Car: .095
Truck: .004

Perceptions
Safety score: 5.349
More boring score: 5.862

Neglect Quintile	Lowest	Highest	p
Total N (%)	39 (50.6)	38 (49.4)	
Land Use Mix (Segmentation)	0.4 (0.1 to 0.5)	0.1 (-0.5 to 0.5)	0.095
Green Space Index (Segmentation)	0.2 (-0.3 to 0.7)	-0.1 (-0.7 to 0.5)	0.308
Surveillance (Segmentation)	-0.0 (-0.4 to 0.3)	0.1 (-0.2 to 0.5)	0.241
Safety Score (Place Pulse)	-0.1 (-0.6 to 0.4)	0.3 (-0.4 to 1.0)	0.050
More Boring Score (Place Pulse)	0.3 (-0.0 to 0.5)	-0.1 (-0.7 to 0.4)	0.018
ADI	115.2 (106.3 to 118.5)	116.9 (110.1 to 122.1)	0.433

Median (IQR)

Generalized Linear Models

- Child neglect incident counts are aggregated to Census Block Groups (CBGs) to enable neighborhood-level analysis.
- Using the 2023 American Community Survey (ACS) 5-year estimates via tidycensus, population counts for children under 18 are downloaded and summed by CBG to serve as the population at risk denominator.
- Built environment indices are created by standardizing and averaging features related to lighting (poles, signs), green space (vegetation), surveillance (buildings, walls), and land use mix (fences, sidewalks).
- Neglect rates per 100,000 children are computed by dividing neglect counts by the child population in each CBG.
- Zero-inflated negative binomial models used to analyze the relationship between neglect rates and key predictors (ADI, built environment indices, and perception scores), accounting for neighborhood-level random effects.

Zero-inflated negative binomial regression results

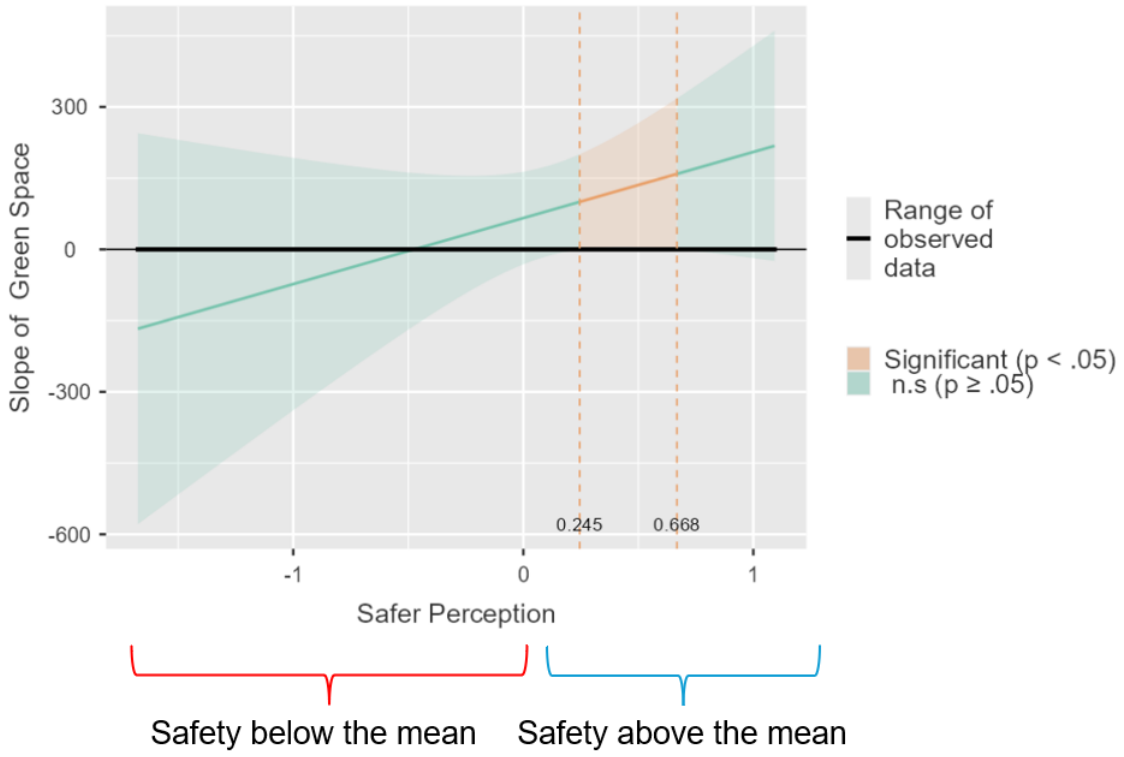
Predictor	IRR	% change	Std. Error	*p-value*
Surveillance Index	0.974	−2.62%	0.011	0.021
Tree Equity Score	1.086	8.62%	0.038	0.029
Green Space Index	0.962	−3.79%	0.013	0.004
Lighting Index	0.969	−3.08%	0.011	0.007
Land Use Mix Index	0.972	−2.82%	0.011	0.014
Safer Perception Score	0.975	-2.50%	0.013	0.062

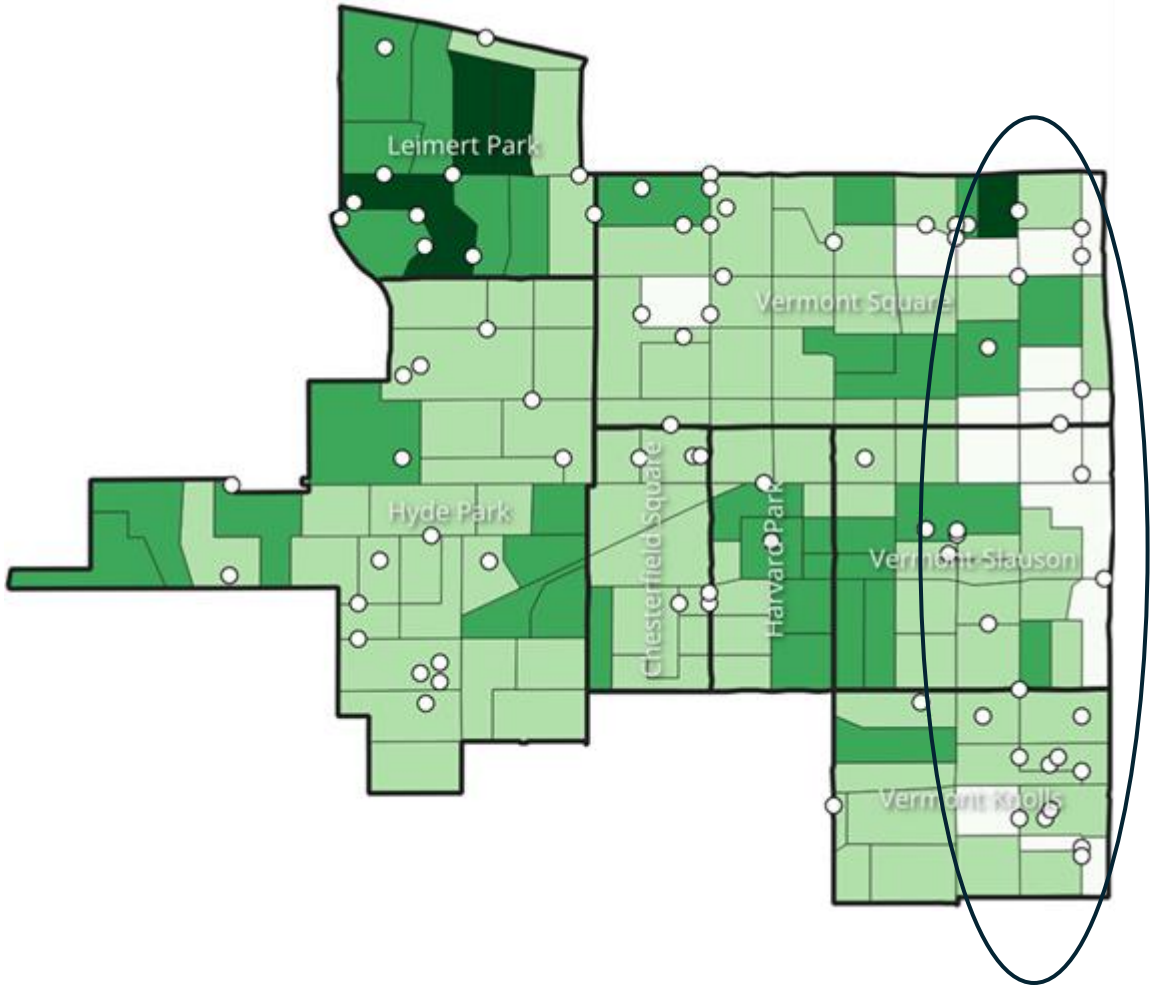
RR = 0.972

Holding other factors constant, a one-unit increase in land use is associated with a 2.82% decrease in the expected rate of neglect incidents.

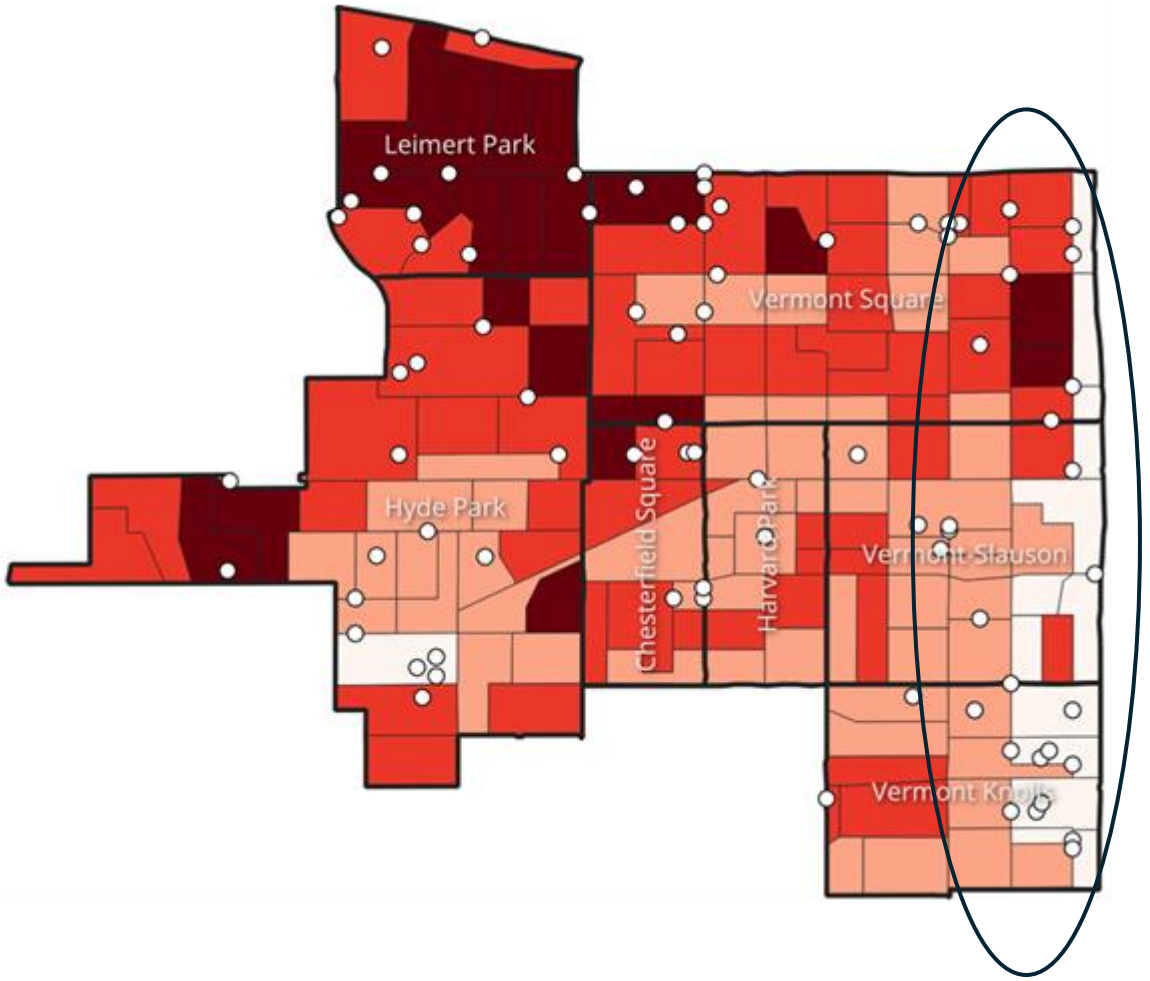
Safety Perception Moderates the Effect of Green Space on Child Neglect

- At lower safer perception scores the slope of green space is negative but not significant
- As the safer perception score becomes safer, the slope becomes positive and significant.
- At higher safer perception values, the slope remains positive, but the effect becomes non-significant again.





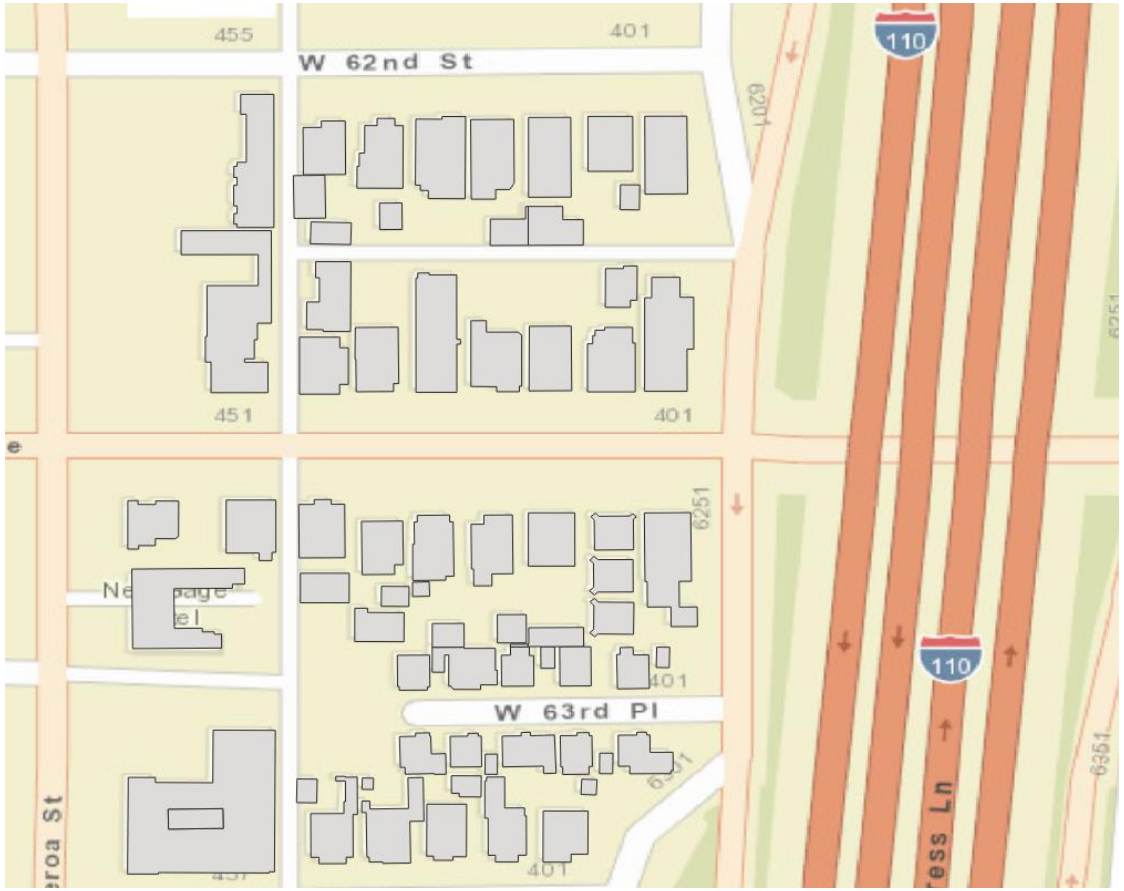
Segmented Green Space & Child Neglect



Safety Perception Score & Child Neglect

The bottom 20th percentile of safety perception scores (mean) was measured within 100 meters of child neglect and physical abuse incidents, based on the characteristics of the surrounding built environment.

Area around a 100-meter buffer of a Child Physical Abuse (CPA) incident (Black Male, 15 years old) — Crenshaw High School



Area around a 100-meter buffer of a Neglect incident (Black Male, under 1 year old) — Near 110 Highway

THANK YOU