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Introduction

- Greenspace may protect cognition via physical activity, cardiometabolic health, stress reduction, and social engagement. Prior work measured average greenspace or park counts, which can hide unequal access within areas.
- Spatial Social Polarization (SSP) indices measure the extent to which populations are distributed at extremes of privilege and deprivation.
- SSP’s application to measuring greenspace and its association with ADRD remains unexplored.
- Because neighborhood context differs across a large, heterogeneous county, a single global estimate may obscure opposing local relationships.

Hypotheses

- Hypothesis 1:** Greater greenspace-access deprivation will be associated with higher dementia prevalence and incidence in global models.
- Hypothesis 2:** The association between greenspace SSP and dementia will vary across local areas, with GWR revealing spatial heterogeneity in both the magnitude and direction of associations that may be obscured in global models.

Data and Study Population

- Data Sources:** We used a 20% national sample of Traditional Medicare beneficiaries aged ≥67 linked to enrollment, demographics, vital status, and Medicare Part A, B, and D claims from 2016–2019. The analytic year was 2018, with 2016–2017 used as a two-year washout period for incident dementia.
- Outcome:** Dementia incidence and prevalence. Following Zissimopoulos et al., we combine three signals:

Table 1. Study Sample’s Demographic and health characteristics

Characteristic	2016	2017	2018
Mean age (years)	76	76	76
History of chronic conditions			
Acute Myocardial Infarction	0.8%	0.8%	0.8%
Depression	16.1%	16.8%	17.4%
Diabetes	30.1%	29.7%	29.4%
Hyperlipidemia	53.8%	56.0%	56.8%
Stroke	4.1%	4.1%	4.1%
Hypertension	66.2%	66.1%	66.1%
Sex			
Female	60.0%	59.8%	59.4%
Race			
Unknown	1.1%	1.4%	1.7%
Non-Hispanic White	83.2%	83.1%	83.0%
Black	6.7%	6.4%	6.2%
Other	0.7%	0.7%	0.7%
Asian/Pacific Islander	3.0%	3.1%	3.1%
Hispanic	4.9%	4.9%	4.8%
American Indian/Alaska Native	0.4%	0.4%	0.4%

Exposures – Greenspace access and SSP

(1) Household-level Greenspace Access

- Network-based pedestrian accessibility:* Following Xu et al. (2026), we measured access to parks and green spaces for approximately 3.7 million households in LA County using GIS-based network accessibility models. The measures accounted for real-world street networks, pedestrian-accessible paths, slopes, network distance, and walking time, and barriers in the built environments.

(2) Classify greenspace access (Figure 1)

- Households with no park or greenspace within a 15-minute walk were classified as having **deprived access**.
- Households with park or greenspace access within 500 meters were classified as having **privileged access**.

(3) Construct greenspace SSP at Zip Code/neighborhood level

- Household-level privilege and deprivation classifications were aggregated to the Zip Code level using the ***Index of Concentration at the Extremes (ICE)***, capturing the spatial concentration of greenspace-access privilege and deprivation (**Figure 2**).

$$ICE = \frac{\text{No. of privileged households} - \text{No. of deprived households}}{\text{Total No. of households}}$$

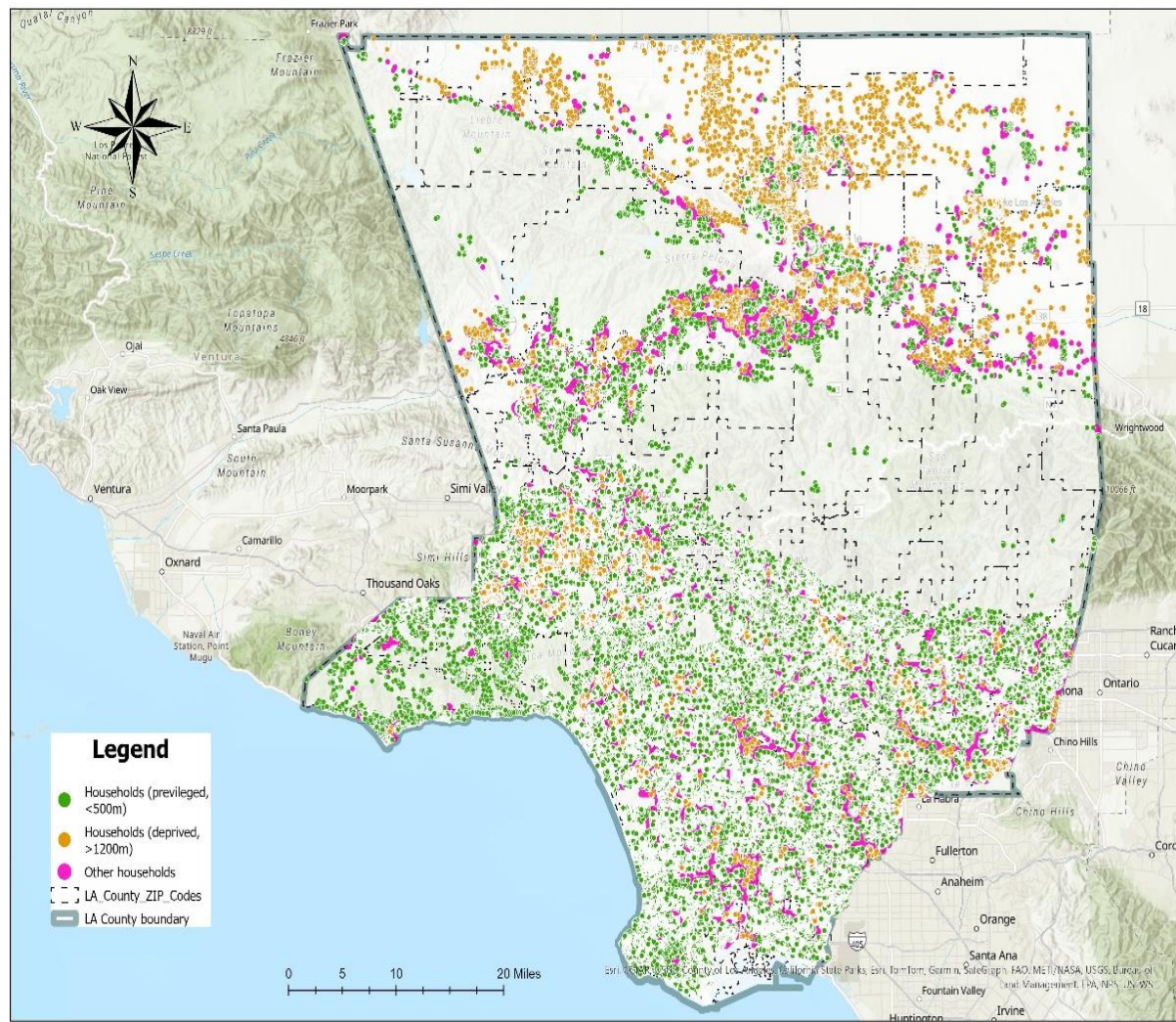


Figure 1. Distribution of household-level classification of greenspace access

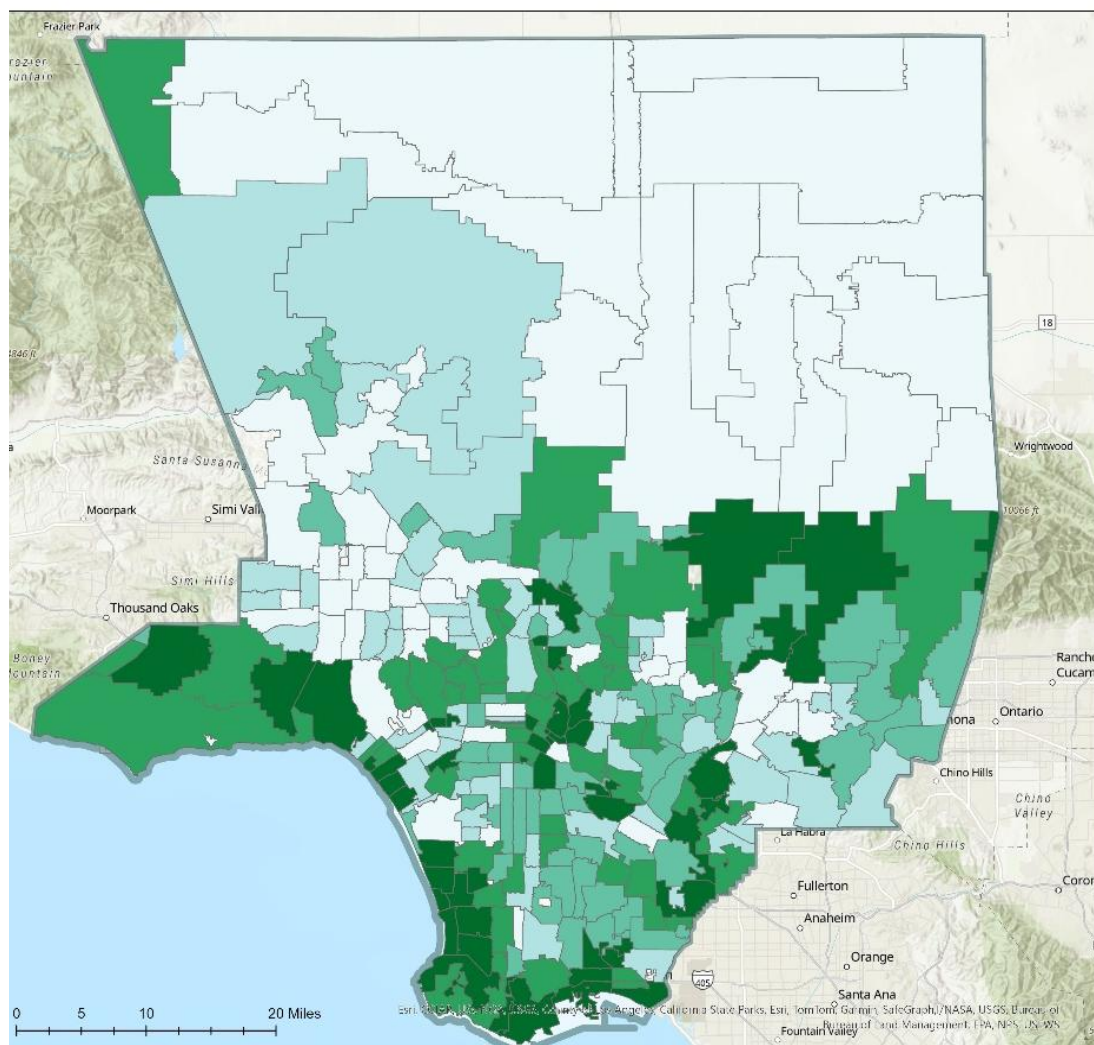


Figure 2. Distribution of greenspace SSP measured by ICE at the Zip Code level across LA County

(4) Sensitivity analyses evaluated alternative distance thresholds.

Statistical Analyses

- (1) Mixed effects multilevel regression models** to account for the clustering at the zip code level (j) were used to quantify the association between the prevalence of diagnosed dementia (Y_{ij}) and each Zipcode-level ICE (ICE_j), adjusting for individual-level (i) covariates (X_{ij}); u_{0j} is the ZIP random intercept (accounts for clustering at ZIP).

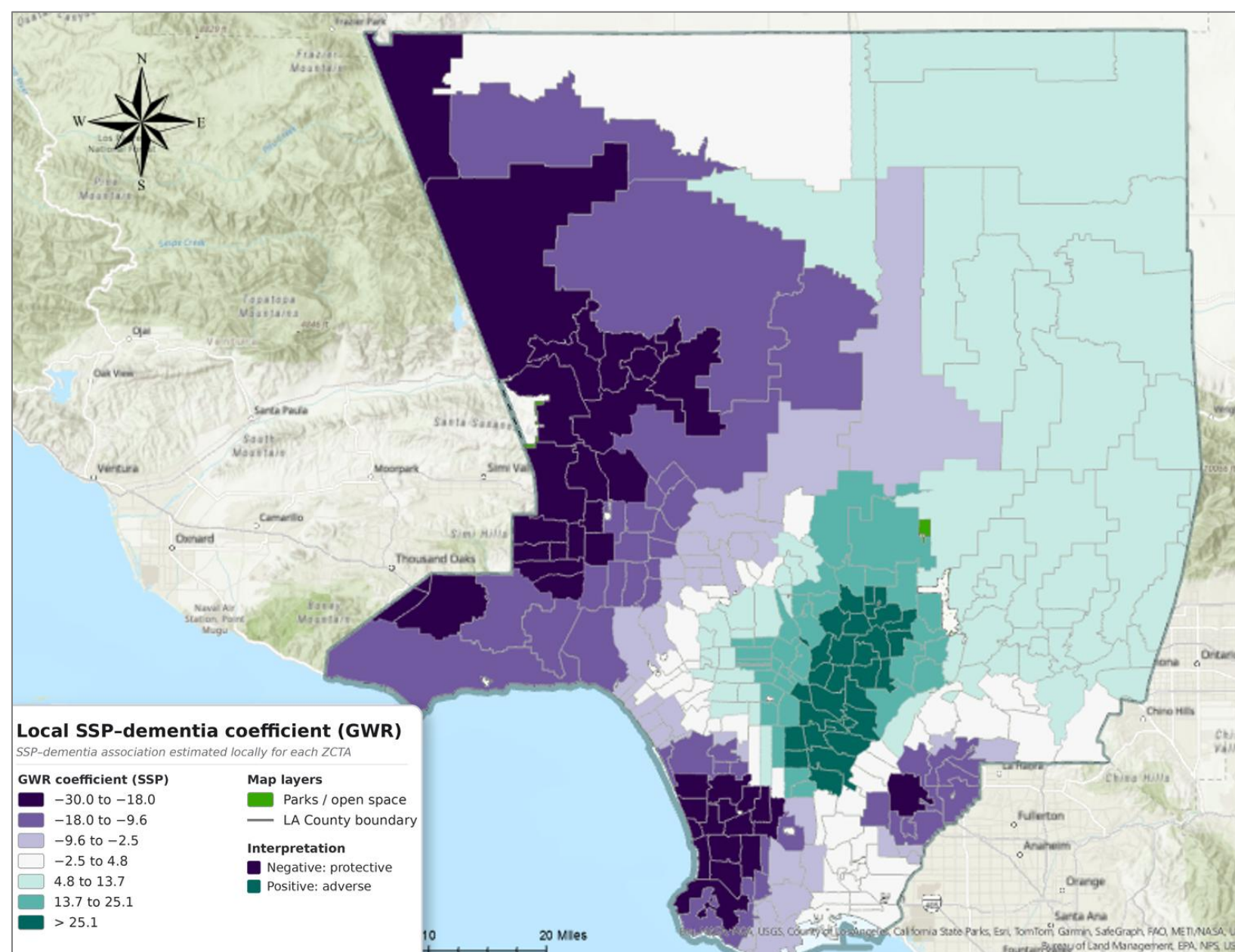
$$\text{logit}(p_{ij}) = \gamma_{00} + \gamma_{01} \text{ICE}_j + \mathbf{x}_{ij}^T \boldsymbol{\beta} + u_{0j}$$

- (2) Local models: Geographically Weighted Regression (GWR).** GWR was used to test whether the association between greenspace SSP and dementia varied across the County. For each ZIP Code, GWR estimated a local SSP–dementia coefficient using nearby ZIP Codes weighted more strongly than distant ZIP Codes, allowing the direction and magnitude of the association to vary across Los Angeles County.

Results

- No global association:** Greenspace SSP was not significantly associated with dementia prevalence or incidence in unadjusted or adjusted multilevel models.
- Strong local variation:** GWR revealed that the SSP–dementia association varied across LA County, with local coefficients differing in both magnitude and direction (**Figure 3**).
 - ❖ The relationship was strongly spatially non-stationary: coefficients ranged from about –30 to over +25 and reversed direction across the county.
 - ❖ Negative (purple) coefficients, indicating a protective association, concentrated in western and northwestern
 - ❖ while positive (adverse) coefficients (teal) clustered in South and Central LA.

Figure 3. Geographically varying association between greenspace SSP and dementia across Los Angeles County



Conclusions / Takeaway

- Greenspace SSP was not significantly associated with dementia in global models, but GWR revealed spatially varying associations.
- The global null finding may mask opposing local relationships that offset one another when averaged across space.
- Dementia-related benefits of greenspace may depend on local social and environmental context.
- Place-based models can identify areas where greenspace inequity may be more relevant for dementia burden.
- Equity-focused greenspace planning should consider not only the amount of greenspace, but also unequal access, spatial concentration of privilege and deprivation, and local neighborhood context.

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