TRANSPORTATION AND CLIMATE CHANGE ADAPTATION

A geospatial investigation of vulnerability and resilience in Los Angeles County

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Project Summary

> Across the country, transportation planners, engineers and policymakers have started devoting more attention to the issues of climate change resilience and adaptation.

> Many projects focus on the physical resilience of infrastructure; few consider the characteristics of people who use the infrastructure as a contributing factor for prioritizing funding or the specific vulnerabilities people might have related to transportation and access, and how those vulnerabilities might shift under a climate-change-affected future.

> This project investigates these concerns for Los Angeles County. By analyzing the geospatial variation of social vulnerability, climate change effects, and transportation access, planners and public officials can better understand the climate risks faced by the most vulnerable people in their jurisdictions and the transportation options available to those people.

Research Question

How resilient are the transportation users in LA County given population patterns, modal choices and availability, and predicted climate change effects?

Data Summary

Social Vulnerability	Description	Source	Date Published
CalEnviroScreen 2.0 Score	Index includes pollution exposure and population characteristics	California Office of Environmental Health Hazard Assessment	2014, with 2010 data
Climate Change			
Temperature Increase	Displays annual average temperature increase expected in 2050	Dr. Alex Hall, UCLA	2012
Wildfire Risk	Displays probability that an area will experience a wildfire by 2039	The Pacific Institute	2012
Flooding / Sea Level Rise	Displays inundation zone for 100-year floor in 2100, given 1.4 m sea level rise	The Pacific Institute	2009
Transportation			
Car Ownership	Displays the percentage of households without access to a vehicle	US Census, American Communities Survey	2012
Bus	Antelope Valley Transit Authority	SCAG	2007
	Big Blue Bus	City of Santa Monica	2014
	Culver City Bus	SCAG	2007
	DASH	SCAG	2007
	Foothill Transit	SCAG	2007
	Glendale Beeline	City of Glendale	2014
	Long Beach Transit	City of Long Beach	2014
	MetroBus	LACMTA	2013
	Montebello Transit	SCAG	2007
	Pasadena ARTS	City of Pasadena	2014
	Torrance Transit	SCAG	2007
Rail	Metro Rail	LACMTA	2012
	Metrolink commuter rail	Metrolink	2010
Bicycle	Facilities in LA County	LACMTA	2012
	Facilities in Santa Monica	City of Santa Monica	2014
	Facilities in Pasadena	City of Pasadena	2014
	Facilities in Long Beach	City of Long Beach	2014
Walking	Shows Grocery Score, reflecting grocery access by foot	Walkscore.com	2014

Analysis

A transportation access index was created using the following parameters:
> **Bus routes:** 0.5 mile
> **Rail stations:** 0.5 mile
> **Walkability:** 0.1 mile around the centroid of the census block group, to show an approximate spatial extent of each data point
> **Bicycle facilities (cycle tracks, Class I bike paths, or Class II bike lanes):** 0.25 mile
> **Car access:** Less than 13.7% of households without access to a car (lowest 80% of all census tracts)

Using ArcGIS, Maps A-E were created to show the interaction between social vulnerability, transportation and climate change.

Map A illustrates spatial patterns of transportation access and age vulnerability across Los Angeles County. The top 10% of census tracts with age vulnerability are shown with the transportation access index, described above.
Map B illustrates spatial patterns of transportation access and overall social vulnerability, as measured by the top 10% of CalEnviroScreen 2.0 scores, and the transportation access index.
Map C shows the overlap between areas with low transportation choice and wildfire risk.
Map D shows the overlap between areas with low transportation choice and temperature increase.
Map E shows the overlap between areas with low transportation choice and flooding risk.
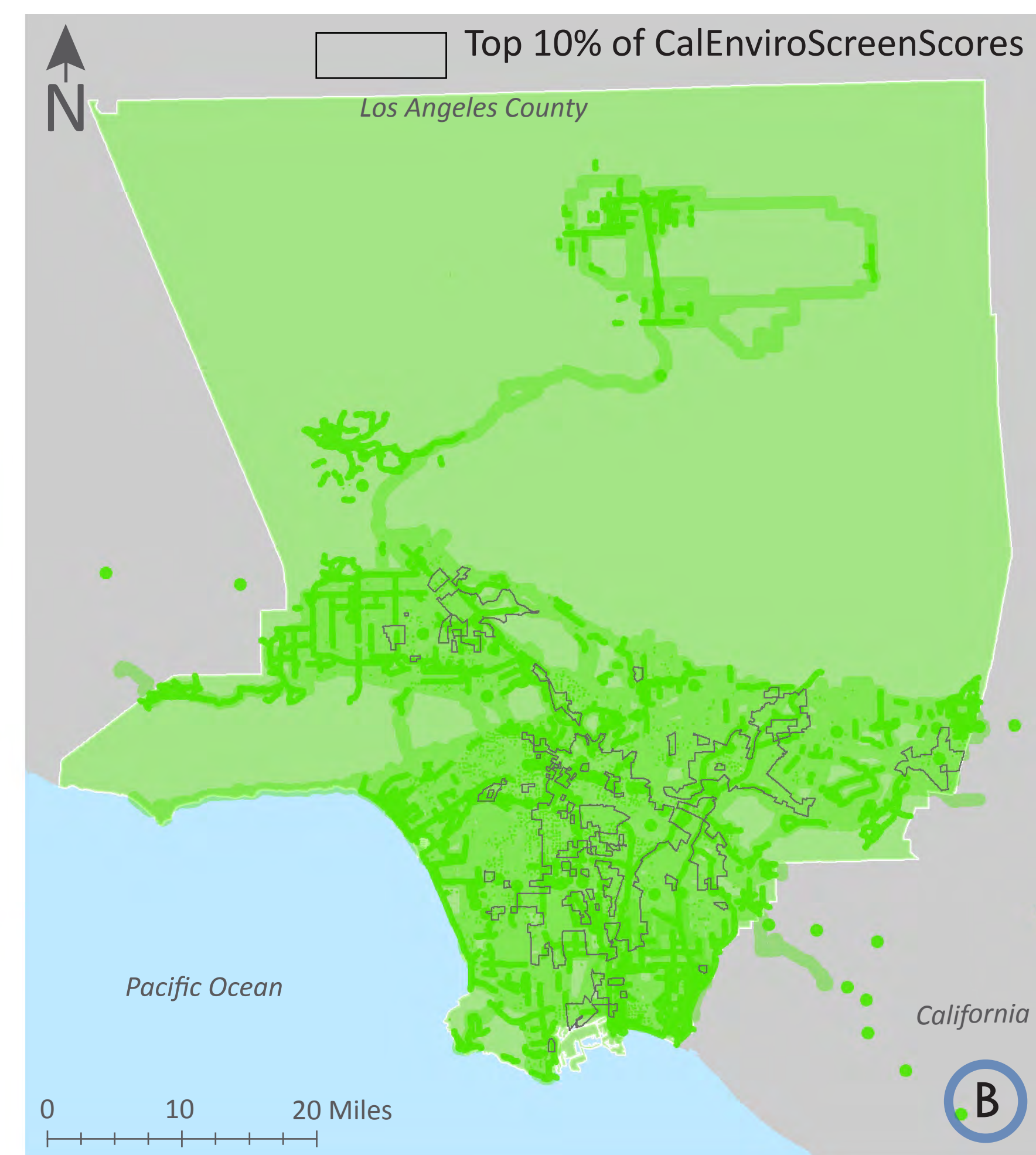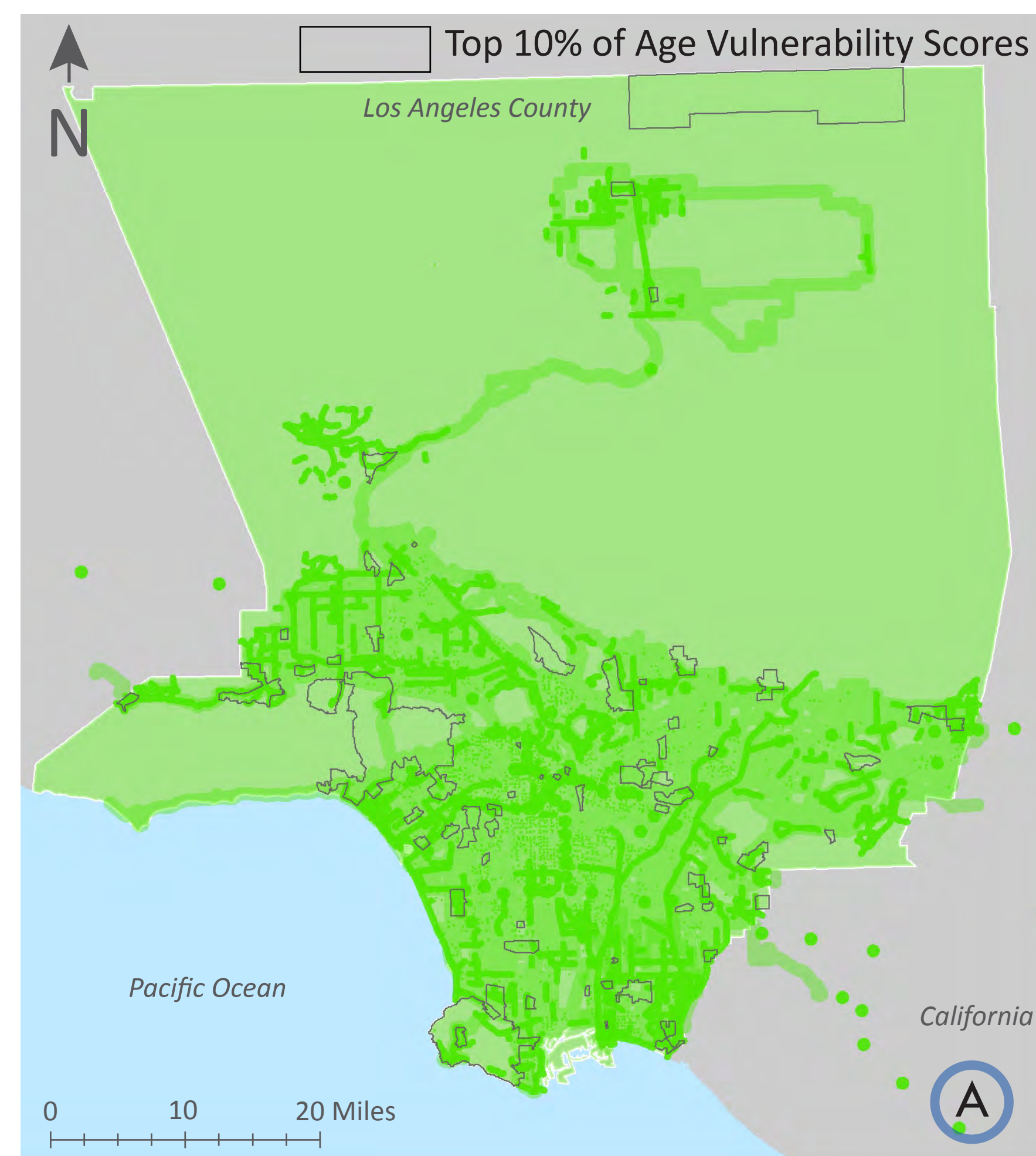
Findings and Recommendations

1. Some of the areas at highest risk of wildfire, heat, and flooding due to climate change are not the most socially vulnerable areas, overall. However, these areas still exhibit high age vulnerability and/or low transportation access.

Recommendation: Future research should look at individual vulnerability variables, rather than a vulnerability index, to analyze how each vulnerablity interacts with particular climate change risks.

2. There is an inherent tension between transportation access, climate risks, and population density. Many of the areas that exhibit high risk for climate change effects do not have high enough population density to warrant significant investment in public transit routes, so the people who live there are especially dependent on their own vehicles.

Recommendation: The jurisdictions identified in the inset maps should investigate the particular interactions between their populations and their unique transportation context. In particular, Los Angeles County has jurisdiction over many unincorporated areas that exhibit high levels of climate risk and low levels of transportation choice. These areas should think critically about how to address the tension between density and transportation choice.

3. In many places around the county, residents only have one mode choice other than their own vehicle: the bus, which provides the best spatial coverage but can vary widely in quality of service and frequency. The language of "redundancy" versus "mode choice" is politically charged and might prevent implementation of new transportation systems.

Recommendation: In order to bridge the linguistic divide between transportation planning, emergency management and climate change adaptation, transportation planners should integrate the goals of resilience into circulation elements of the general plan, focusing on mode choice as an adaptive strategy as well as an emissions mitigation strategy.

4. There are no sweeping correlations between areas that lack transportation choices and commonly used socio-economic variables ulike population density or income. The most vulnerable census tracts are distributed throughout the county, primarily in central or southern Los Angeles.

Recommendation: Local jurisdictions should conduct spatial analysis as climate data becomes available so planners and public officials understand how the predicted effects of climate change will impact the particular vulnerable populations they serve.

Top 10% of Age Vulnerability Scores
Los Angeles County
Pacific Ocean
California

Overall Transportation Choice
Less Choice — More Choice

Top 10% of CalEnviroScreenScores
Los Angeles County
Pacific Ocean
California

C
Top 25% of Age Vulnerability (Persons <10 or >65 years old)
Probability of wildfire by 2039 is between 0.345 and 0.468 (Top 40%)

Calabasas, Unincorporated, Los Angeles, Malibu
Palos Verdes Estates, Rolling Hills, Rancho Palos Verdes, Unincorporated, Los Angeles
Los Angeles, La Canada Flintridge, Burbank, Glendale, Pasadena, Unincorporated
Unincorporated, La Habra Heights, Santa Fe Springs, Unincorporated, Unincorporated

D
Top 25% of Age Vulnerability (Persons <10 or >65 years old)
Annual mean temperature increase between 3.29 and 3.78 Degrees F (Top 40%)

Unincorporated, Lancaster
Palmdale, Unincorporated

E
Top 25% of Age Vulnerability (Persons <10 or >65 years old)
Flood zone in year 2100, with predicted 1.4 meter sea level rise

Santa Monica, Los Angeles, Unincorporated, Los Angeles
Carson, Signal Hill, Los Angeles, Long Beach, Long Beach

Note: This project was adapted from a larger study. For full references and citations, please contact Chelsea Richer at chelsea.richer@gmail.com.