Assessing Electric Vehicle Readiness of Los Angeles City, California

Thanh Binh Le, Keough School of Global Affairs, University of Notre Dame

Introduction

In August 2022, the state of California marked a historic step in tackling climate change and emission reduction by issuing the rule to ban all new gas-powered sales by 2035. This policy is considered one of the most important efforts to clean the air, with the expectation to reduce 50% of pollution by 2040. As the pioneer, California's strong commitment brings hope to other states, such as New Jersey, New York, and Pennsylvania to follow[1].

A report from the Center for Sustainable Energy shows that 79% of new EV buyers in California come from households that have more than $100,000 annual income, which implies lower-income households may hesitate to adopt an EV[2]. To promote clean vehicle adoption, the state offers rebates ranging from $1,000 to $7,000 for the purchase or lease of new zero-emission vehicles, including electric vehicles (EV)[3].

However, the refund program alone is not sufficient for California to achieve its ambitious goal. Accessibility to EV charging stations could be a prominent barrier to successful EV adoption policies, especially in a metropolis. Research by Khan et. al. 2022 has indicated inequitable access to EV charging infrastructure in New York City as charging stations are inadequately distributed in low-income neighborhoods[4]. Additionally, evidence demonstrates a homeowner-renter gap for EVs in both California and the rest of the United States. Renters are three times less likely to own an EV than homeowners due to inaccessibility to charging stations. Specifically, renters rarely have access to a convenient parking spot for overnight charging, while homeowners could do so at their garage built-in charging stations. The challenge becomes more significant for renters living in multi-unit buildings. Additionally, the cost of at-home EV charging equipment could raise the entry barriers for renters as renters do not want to make expensive investments in a property they do not own, and landlords do not find the motivation to do so[5].

Methodology

To complement the findings in empirical research on EV adoption barriers in California and other United States metropoles, **spatial analyses** on areas of vulnerability and distribution of EV charging infrastructure are critical in assessing equitable distribution. The findings of this method would expect to acknowledge possible inequality in the current installation of EV charging stations, from which to recommend policymakers with better planning to set up EV charging infrastructure.

California's largest city, Los Angeles city, is the objective of the study (**Figure 1**). Los Angeles renters and multi-unit households are the two proxies to evaluate the equality of the policy. To buttress the vulnerability of the renter stakeholder, the rent-burdened index is used, which aggregates the population whose home rent accounts for more than 30% of the income. Households living in residences, each of which has 10 units or more are considered multi-unit households.

Figure 3 visualizes the current installment of EV charging stations and EV charging docks in capacity-weighted points. These two maps would show the relationship distribution of EV charging stations and each station's capacity (i.e: the number of charging docks). Information about charging docks is the summary of three types of EV supply equipment in each census tract (i.e: dock), which are Type 1, Type 2, and DC Fast Charging.

Figure 4 includes two choropleth maps to represent the distribution of rent-burdened and multi-unit households.

Figure 5 conducts a deeper analysis of the areas of "vulnerability" by using hot spot analysis.

Findings

The distribution of EV charging stations and EV charging docks are obviously correlated in **Figure 3**, however, there is a slight difference in the number of distributed EV charging infrastructures by census tract. This distinction is significant in the upper area of Los Angeles city, where each census tract has a small number of EV charging stations, but the capacity of each charging station is considerably higher than in other areas.

Figure 4 has two implications in the distribution of rent-burdened and multi-unit census tracts. There is a positive relationship between these two indexes in the upper area of Los Angeles city with an extremely high rent burden and a large number of multi-unit buildings. Meanwhile, the lower area indicates a negative correlation where nearly 70% or more of the population has a rent burden but the density of multi-unit residences is low.

Figure 5 presents the hot spot analysis to confirm the vulnerability of the two aforementioned areas. The Northern and Southeastern area of Los Angeles city is the hot spot for rent-burdened households, implying an area of vulnerability. The center of Los Angeles city shows hot spots for multi-unit households. Interestingly, on a closer look at the Western and Southern parts of the city, a contradictory picture could be seen between the two indicators: one is a hot spot for rent burden but a cold spot for multi-unit buildings, and vice versa.
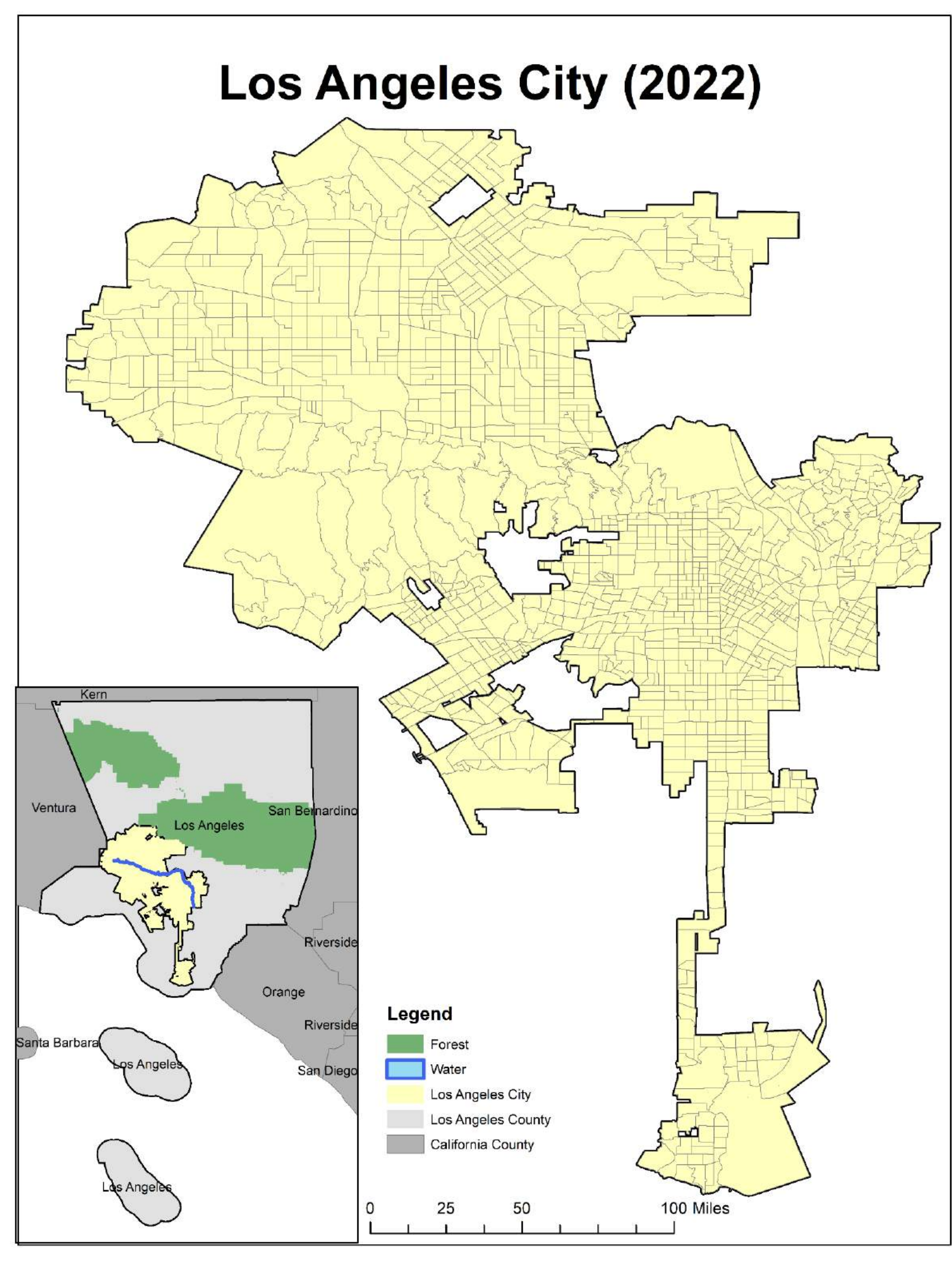
Data source

Los Angeles base maps (water, boundary, and county): Los Angeles GeoHub. 2022. https://geohub.lacity.org/
Rent burden data: The County of Los Angeles. "Los Angeles County Climate Vulnerability Assessment". 2022 https://lacounty.maps.arcgis.com/apps/webappviewer/index.html?id=c78e929d004846bb993958b49c8e8e65
Multi-unit households data: U.S. Census Bureau. "American Community Survey", 2021
EV charging information: U.S. Department of Energy. "Alternative Fuel Data Center". 2022. https://afdc.energy.gov/fuels/electricity_locations.html#/find/nearest?fuel=ELEC
EV Sales: California Energy Commission. 2022. https://www.energy.ca.gov/data-reports/energy-almanac/zero-emission-vehicle-and-infrastructure-statistics/new-zev-sales

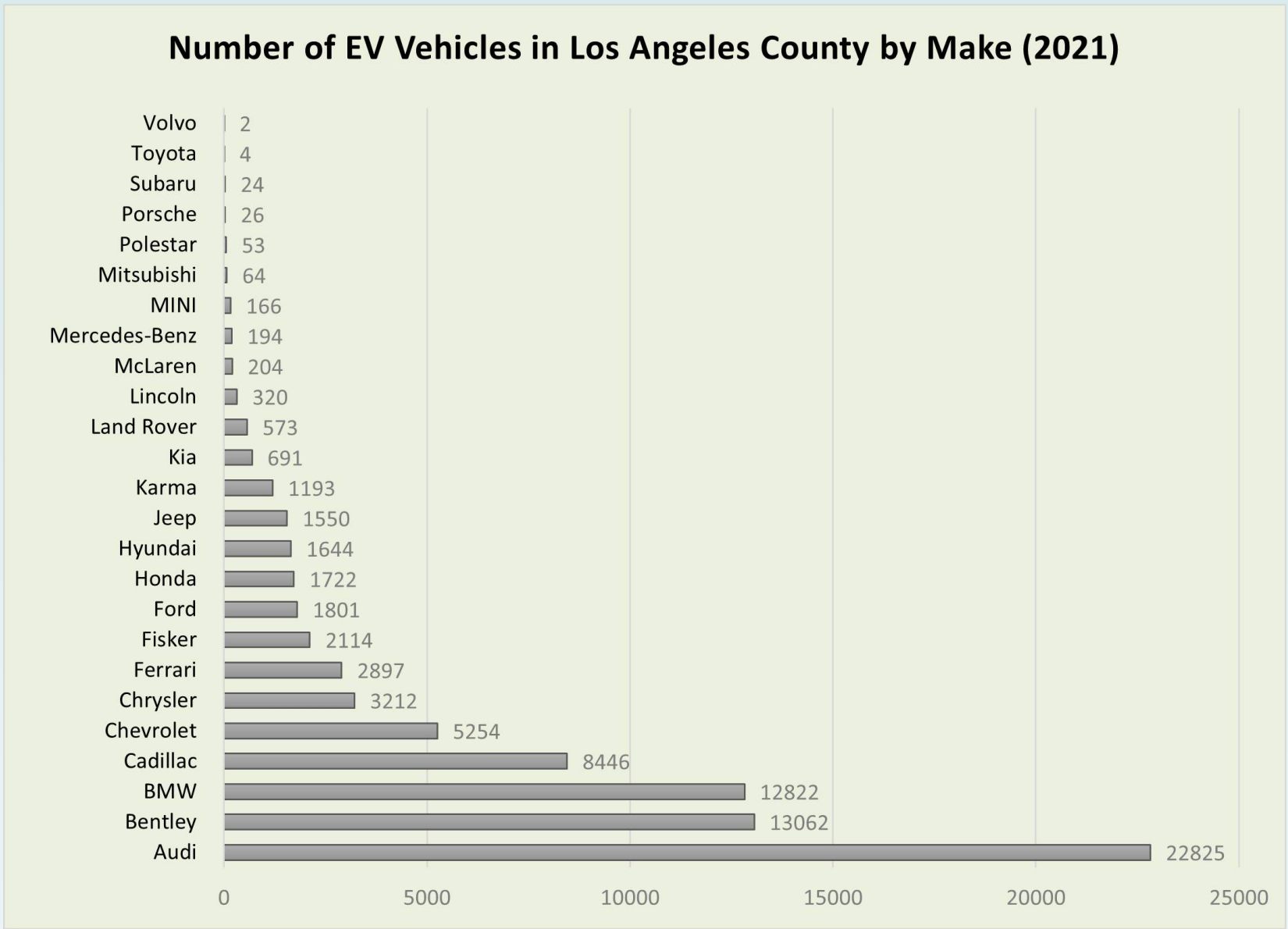**Figure 1:** Map of Los Angeles City (2022**)**

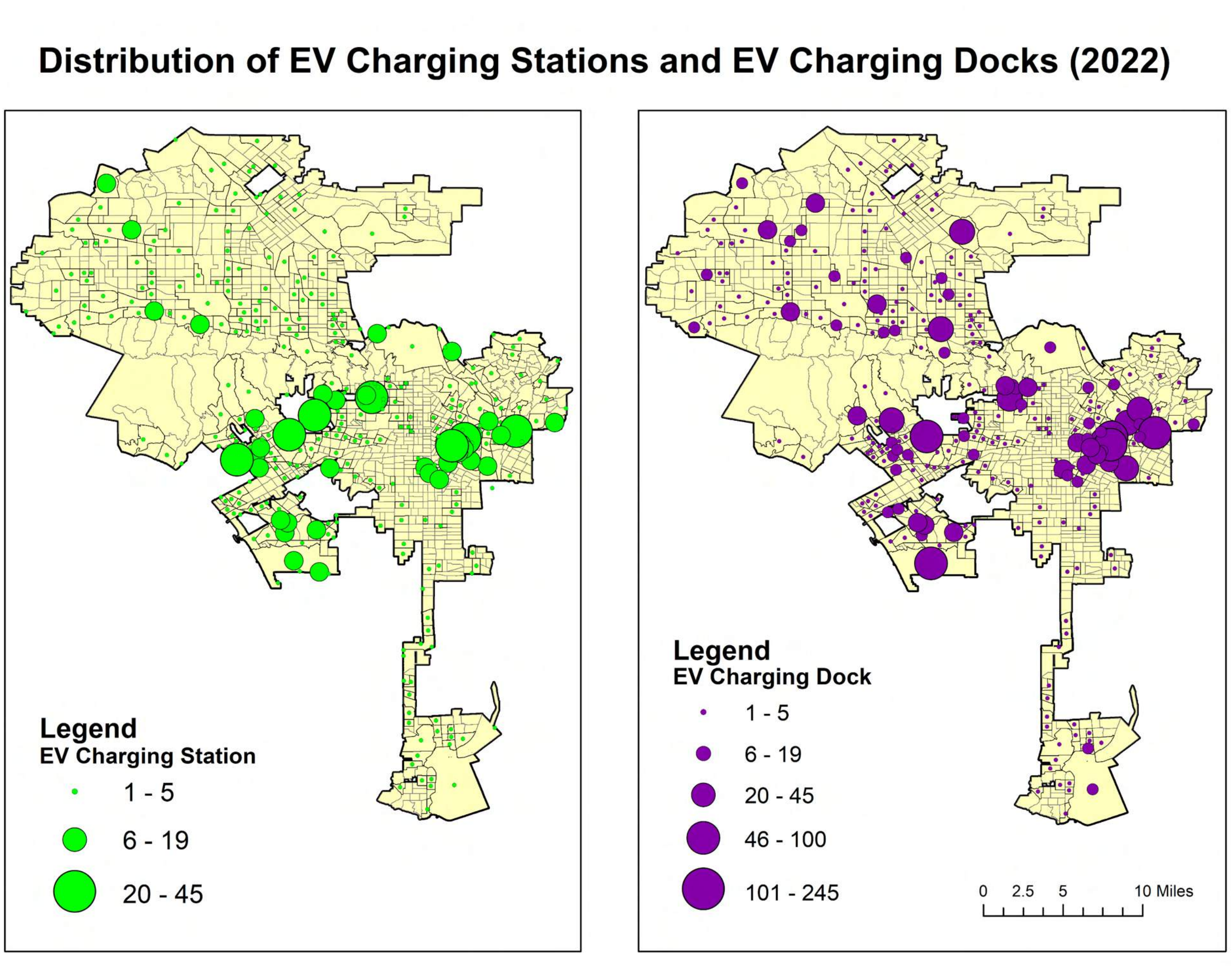**Figure 2:** Number of EV in Los Angeles County by Make (2022)

Figure 3: Distribution of EV Charging Stations and EV Charging Docks (2022)
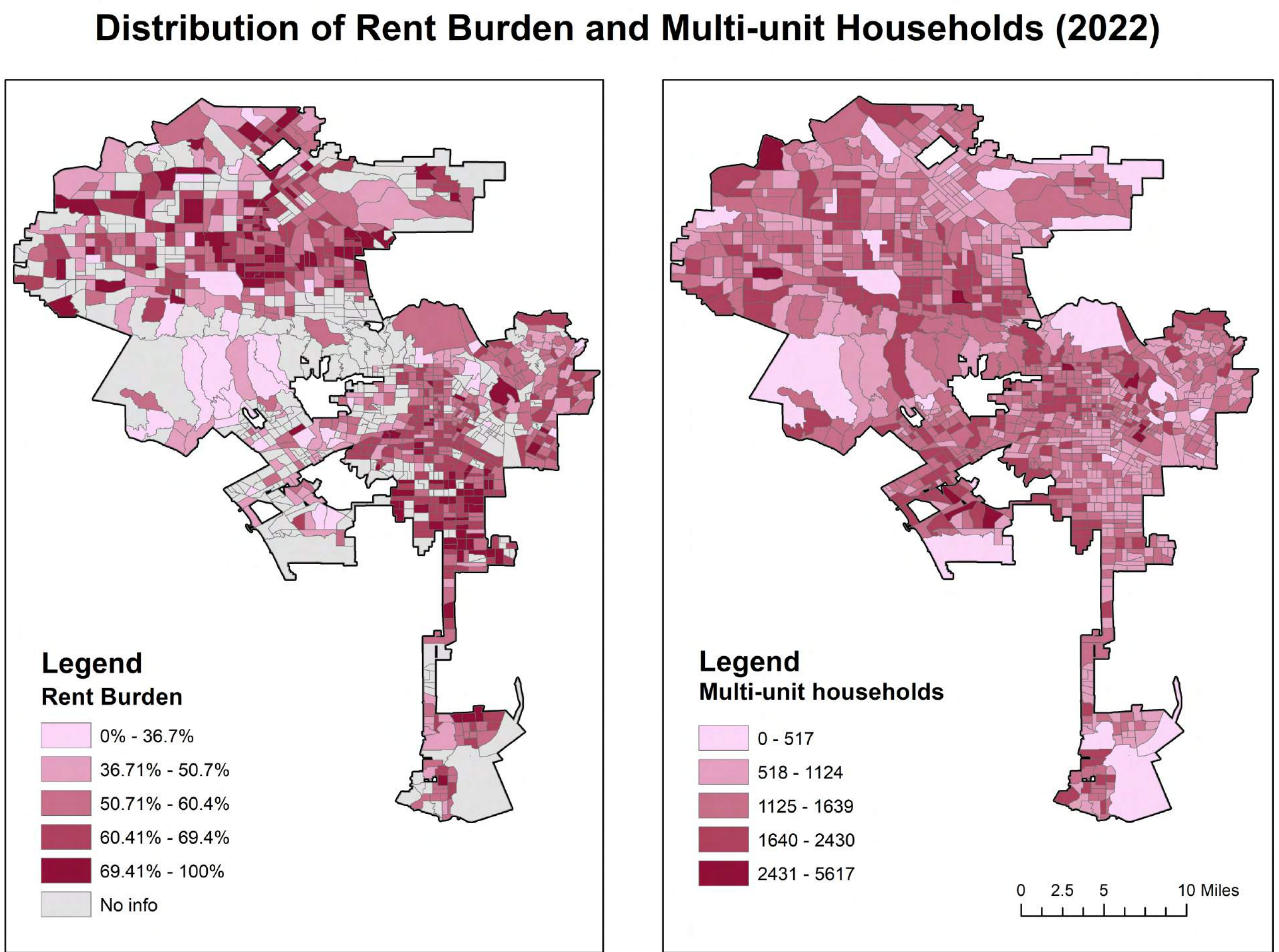

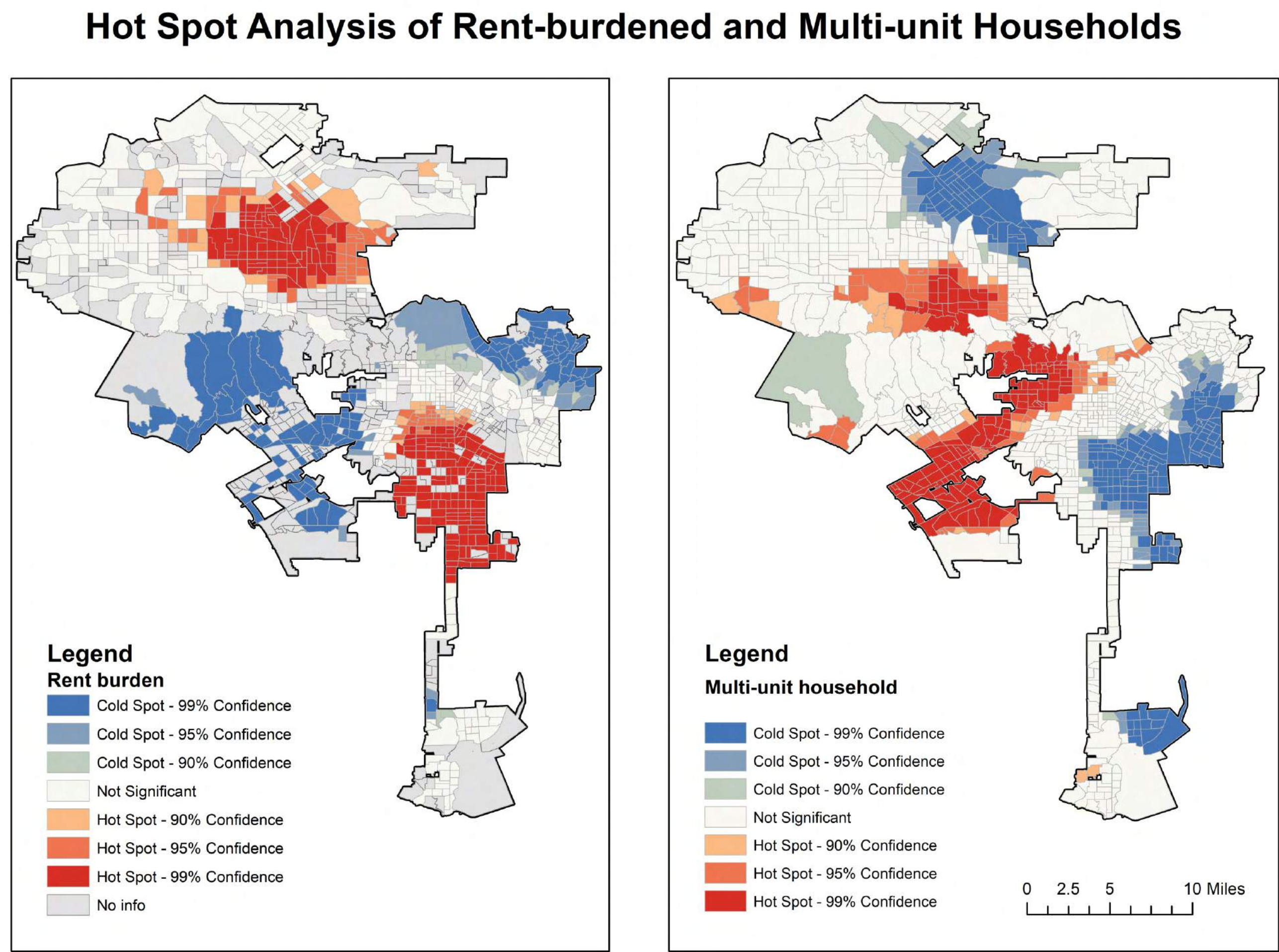**Figure 4:** Distribution of Rent Burden and Multi-unit Households (2022)

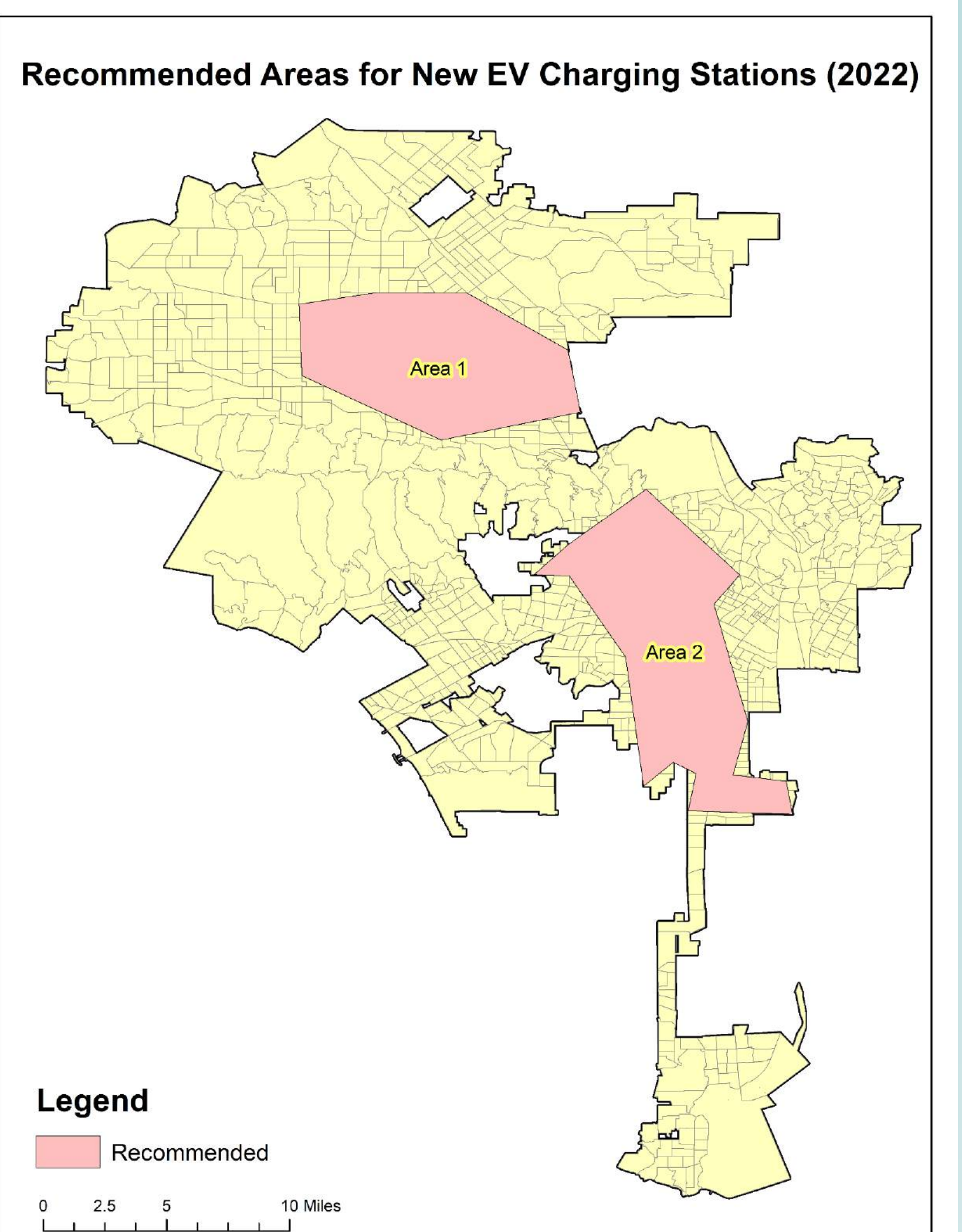**Figure 5:** Hot Spot Analysis of Rent-burdened and Multi-unit Households (2022)

Figure 6: Recommended Areas for New EV Charging Stations (2022)

Recommendations

The *Northern* and *central areas* of Los Angeles are hot spots for rent burden and multi-unit residences, let alone they are neighboring areas. Therefore, a strong focus in this area should be seriously considered as the lack of charging stations in an area can **spill over** to the nearby ones. The focus in these areas should be on the number of **new multi-dock charging stations**, each of which should have high capacity with multiple charging equipment.

In combination of Figure 3 and Figure 5, it is recommended to set up more charging stations in the Southern part of Los Angeles city due to its vulnerability. However, as this area is a cold spot for multi-unit residences, multi-dock stations are not required. **Small charging stations** are recommended, but the availability of these stations in the area should be improved.

The two recommended areas for the new installation of EV charging stations are illustrated in **Figure 6**.

Reference

[1] CNBC. 2022. "California bans the sale of new gas-powered cars by 2035." *CNBC*, August 25, 2022. https://www.cnbc.com/2022/08/25/california-bans-the-sale-of-new-gas-powered-cars-by-2035.html.
[2] California Center for Sustainable Energy. n.d. "California Plug-in Electric Vehicle Owner Survey." California Plug-in Electric Vehicle Owner Survey.
[3] Clean Vehicle Rebate Project. n.d. "CVRP Overview." Clean Vehicle Rebate Project. Accessed December 5, 2022. https://cleanvehiclerebate.org/en/cvrp-info.
[4] Khan, Hafiz A., Sara Price, Charalampos Avraam, and Yury Dvorkin. 2022. "Inequitable access to EV charging infrastructure." *The Electricity Journal* 35, no. 3 (February). https://doi.org/10.1016/j.tej.2022.107096.
[5] Davis, Lucas W. 2019. "Evidence of a homeowner-renter gap for electric vehicles." *Applied Economics Letters* 26, no. 11 (September): 927-932. https://doi.org/10.1080/13504851.2018.1523611.