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Introduction

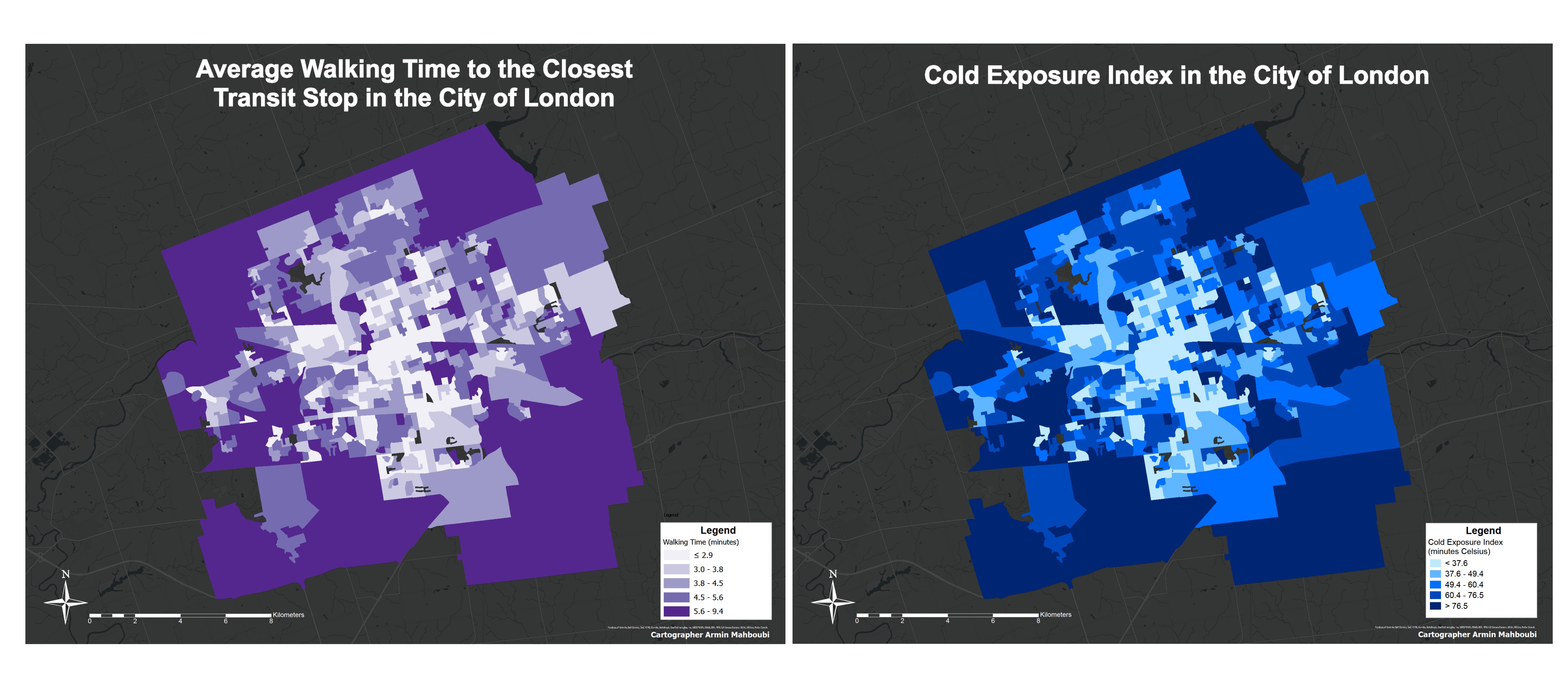
Due to the expansion of suburban areas in many cities around the world, accessibility to public transit through walking has become a new challenge for riders. Considering the impacts of climate change in creating more extreme weather, such as extreme cold, heat, or flooding, transit riders may thus be at a higher risk of exposure for various weather -related illnesses (Fraser & Chester, 2016).

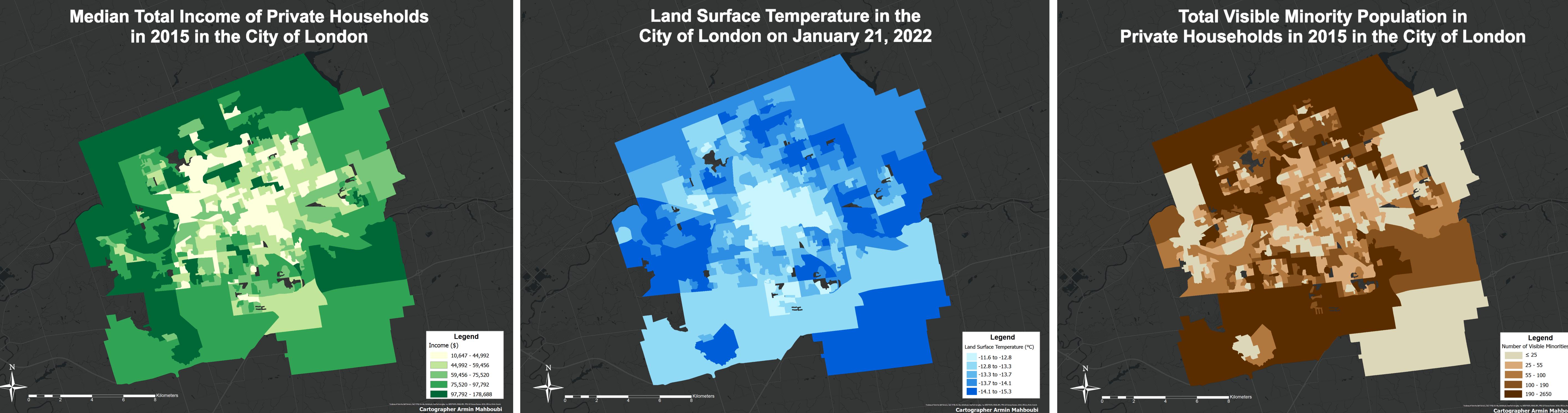
Using ArcGIS Pro and ArcMap software, and data collected from City of London's Open Portal, the United States Geological Survey, Open Mobility Data, and Statistics Canada, the exposure and vulnerability of transit riders to cold temperatures in London were calculated and visualized. This was done by measuring the walking distance from the center of postal codes to the three closest bus stops, and thereafter calculating the average land surface temperature along the respective route. The analysis excluded areas where the average distance to the closest stop was beyond 800 metres, since it would be unlikely for an individual to walk longer distances to access public transit (Fraser & Chester, 2016). The information was then amalgamated and averaged to the dissemination area scale in order to standardize the neighbourhoods to match census tracts.

The cold exposure index was then calculated by multiplying the average walking time to the closest bus stop with the average absolute value of the land surface temperature of the respective route. A walking speed of 4.7 km/h, consistent with the average human walking speeds, was selected for the analysis.

Lastly, the median total income and visible minority population data within private households in each neighbourhood in London were collected and visualized using the 2016 national census to discern any equity implications related to the vulnerability of riders.

Measuring the Exposure and Vulnerability of Transit Riders to Cold Temperatures in London, Ontario, Canada





Results

August 15, 2022

Discussion

The maps reveal contrasting results in cold temperature exposure. The average walking time to the closest bus stop in each neighbourhood as seen in the top left map increases as we get farther from downtown and the central business district. Thus, the outskirts of the city have the highest walking time to the nearest bus stop. Furthermore, the land surface temperature data collected on January 21, 2022 also reveals that the downtown core boasts the warmest temperatures, with temperatures getting progressively colder as we move to the periphery.

The final resultant map visualizes the cold exposure index, revealing that riders who live farther from the city's core both have to walk longer to the nearest bus stop, and are more exposed to cold temperatures.

The two equity maps also reveal similar but ambiguous results. When looking at the visible minority population, more minorities live in the outskirts of the city, emphasizing the higher vulnerability of such populations. However, the median total income of private households showcases the fact that although income levels may be higher in the outskirts of the city due to larger houses in suburban neighbourhoods, citizens may conversely be less willing to take public transit as a reliable method of commuting due to longer walking distances.

Acknowledgments

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