

# Seeking Environmental Justice in a Developed City: How Does Citizen's Carbon Footprint Compare Between Advantaged and Disadvantaged Neighborhoods in the City of Montreal

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Data on the environmental impact of food choices exist, but their fragmented dissemination hampers policymakers in designing effective behavior change initiatives for more environmentally friendly diets. Integrating environmental concerns adds complexity to policy formation, specifically in cities where socioeconomic differences are salient.

This paper introduces a novel method to estimate neighborhood-level carbon footprints linked to food purchases. By combining purchase data from a large supermarket retail chain (loyalty program data) and carbon footprint estimates from life-cycle assessments, the study presents estimates of carbon footprints associated with food consumption across 111 neighborhoods in Montreal region.

To accomplish this mission, first, we ensured that the loyalty program data correctly represent eligible stores in the Montreal region: food stores in the loyalty data were matched using geocoding with a verified list of on-the-ground stores. Then individual-level food purchases were aggregated (1) by neighborhoods (n=111) based on the clients' postal codes and (2) by higher-order food categories for matching, focusing on sources of protein as a first step. The resulting average consumption by category and neighborhood was then linked to carbon footprint data which was retrieved from three databases: two global averages and one Quebec-specific dataset. The average carbon footprint of each food category was calculated, and inter-rater reliability verifications were conducted.

The results reveal higher quantities of animal-based protein purchases compared to plant-based alternatives across all neighborhoods. Among animal-based protein categories, animal-based milk is the most consumed, followed by yogurt, while plant-based milk and legumes are the most consumed plant-based protein items. Animal-based protein categories, particularly beef, contribute significantly to carbon emissions. Neighborhood-level socio-economic factors, like household structure-was related to food purchase quantities, while the poverty index is only marginally related to carbon emissions.

The results also demonstrate that utilizing region-specific versus global average carbon footprint datasets can yield significant variations in carbon footprint estimates.

These findings offer a roadmap for policymakers to integrate environmental considerations through equitable processes in food policies. Furthermore, they emphasize crucial considerations for scientists seeking to incorporate carbon footprint data into interdisciplinary and transdisciplinary sustainability research.