Idea #2: Mapping and Predicting Food Deserts in Canadian Cities

Acceptance Likelihood: 4.7/5 — Strong Pick

The Problem

Food deserts are areas where residents have poor geographic access to grocery stores and fresh food. In Canada, this disproportionately affects low-income, elderly, immigrant, and disabled populations.

Key Statistics

- **62%** of families in subsidized housing are food insecure (StatCan)
- **48%** of female lone-parent families are food insecure
- **48%** of Indigenous families are food insecure
- **60%** of families where major income earner is unemployed are food insecure
- Urban food deserts defined as residences **>1 km** from a food store
- Rural food deserts defined as residences **>16 km** from a food store
- Food insecurity rates have risen significantly post-COVID with grocery inflation

Why It Matters

People in food deserts rely on convenience stores with limited, expensive, and unhealthy options. This directly contributes to diet-related diseases (diabetes, heart disease, obesity) and deepens poverty cycles. Identifying and predicting food deserts enables cities to make informed decisions about zoning, transit, and food program placement.

Why Machine Learning Can Help

Food desert formation is driven by observable socioeconomic and geographic patterns:

- **Income levels** (strongest predictor per CHAID analysis)
- **Population density and demographics** (age, immigration status)
- **Retail store density and type**
- **Transit accessibility scores**
- **Housing type and tenure** (owned vs. rented)
- **Neighborhood deprivation indices**

ML can identify at-risk neighborhoods before they become full food deserts, and classify existing areas by severity.

ML Tasks

1. **Clustering:** K-medians to identify food environment typologies across 56,589 Canadian dissemination areas
2. **Classification:** Decision tree / Random Forest to predict food desert status from socioeconomic features
3. **Spatial analysis:** Map predictions to identify intervention priorities

Published Approaches

- **CHAID decision trees:** Successfully identified income as key predictor of food desert status

- **K-medians clustering:** Can-FED dataset used this to create categorical food environment variables
- **Logistic regression:** Used in Mississauga study to identify socioeconomic indicators of food deserts

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Datasets

1. StatCan Food Desert Indices (Primary)

- **Source:** Statistics Canada via Open Canada Portal
- **URL:** https://open.canada.ca/data/en/dataset/c69d8357-061a-4122-b8b9-51bcbc786aa7
- **Contains:** Geographic food desert indices, accessibility scores to food shops (grocery stores, supermarkets, public markets)
- **Coverage:** Quebec-focused but methodology applicable nationally
- **Format:** GeoJSON, downloadable

2. Can-FED Pan-Canadian Food Environment Dataset

- **Source:** Statistics Canada Business Register
- **URL:** https://www150.statcan.gc.ca/n1/pub/82-003-x/2022002/article/00001-eng.htm
- **Contains:** Retail food environment measures for 56,589 dissemination areas across all of Canada
- **Features:** Network buffer distances to food retailers, food environment typology classifications
- **Format:** Academic dataset — may need to request access

3. StatCan Food Insecurity Survey Data

- **Source:** Canadian Income Survey / Household Food Security Survey Module
- **URL:** https://www150.statcan.gc.ca/n1/pub/75-006-x/2023001/article/00013-eng.htm
- **Contains:** Food insecurity rates by demographic group, province, income level
- **Use:** Ground truth for validation and impact framing

Proposed ML Pipeline

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1. Data collection & integration
   — Download food desert indices from Open Canada
   — Obtain or reconstruct Can—FED measures
   — Merge with Census demographic data (income, age, immigration status)

2. Exploratory analysis
   — Spatial visualization of food deserts across Canadian cities
   — Correlation between deprivation indices and food access
   — Comparison across provinces/CMAs

3. Model training
   — K—medians clustering to identify food environment typologies
   — Random Forest classifier to predict food desert status
   — CHAID decision tree for interpretable policy recommendations
   — Feature importance analysis

4. Evaluation
   — Classification accuracy, precision, recall
   — Spatial validation (does the model identify known food deserts?)
   — Cross—city generalization testing
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5. Deliverable
   — Interactive map of Canadian food deserts with risk scores
   — Feature importance dashboard (what drives food deserts?)
   — Policy recommendation report for city planners
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Strengths

- **Purpose-built government dataset:** StatCan created this data specifically for food desert analysis
- **Pan-Canadian scope:** Can-FED covers all 56,589 dissemination areas in Canada
- **Novel for Let's SOLVE It:** Food deserts never explored in past cohorts (food bank forecasting is different)
- **Strong equity angle:** Disproportionately affects low-income, Indigenous, immigrant, elderly populations
- **Actionable output:** Maps and risk scores directly useful for city planning and food program placement
- **Clear ML task:** Clustering + classification with clean tabular data — very feasible for undergrads

Risks & Mitigations

Risk	Mitigation
Can-FED may require academic access	Use Open Canada food desert indices as primary. Supplement with Census data.
More analysis than prediction	Frame as predicting emerging food deserts — which neighborhoods are one store closure away?
Quebec-focused primary dataset	Acknowledge limitation. Propose national extension as future work.
Data is point-in-time	Use multiple Census years to create temporal dimension for prediction

References

- Open Canada Portal: "Indices of food desert and accessibility to food shops" — https://open.canada.ca/data/en/dataset/c69d8357-061a-4122-b8b9-51bcbc786aa7
- StatCan (2022): "A pan-Canadian dataset of neighbourhood retail food environment measures" — https://www150.statcan.gc.ca/n1/pub/82-003-x/2022002/article/00001-eng.htm
- MDPI (2025): "Identifying Food Deserts in Mississauga" — https://www.mdpi.com/2413-8851/9/7/265
- StatCan (2023): "Food insecurity among Canadian families" — https://www150.statcan.gc.ca/n1/pub/75-006-x/2023001/article/00013-eng.htm