HUNGER ATLAS: FOOD INSECURITY IN ONTARIO BY ELECTORAL RIDING METHODOLOGY

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ABSTRACT

The purpose of this report is to outline the methodology used within the development of the hunger atlas completed for the client, Feed Ontario. The methodology outlined primarily refers to the data acquisition and pre-processing stages of the map's development. The spatially calculated methods used within certain stages are also explained in greater detail in order to provide validity to the findings.

KEYWORDS

CONTENTS

I. LIST OF FIGURES

II. LIST OF TABLES

1. INTRODUCTION

1.1 PROJECT BACKGROUND, SCOPE, & PREVIOUS WORK

This report aims to provide the methodology applied throughout the development of the interactive hunger atlas. Since 2014, Feed Ontario has been acquiring its organizational data from the software company Link2Feed. Link2Feed provides a robust client intake tool allowing non-profit organizations in the food industry to effectively track food bank usage and other relevant data. The system has provided many food banks with a useful resource for understanding hunger in Ontario and beyond. This data structure is groundbreaking for Feed Ontario, but does not possess an effective online platform to visualize and communicate this knowledge with the greater public and policy makers.

Given the lack of an effective way to communicate the data, an interactive web map was requested capable of effectively displaying data collected from the year of 2018. As a result of this request, a product has been created in the form of web-based interactive application displaying data pertaining to foodbank usage across Ontario.

1.2 PROBLEM DEFINITION

Data regarding food bank usage is collected on an ongoing basis through software provided by Link2Feed. As food banks acquire new clients daily, the need to analyze data becomes more prominent. Key issues within the food bank industry stem from a lack of an effective medium to analyze, display and communicate the data. By analyzing and effectively presenting the data, unobserved trends and increased awareness can be brought towards the issue food security in Ontario.

1.3 STUDY AREA

The study area encompasses each provincial electoral riding across the entire province of Ontario. Please refer to Figure 1. and Figure 2. below for reference.
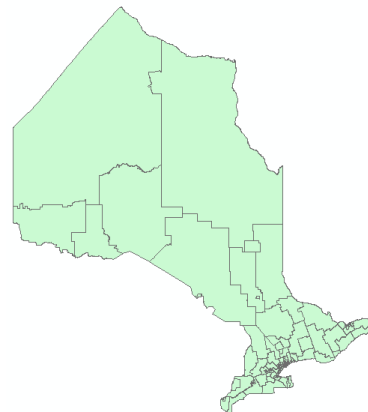

Figure 1. *Project Study Area within Canada*

Figure 2. *Project Study Area with electoral riding boundaries*

2. METHODOLOGY

2.1 DATA ACQUISITION

Refer to Appendix I, Table 1. to view the MetaData of the project's datasets.

2.1.1 PRELIMINARY DATA

The preliminary data sets acquired for the map include the location of each provincial electoral riding in Ontario, the population of each riding, and the point locations of every 6-character postal code in Ontario. The data containing the location of each provincial electoral riding and the population counts were obtained through Elections Ontario. The data containing the point locations of every 6 character postal code in Ontario were acquired through the company Geolytica Analytics Inc.

2.1.2 PRIMARY DATA

The primary data used to develop the map was collected from Link2Feed, the client intake system used by all Feed Ontario member food banks and their affiliate agencies, between the period of January 1, 2018 and December 31, 2018. This map only represents the individuals that provided their residential postal code when they visited a food bank. A total of 507,977 people visited a food bank during this period, but only 446,183 are represented on this map. Link2Feed provides Feed Ontario and its members the capability to collect information regarding food bank usage.

The first data set used to develop the Hunger Atlas contains the number of total food bank visits (adult and child counts) sorted by each visitors respective 6-character postal code. The second data set used contains the number of total unique individual visits (adult and child counts) also sorted by each visitor's respective 6-character postal code.

Due to insufficient data, food bank use in the ridings of Kiiwetinoong, Mushkegowuk-James Bay, and Kenora-Rainy River were not accurately reflected on this map. Northern food insecurity is both complex and a crisis in Ontario and across Canada. Northern food banks do provide service to these remote areas; however, the numbers reported are significantly lower than the number of people served or requiring support. Feed Ontario supports Food Banks Canada in its work to address Northern food insecurity and their recommendations.

2.1.3 SUPPLEMENTARY DATA

The supplementary data used within the Hunger Atlas was obtained from Environics Analytics using a method called data apportionment through ArcGIS Online.   The supplementary data sets included mean income, median income and occupied private dwelling by tenure.

2.3 DATA PRE-PROCESSING

After acquiring the data, the next stage within the methodology required the data to be pre-processed and manipulated to ensure all desired data was captured appropriately. Refer to table 1. in appendix I for an in-depth technical outline of the steps taken to pre-process the data.

2.3.1 GEOGRAPHICALLY REFERENCE THE COLLECTED DATA

The first step required was to assign the geographic location of each 6 character postal code collected by Link2Feed. The file containing the geographic locations of each 6 character postal code was then matched with the data from Link2Feed. This resulted in capturing the exact point locations of each recorded food bank visit and its associated data.

2.3.2 CALCULATE THE PRIMARY STATISTICS

The second step required was to calculate the grand totals of the Link2Feed data within each electoral riding. This was achieved by running a tool within ArcGIS software that calculates the statistics of the data associated with each point location. The tool is designed to calculate the sums of all the supplied point data within each defined area.
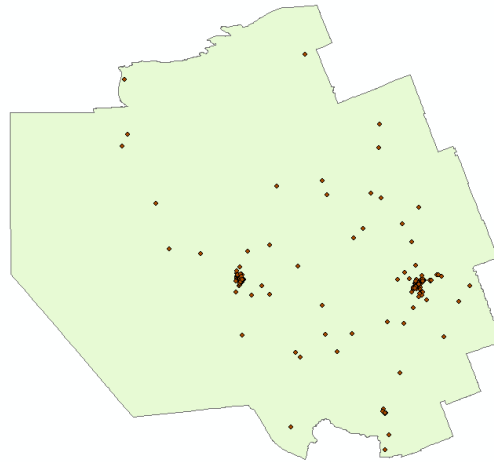

Figure 3. *Project Study Area with electoral riding boundaries*

The figure above displays the geographic locations of the matched postal codes within the selected electoral riding. Each point location, determined by postal code, contains the number of unique individuals and total visits (adult and child counts). The tool selects the points contained within each riding and calculates the sum of all associated statistics specific to that riding. The result of this example would display the grand totals of child visits, adults visits and total visits that took place within the riding.

2.3.2 MEAN INCOME, MEDIAN INCOME AND CCCUPIED PRIVATE DWELLING BY TENURE

The mean income, median income and occupied private dwelling by tenure of each riding were all calculated using a method call data apportionment. Data apportionment captures information based on the relative portion of each area.

Figure 4. *Data apportionment*

In the figure above, the circle represents the chosen area that will capture all the desired information. The blocks and block groups each contain information attached that is then calculated based on the proportion that lies within the circle. Environics Analytics has supplied ArcGIS online with a variety of information that is geographically referenced by these blocks and block groups. In the case of the web-map, information such as mean income, median income and occupied private dwelling by tenure were all calculated based on the relative proportion of each block group contained within every riding by using a tool called "Data Enrichment". In this example an electoral riding would represent the circle.

2.3.4 UNIQUE INDIVIDUAL VISITS PER CAPITA

The unique individual visits per capita was calculated based on the rounded percentage of the total unique individuals visiting a food bank. The formula used to calculate this statistic was:

$$Unique\ Individuals\ Per\ Capita = \frac{\text{Total Unique Individuals Visiting}}{\text{Population of Riding}}\ X\ 100$$

3. CONCLUSION

The methodology outlined in this report aims to provide validity to the process used to calculate and present the data in the form of an interactive web-map. The methodology outlined within this report was the final solution used after experimenting with other various methods.

REFERENCES

Feed Ontario. (n.d.). *Feed Ontario*. Retrieved from About Us: https://feedontario.ca/about-us/

Feed Ontario. (January 2019). *Brand Guide Version 1.0.* Toronto: Feed Ontario.

Mapbox. (2017). *Mapbox Tutorials*. Retrieved from Mapbox: https://www.mapbox.com/

Mapbox Tippecanoe. (2019, May 16). *Github*. Retrieved from mapbox/tippecanoe: Build vector tilesets from large collections of GeoJSON features: https://github.com/mapbox/tippecanoe

OAFB. (2018). *Hunger Report 2018 A Looming Crisis: Senior Hunger in Ontario.* Retrieved from feedontario.ca: https://feedontario.ca/wp-content/uploads/2018/11/Hunger-Report-2018-Digital.pdf

Sinton, D. S. (2017, July 16). *Communicating through Maps: Exploring the complexities and challenges of GIS mapping*. Retrieved from directionsmag.com: https://www.directionsmag.com/article/1243

Data Set	Type	Source	Format
Provincial Electoral Ridings	Preliminary	Elections Ontario	.shp
Postal Code Conversion File (PCCF)	Preliminary	Geolytica Inc.	.xlsx
Population of Each Riding	Preliminary	Elections Ontario	Manually Entered in .shp file
Ontario Food Bank Visits	Primary	Feed Ontario, Link2Feed	.xlsx
Unique Individual Food Bank Visits	Primary	Feed Ontario, Link2Feed	.xlsx
Mean income, median income and occupied private dwelling by tenure	Supplementary	ArcGIS Online, Environics Analytics	Data apportionment into .shp file

Table 1. *Metadata of relevant project datasets*

Step	Requirement	Action Taken	Software	Result
1	Reduce Postal Code Conversion File to Ontario postal codes	Select only postal codes within Ontario by using ArcGIS' select by location tool	ArcMap 10.6	Shapefile containing postal codes only in Ontario
2	Join postal code data from client with Postal Code Conversion File	SQL statement joining postal code data from client with PCCF	Microsoft Access	Entire Postal Code Conversion File containing Ontario point with all matched records from JOIN
3	Select only the matched records of client data	(1) Export previous join to an Excel Spreadsheet (2) Upload Excel Spreadsheet containing previous join (3) administer SQL statement in query that selects only matching records (4) Export query results to .csv file	Microsoft Access	.csv file of all matched postal code records with xy locations and client food bank use data
4	Display XY data of matched .csv file of all matched records	(1) Set data frame to GCS of WSG 1984 (2) Import .csv to ArcMap and assign longitude and latitude attributes to XY Data (2) Export to shapefile	ArcMap 10.6	Shapefile of postal code points containing client data
5	Spatial join shapefile of matched records with polygon shapefile containing provincial electoral ridings	(1) Import riding shapefile and Shapefile of matched records (2) Batch project both shapefiles to Web Mercator (3) Administer spatial join	ArcMap 10.6	Shapefile containing the sum of each data field associated with
6	Clean Data	(1) Export attribute table to .csv from ArcMap 10.6 (2) Delete and rename relevant fields appropriately (3) Import to ArcMap as a table (4) Ensure data field types are correct	ArcMap 10.6 Microsoft Excel	Shapefile containing data from all electoral ridings with correct field names and data types

		(5) Rejoin data to shapefile based on Electoral_ID (6) Delete old fields with improper names		
7	Obtain mean income, median income and occupied private dwelling by tenure	(1) Import Shapefile containing data from all electoral ridings into ArcGIS Online (2) Run Data Enrichment tool and select desired data sets (3) Export results to shapefile	ArcGIS Online Enrich Layer tool	Shapefile containing food bank usage data, mean income, median income and occupied private dwelling by tenure across each electoral riding
8	Add population data for further data calculations	(1) Create population field and manually enter population values listed on Elections Ontario website	ArcMap 10.6	Shapefile containing food bank usage data, mean income, median income, occupied private dwelling by tenure, population, and unique individual visits per capita across each electoral riding

Table 2. *Data pre-processing steps taken*