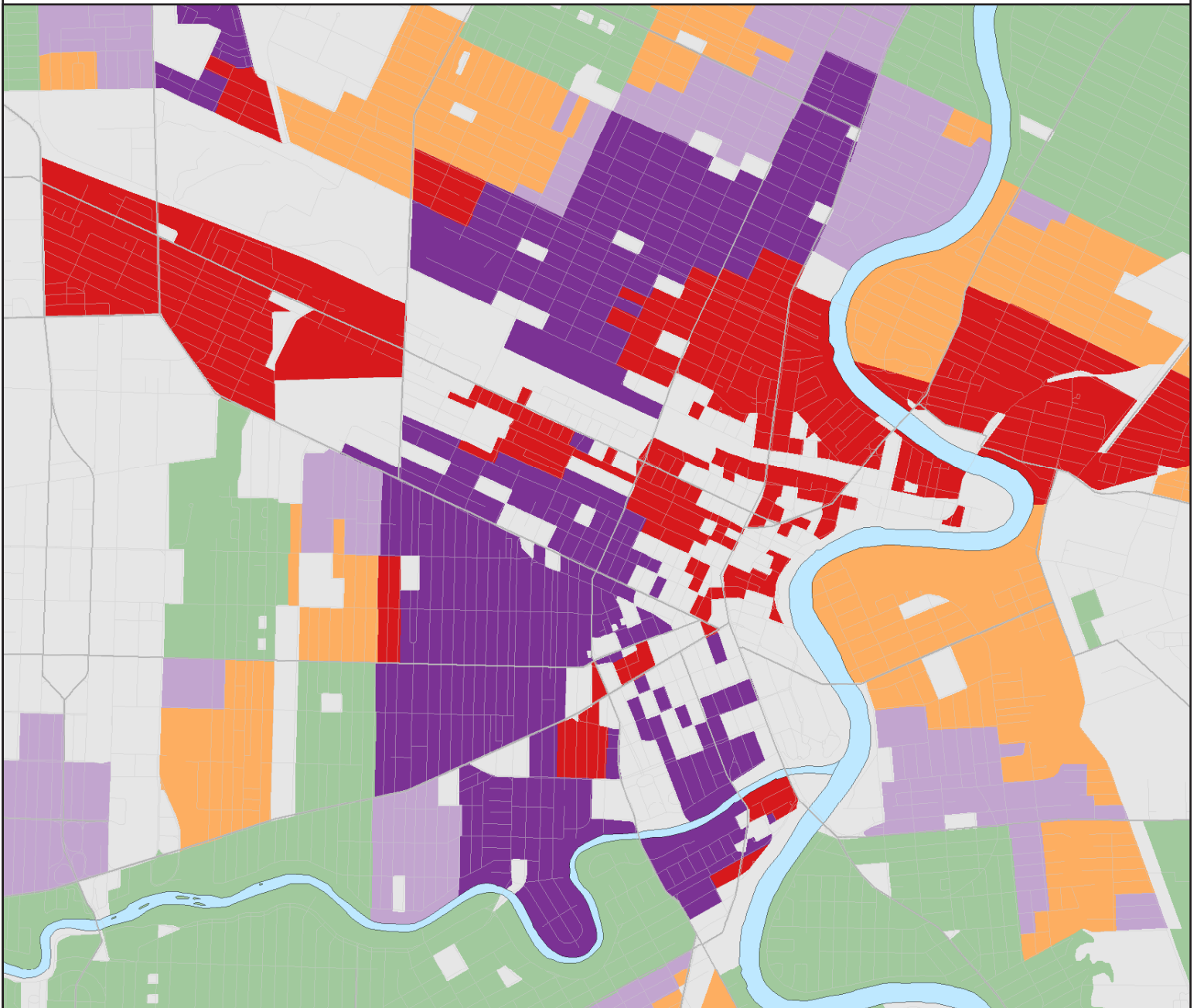




The IUS *In-Brief* Series

CONFRONTING THE ILLUSION: *Developing a Method to Identify Food Mirages and Food Deserts in Winnipeg*

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THE UNIVERSITY OF
WINNIPEG

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The Institute of Urban Studies is an independent research arm of the University of Winnipeg. Since 1969, the IUS has been both an academic and an applied research centre, committed to examining urban development issues in a broad, non-partisan manner. The Institute examines inner city, environmental, Aboriginal and community development issues. In addition to its ongoing involvement in research, IUS brings in visiting scholars, hosts workshops, seminars and conferences, and acts in partnership with other organizations in the community to effect positive change.

Abstract

The identification and mapping of food deserts has become popular practice for framing discussions about food security in Canadian cities. However, while food deserts describe low-income areas with an absence of healthy food, the concept fails to account for individuals who live near healthy foods but may be unable to purchase them because of social deprivation or prohibitively high food prices. These unidentified areas are considered to be “food mirages”. This In-Brief develops a new method to classify and identify both food deserts and food mirages in Winnipeg in order to broaden the conceptual understanding of what barriers individuals face to accessing food. This In-Brief finds that while food deserts exist in Winnipeg, food mirages are even more prevalent, specifically within the inner city. This suggests that income and food affordability are more common barriers to consuming healthy food than distance is. These results emphasize the need for future policy and programming targeting the affordability of healthy food and the incomes of individuals, complemented by efforts to promote the availability of culturally sensitive foods and the promotion of nutritional and food skills education.

Introduction

Food environment research in Canada has been primarily concerned with identifying and mapping food deserts, which are understood as areas presenting physical and economic barriers to accessing healthy food. However, this traditional approach falls short in that it fails to account for areas where individuals live close to healthy food sources but face serious economic hardship that prevents them from accessing those healthier food choices. These geographies, referred to as “food mirages”, can equally contribute to negative health outcomes but present unique challenges to meeting local food needs. To account for these areas this IUS In-Brief develops a new approach to food environment research that identifies both food deserts and food mirages in Winnipeg by:

- (1) classifying, identifying, and mapping supermarkets in Winnipeg;
- (2) calculating dissemination block distances to supermarkets;
- (3) identifying areas of deprivation by constructing a social deprivation index; and

- (4) distinguishing between problematic food environments by linking an area’s distance to a supermarket with its social deprivation score.

Once food deserts and food mirages are identified this In-Brief then assesses their spatial distribution and the scale to which they affect the city’s population. In doing so, this In-Brief contributes to the conversation about food security¹ in Winnipeg by advancing an empirical analysis that offers a more accurate and visual understanding of the broader economic and physical barriers residents face in accessing food.

Background:

Food Environment Mapping in Literature

Unhealthy diets are known causative risk factors for multiple chronic health problems including heart disease, diabetes, and obesity (WHRA, 2014). However, the prevalence of health problems varies across socio-economic characteristics; low-income individuals, for example, are more likely to be diabetic (WHRA, 2014) and obese (Smoyer-Tomic et al.,

2006). This is partially related to different food consumption habits between socio-economic groups, with low-income individuals tending to consume lower nutritional value foods (Smoyer-Tomic et al., 2006) and having lower-quality diets (Darmon and Drewnowski, 2008). However, shifting public consumption habits goes beyond increasing nutritional awareness, as an unhealthy diet is not exclusively indicative of an individual's desire to eat unhealthy. Instead, unhealthy diets are in part influenced by a surrounding food landscape that lacks the availability of healthy food (Morland et al., 2002; Smoyer-Tomic et al., 2006; Zenk et al., 2008).

This understanding has spurred researchers to identify areas that are far away from healthy food sources to determine areas that could potentially contribute to a poor diet. Efforts to do so have largely been concerned with identifying food deserts, which are defined as “areas of relative exclusion where people experience physical and economic barriers to accessing healthy food” (Reisig and Hobbis, 2000, p. 138). The food desert concept suggests that low-income individuals that live far from healthy food sources lack the economic resources required to overcome distance to access healthy food. In turn, their diet may be more dependent on nearby and less nutritious food, for example fast-food or food from convenience stores. Therefore, a common operationalization of the concept in research has focused on:

- (1) identifying healthy and affordable retail food sources; and
- (2) identifying areas where populations have limited financial resources.

Thus defined, food deserts are areas characterized by both an absence of healthy food and a relative presence of poverty.

However, while the concept of food deserts describes areas in which physical access to healthy food is restricted, it fails to account for a subsection of the population that may be close to healthy foods but unable to purchase them because of economic barriers. Therefore, although noted in deprivation and poverty literature, this group has remained largely invisible within food environment research focusing on food deserts simply because their proximity to healthy food provides the illusion of access. The failure of traditional food environment research to account for this population due to their proximity to healthy food is disconcerting

given that distance to a supermarket is not the only barrier to purchasing healthy food. **Without accounting for individuals that are close to healthy foods but may be unable to purchase them, food environment literature takes on a singular narrative and a narrow conceptual representation of the barriers people face to accessing food.**

In response to this limitation, alternative methods to mapping food environments have emerged. Recent research has identified food mirages, which are defined as areas where “full-service grocery stores appear plentiful but, because food prices are high, healthful foods are economically inaccessible for low-income households” (Breyer and Voss-Andreae, 2013, p. 131). Therefore, unlike food deserts, aptly named food mirages are areas where the consumption of healthy food may be limited by barriers associated with the actual purchasing of healthy food rather than the presence of the food in the area.²

Recognizing that barriers to food security exist in both food deserts and food mirages, this In-Brief refers to both as unsupportive food environments (UFEs).

Why Winnipeg Needs Its Food Environments Identified

The need to identify food mirages and food deserts in Winnipeg has increased as the food landscape has changed drastically over the last five years. From 2010 to 2013, five major supermarkets in the inner city closed,³ and three more shut their doors following the merger of Sobeys and Safeway in 2014.⁴ However, Winnipeg has also begun to see the re-emergence of discount grocery stores with the opening of two No-Frills locations in the inner city in 2015 and the announcement of Save-on-Foods opening three supermarkets in 2016.

While the opening and closing of supermarkets, specifically those in the inner city, has garnered much public interest, there is currently no city-wide mapping of both food deserts and food mirages. Without a comprehensive spatial understanding of these food environments, it is difficult to

assess how future changes to the food landscape will affect access to healthy food.

A key objective of this project is to support policy change and contribute to building awareness of food security issues in Winnipeg. By distinguishing between food deserts and food mirages this research helps local organizations make informed policy and program decisions on urban food issues by identifying key neighbourhoods at risk of health problems related to a lack of access or inability to purchase healthy food.

Our approach to identifying food environments is also unique in that it compares the inner and non-inner city areas of Winnipeg. The inner city includes 41 neighbourhoods and nearly 130,000 people, which represents approximately 20% of the city's population. By using the inner city boundary in the analysis, this In-Brief supports policy makers in targeting interventions by comparing inner-city characteristics with those in the rest of the city

Data and Methods

To identify food deserts and food mirages it is necessary to start by operationalizing the three variables used in this analysis to define unsupportive food environments that are:

- (1) the identification and classification of supermarkets, which are considered a healthy food source;
- (2) dissemination block distances to identified supermarkets, which are used as a proxy variable for physical access to health food; and
- (3) social deprivation, which represents an individual's economic ability to readily travel to and purchase healthy food sources.

Once the distance to a supermarket and a social deprivation score are determined for an area it is possible to link the values together. Specific combinations of different distances to healthy food sources and social deprivation values are then used to describe different food environments.

CLASSIFICATION OF SUPERMARKETS

This research defines supermarkets as fulfilling one of the following three criteria:

- (1) a franchise associated with a national supermarket chain (e.g., Loblaws, Sobeys);
- (2) a national retail chain with a full-service grocery store (e.g., Walmart Canada Corp., Costco Wholesale Corp.); or
- (3) a franchise associated with a major regional supermarket operating in Manitoba (e.g., Family Foods, Foodfare, Red River Co-op).

This classification of supermarkets is similar to that used in extant food environment research, including an analysis of Montreal's food deserts (Apparicio, et al., 2007). However, since the existence of specific food environments is contingent on the definitions and data sets selected, adherence to this particular classification of supermarkets has a direct impact on how food environments are identified.

TABLE 1: *Supermarkets Retained for Analysis*

Supermarket Name	Number of Stores
National Chains	
Loblaws	
Extra Foods	4
No Frills	2
The Real Canadian Superstore	8
The Real Canadian Wholesale Club	1
Sobeys	
Safeway	19
Sobeys	12
Price Chopper	1
IGA	2
Walmart Canada Corp.	
Walmart	7
Costco Wholesale Corp.	
Costco	3
National Chain Total	59
Regional Chains	
Foodfare	5
Family Foods	5
Red River Co-op	4
Regional Chain Total	14
National and Regional Chain Total	73

One major limitation of this classification is the exclusion of independently owned large grocery stores,⁵ large grocery stores specializing in imported-goods or “ethnic foods,”⁶ small grocery stores, and convenience stores. However, our view is that supermarkets offer consumers a greater diversity of healthy food products (Morland et al., 2002) and generally offer products at more competitive prices (Chung and Myers, 1999; Morland et al., 2007; Smoyer-Tomic, 2006).

IDENTIFYING SUPERMARKETS

A total of 73 supermarkets were identified in Winnipeg using Google Maps and local online directories^{7,8} (Table 1). Of those 73 supermarkets, 59 were national chains and 14 were associated with regional chains.

CALCULATING PHYSICAL ACCESS TO SUPERMARKETS

Distances to supermarkets, which are used as a proxy variable for physical access to health food, were analyzed at the dissemination block level.⁹ The shortest route from the centroid of each dissemination block to the nearest supermarket was used to calculate distance.¹⁰ Dissemination block distances to supermarkets were then used to describe one of three “physical access to supermarket” categories:

- (1) high physical access if they were within 500 meters of a supermarket;
- (2) moderate physical access if they were 501–1000 meters of a supermarket; and
- (3) low physical access if they were beyond 1000 meters of a supermarket (Table 2).

These parameters, based on previous food environment research, suggest that distances less than one kilometer are easily covered by walking (Apparicio et al., 2007; Smoyer-Tomic et al., 2006).

A limitation of this method is that it does not take into account that the nearest supermarket may not be the most preferred or appropriate supermarket in terms of price and products offered (Smoyer-Tomic et al., 2006). While other food environment research has addressed these types of limitations through qualitative research instruments (Shaw, 2006) and by comparing food prices between supermarkets (Breyer and Voss-Andreae, 2012), such approaches are beyond the scope of this In-Brief. Further research should examine the influence of price, product diversity, and distance on retail grocery shopping behaviour.

SOCIAL DEPRIVATION INDEX

Building on the work of Apparicio et al. (2007), a social deprivation index was developed using seven distinct variables associated with mobility and poverty. These variables represent socio-economic characteristics that may present barriers to an individual’s ability to travel to supermarkets and purchase healthy foods.

The variables were drawn from the 2006 Census, at the Census Tract level, and include: (i) percentage of low-income families; (ii) unemployment rate; (iii) population aged 25–64 with no high school certificate, diploma, or degree; (iv) percentage of recent immigrants (immigrants arriving between 2001 and 2006); (v) percentage of lone-parent families; (vi) percentage of the labour force that does not drive; and (vii) percentage of the population that identifies as Aboriginal.

TABLE 2: Access to Supermarket Categories by Distance

	“Physical Access to Supermarket” Category		
	High Physical Access	Moderate Physical Access	Low Physical Access
Distance to Supermarket (meters)	< 500	501–1000	> 1000
Walkable Access to Supermarket	Yes	Yes	No

Variables (i) through (v) were similar to those used by Apparicio et al. (2007). However, variables (vi) and (vii)—non-drivers and Aboriginal identification—were added based on research linking their importance to mobility and poverty. The percentage of non-drivers was included based on its use in other Canadian food landscape literature (Smoyer-Tomic et al., 2006) and because access to a vehicle reduces the effect of distance. Aboriginal identity was incorporated because of research indicating that in Manitoba Aboriginal children are more likely to live in poverty than non-indigenous children (Macdonald and Wilson, 2013). By including these additional variables this research provides a method to identifying social deprivation that is sensitive to realities of poverty and mobility in Winnipeg.

As Shaw (2006) notes, “accessing food requires multiple forms of resources.” By using a social deprivation index we are expanding our understanding of deprivation beyond the prevalence of low-income populations and identifying areas where multiple factors may contribute to an individual’s relative ability to purchase healthy food and physically access healthy food sources.

CALCULATING A SOCIAL DEPRIVATION SCORE

To use multiple variables in a singular index, all variables needed to be standardized on a scale of 0 to 1. This standardization was done by subtracting the minimum value in a variable from all cases’ (Census Tracts) original values and then dividing it by the variables range (Equation 1).

EQUATION 1: Standardizing Social Deprivation Score

$(V - \min V) / (\max V - \min V)$ where:

V = original value

maxV = maximum value

minV = minimum value

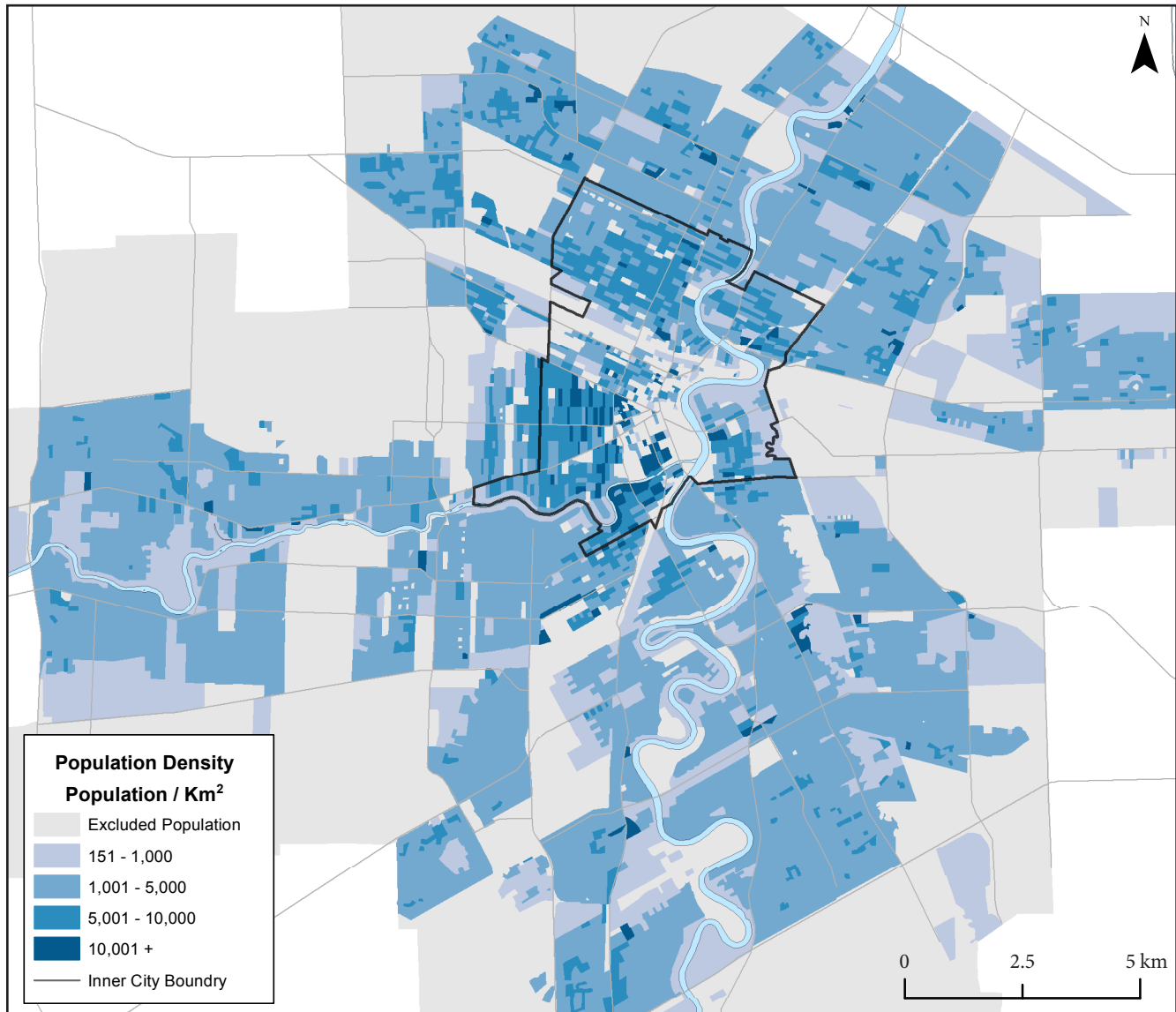
Once all variables were standardized, a compounded variable was calculated by summing the standardized variables. This created a social deprivation score that could range from 0 (minimum deprivation) to 7 (maximum deprivation). These scores were then binned into quintiles to create five social deprivation groups. Based on the socio-economic characteristics of these quintiles, we considered the highest three quintiles (1–3), with scores between 0 and 1.78, to have low social deprivation; the fourth quintile (4), with scores between 1.79 and 2.39, to have moderate social deprivation; and the fifth quintile (5), with scores between 2.4 and 5.61 (max), to have high social deprivation (Table 3).

Although the variables used to compose the social deprivation index are only available at the Census Tract level, each dissemination block was ascribed a social deprivation score that corresponded to the score of the Census Tract in which it is located. This allowed for social deprivation scores to be compared with “physical access to supermarket” categories at the dissemination block level, rather than at the Census Tract level where a calculation of the distance to a supermarket would be relatively meaningless as they represent large spatial boundaries.¹¹

TABLE 3: Social Deprivation Categories

	Social Deprivation Category				
	Social Deprivation Category			Moderate	High
Quintile	1	2	3	4	5
Score Range	0 – 1.78			1.79 – 2.39	2.4 – 5.61

FIGURE 1: Population Density in Winnipeg



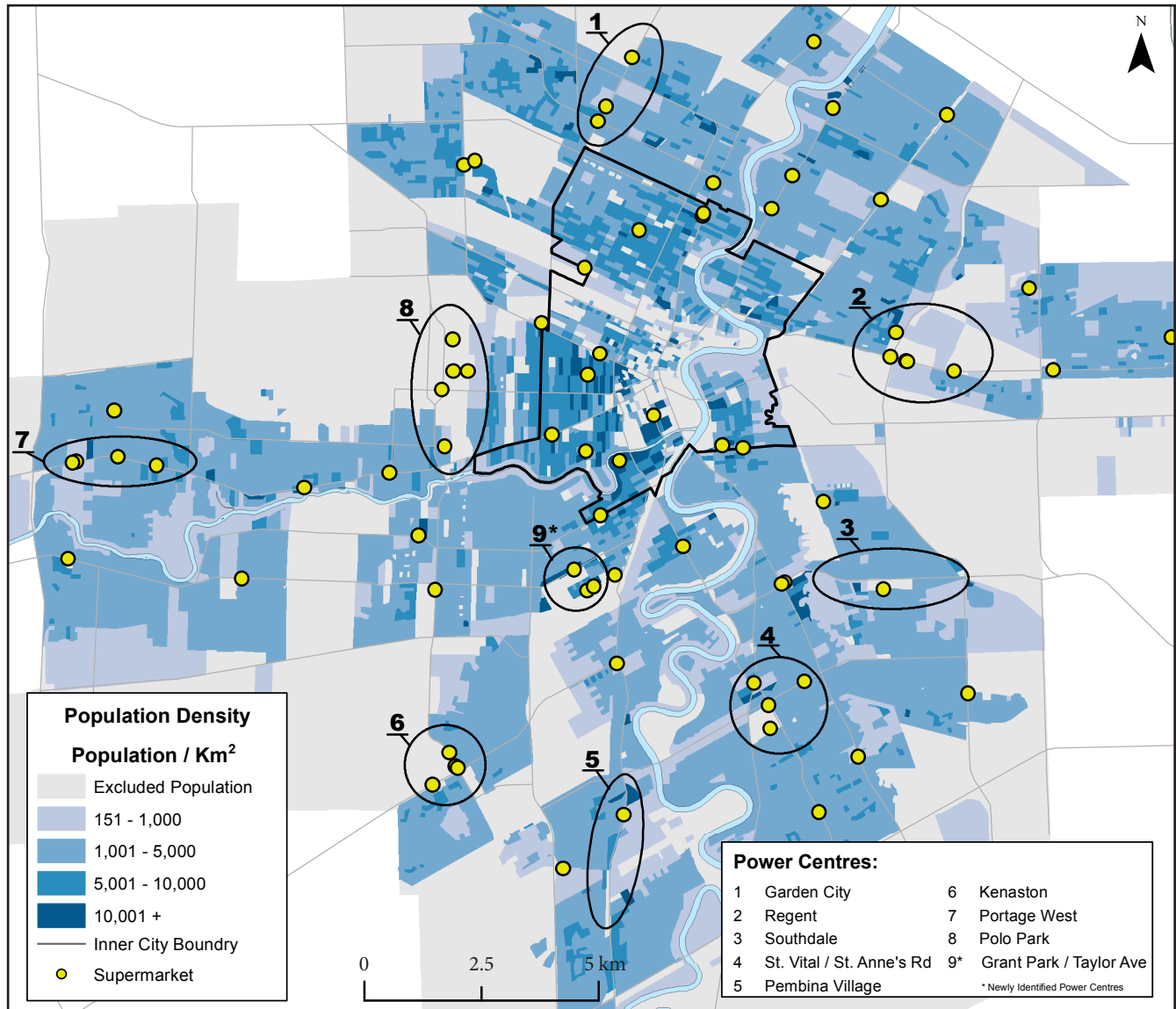
Results

POPULATION DENSITY

Population density adds an important layer to the analysis by showing clusters of people in relationship to the location of and distance to supermarkets.¹² Population density is also an important variable used by supermarket planners for store locational analysis, which determines a site's market opportunity. While the importance of this factor

has dropped with the increasing use of automobiles, smaller footprint stores located in the downtown and the inner city are greatly influenced by density with respect to walkability. The most densely populated areas in Winnipeg are in the inner city, with density generally decreasing towards the periphery of the city (Figure 1).

FIGURE 2: Spatial Distribution of Supermarkets and Power Centres



SPATIAL DISTRIBUTION OF SUPERMARKETS AND POWER CENTRES

Of the 79 supermarkets retained for the study, 13 are within the inner city boundary, and 60 are in the non-inner city.

In Winnipeg, supermarket locations display a dispersed pattern that includes some clustering in specific areas. These clusters spatially correspond to areas identified as power centres in a geographical analysis of Winnipeg's retail landscape by Lorch (2004) (Figure 2). Power centres, which consist of an "agglomeration of big box retail outlets that may or may not be accompanied by conventionally-sized

commercial units," began emerging in the 1970s but gained prominence in Winnipeg during the 1990s when Walmart opened its first five stores (Lorch, 2004, p. 1). While not all power centres include a clustering of supermarkets, they are becoming increasing popular locations for them. Nine power centres have been identified in Winnipeg, and currently 29 supermarkets, or more than one-third of those retained in this study, are located within these centres.¹³

The design and location of these power centres has a direct impact on how accessible they are by different modes of transportation. Located primarily on the periphery of the city, on major arteries, and in low density neighbourhoods,

access to supermarkets in power centres is almost exclusively dependent on a personal vehicle. While vast parking lots eliminate the stress of finding parking, the geographic isolation and lack of walkable features, such as pedestrian walkways and crosswalks, alienates pedestrian access in these areas. Accessing supermarkets in power centres by public transit is also burdensome, as buses to suburban destinations are infrequent, and the weight of groceries and the seasonal winter temperatures can discourage public transit users.

DISSEMINATION BLOCK DISTANCES TO SUPERMARKETS

Although more than one-third of supermarkets are located in power centres on the periphery of the city, our analysis indicates that the inner city still has some of the highest physical access to supermarkets (Figure 3). While neighbourhood disparities exist, the average distance to the nearest supermarket in the inner city is 1,087 meters, compared to outside the inner city where it is 1,396 meters (Table 4). The finding that distance to supermarkets increases as you move out from the core towards the periphery echoes findings in other Canadian cities, including Montreal (Apparicio et al., 2007), Edmonton (Smoyer-Tomic et al., 2006), and London (Larsen and Gillian, 2008).

The differences in physical access are even more evident when looking at the three “physical access to supermarket” categories. In the inner city, 25% of the population has high physical access to a supermarket and 40% has moderate physical access. Together, this means that 65% of the population in the inner city is within walking distance of a supermarket. **The high percentage of the inner city population within walkable distance to a supermarket is in stark contrast to the often-made argument that distance is the primary barrier to accessing healthy food in the inner city.**

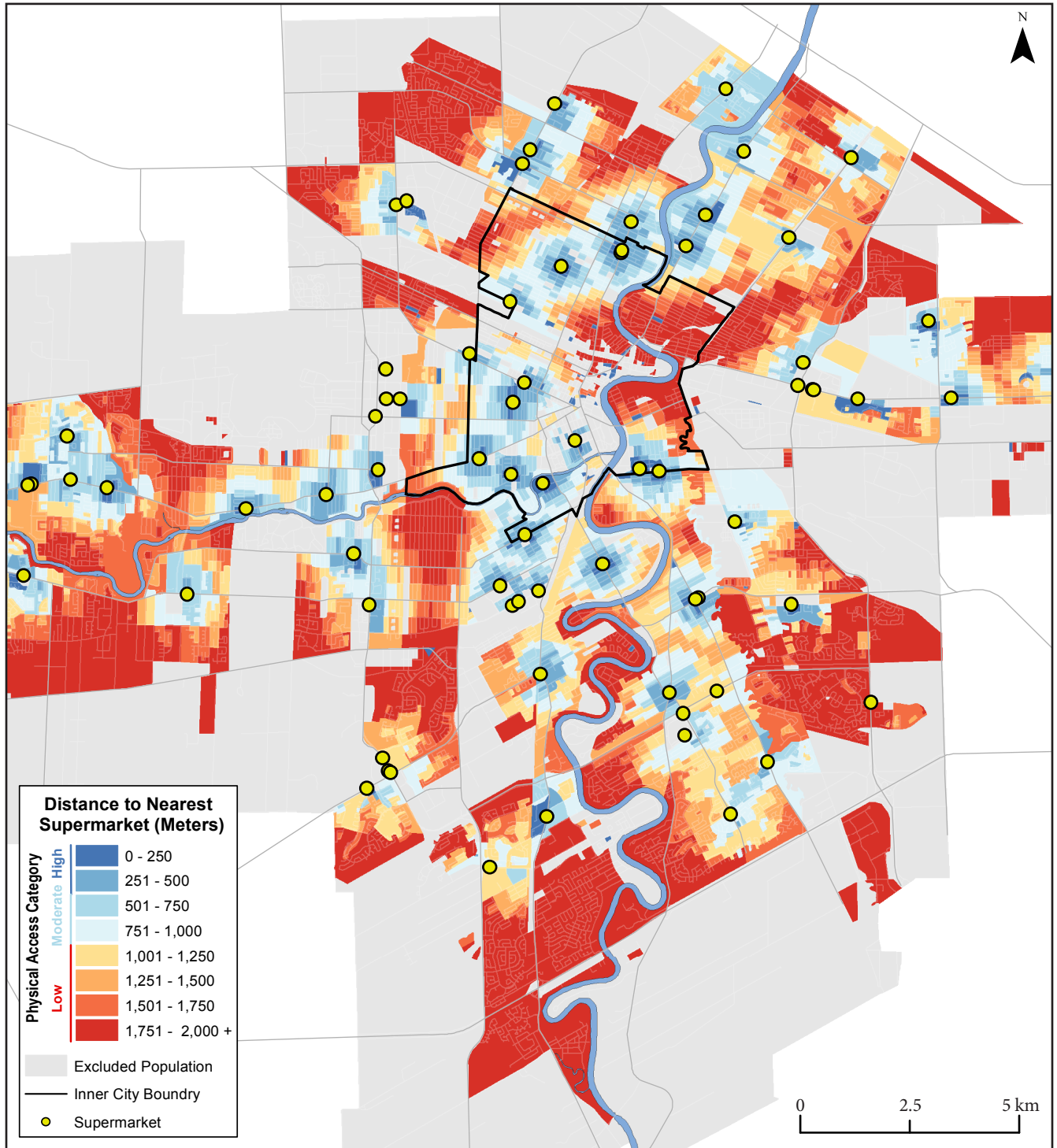
Walkable access in the non-inner city is substantially lower, as only 11% and 27% of the population are within high or moderate physical access to a supermarket, respectively. In other words, more than 60% of the non-inner city lives beyond walking distance to a supermarket.

However, proximity to a supermarket alone is not substantive enough to discern if an individual is able to purchase and consume healthy food since different socio-economic groups are able to navigate and overcome spatial barriers differently. Furthermore, there is no relationship between proximity to a supermarket and capacity to purchase healthy food. As such, a definition of food environments must include an analysis of social deprivation.

TABLE 4: Distance to Nearest Supermarket by Inner and Non-Inner City Neighbourhoods

	Population	Average Distance to Nearest Supermarket (meters)	% Pop. With High Physical Access: <500m	% Pop. With Moderate Physical Access: 500–1000m	% Pop. With Low Physical Access: >1000m
			Walkable Access to Supermarket		No Walkable Access to Supermarket
Inner City	127,754	1,087	25.03% (n=31,971)	40.37% (n=51,573)	34.6% (n=44,210)
Non-Inner City	530,991	1,396	7.87% (n=41,780)	24.02% (n=127,527)	68.11% (n=361,684)
Winnipeg Total	658,745	1,338	11.2% (n=73,751)	27.19% (n=179,100)	61.61% (n=405,894)

FIGURE 3: Dissemination Block Distance to Supermarkets



HOUSEHOLD AND INDIVIDUAL CHARACTERISTICS OF SOCIAL DEPRIVATION QUINTILES

Before analyzing the spatial distribution of social deprivation, it is important to discuss the socio-economic variables that characterize each group (Table 5). In areas with high social deprivation, nearly one-third of residents are low-income and may face significant economic barriers to purchasing healthy food. Furthermore, over one-third of high deprivation households are lone-parent households, which are more likely to experience food insecurity than couple-with-child households (Che and Chen, 2007). More than half of the population in these areas is also non-driving, representing a barrier to physically accessing food in areas without a nearby supermarket. Additionally, it is important to note that one-quarter of the population in high deprivation areas are of Aboriginal ancestry and 7% are recent immigrants. These numbers highlight the importance of culturally sensitive approaches to addressing food environments.

As expected, households in the moderate social deprivation group are characterized by lower frequencies of deprivation across all variables. However, the high presence of lone-parent, low-income, and non-driving households indicates vulnerabilities in a subsection of residents that should not be ignored when mapping food environments. In contrast, the characteristics of the low social deprivation group, including the low percentage of non-drivers and low-income individuals, indicates that they experience relatively minimal economic hardship.

SPATIAL DISTRIBUTION OF SOCIAL DEPRIVATION

High Social Deprivation Areas

The majority of people experiencing high social deprivation in Winnipeg live in the inner city (Figure 4). This trend reflects other food mapping literature in Canada, which finds urban cores to be among the most socially deprived areas of cities (Smoyer-Tomic et al., 2006). In total, 62% of dissemination blocks in the inner city are characterized as high social deprivation. Populations experiencing high social deprivation outside of the inner city are located in Elmwood, Transcona, St. Vital, South Pembina, and Weston (Figure 4). These non-inner city areas include nearly 35,000 residents and account for almost 30% of the Winnipeg's total high social deprivation population (Table 6).

Moderate Social Deprivation Areas

Moderate social deprivation was primarily identified in areas adjacent to high social deprivation dissemination blocks. With most high social deprivation occurring in the inner city, it is not surprising that nearly one-quarter of inner city dissemination blocks, which represents almost 30,000 individuals, are characterized as having moderate social deprivation. Moderate social deprivation populations are also present in non-inner city areas, including Fort Richmond, Munroe East, and Tyndall Park, as well as numerous neighbourhoods surrounding the inner city boundary (Figure 4). In total, over 20% of the non-inner city population lives in areas considered to have moderate social deprivation.

TABLE 5: Social Deprivation Characteristics by Quintiles and Variables

		Social Deprivation Index Variables						
		Percent Low-Income	Percent Lone-Parent	Percent Unemployed	Percent Non-Drivers	Percent Low Education	Percent Aboriginal	Percent Recent Immigrant
Social Deprivation Quintiles	Low (1-3)	5.38%	13.87%	2.62%	24.92%	10.33%	5.79%	2.03%
	Moderate (4)	12.13%	23.70%	4.39%	35.27%	18.13%	11.71%	3.6%
	High (5)	32.08%	36.05%	8.72%	51.25%	28.87%	25.92%	7.02%
City Average		11.29%	19.78%	4.02%	31.62%	15.17%	10.45%	3.22%

Low Social Deprivation Areas

Over 70% of the non-inner city population is characterized by low social deprivation. Generally, social deprivation scores are lower towards the periphery of the city (Figure 4).

While the inner city areas of Wolseley, Roslyn and Robertson have pockets of low social deprivation, combined these areas account for only 10% of the total inner city population (Table 6).

FIGURE 4: Spatial Distribution of Social Deprivation Scores

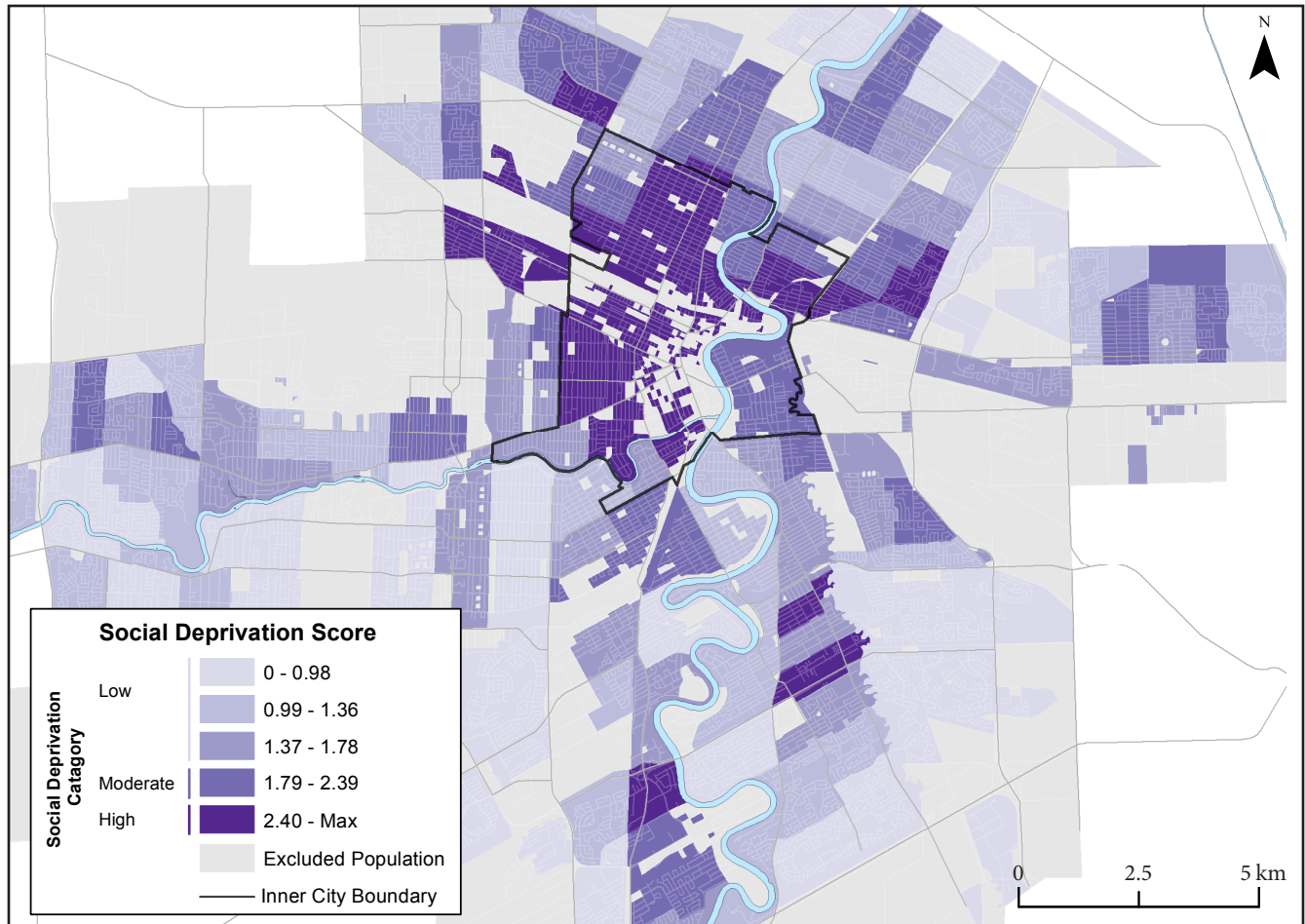


TABLE 6: Social Deprivation Areas by Population and Dissemination Block

	Inner City		Non-Inner City		Winnipeg	
	Population (%)	Dissemination Block %	Population (%)	Dissemination Block %	Population (%)	Dissemination Block %
Low (1-3)	12,925 (10.12%)	9.38% (n=88)	381,845 (71.91%)	71.93% (n=2927)	394,770 (59.93%)	60.22% (n=3015)
Moderate (4)	29,992 (23.48%)	28.14% (n=264)	113,461 (21.37%)	22.56% (n=918)	143,453 (21.78%)	23.60% (n=1182)
High (5)	84,837 (66.40%)	62.47% (n=586)	35,685 (6.72%)	5.51% (n=224)	120,522 (18.29%)	16.18% (n=810)
Total	127,754 (100%)	100% (n=938)	530,991 (100%)	100% (n=4069)	658,745 (100%)	100% (n=5007)

LINKING SOCIAL DEPRIVATION WITH PHYSICAL ACCESS: DEFINING FOOD ENVIRONMENTS

To use social deprivation and distance to identify different types of food environments, each social deprivation quintile (1–5) was assigned three different subscript values that corresponded to the three “physical access to supermarket” categories: (1) high, (2) moderate, and (3) low. This created 15 new X.Y variables, where X is equal to the social deprivation category and Y is equal to the “physical access to supermarket” category (Table 7). Each new variable identifies a food environment based on its combination of distance to a supermarket and social deprivation.

Of the 15 variables created, 9 were considered to describe “Not at Risk Food Environments.” These are areas where residents experience the lowest levels of social deprivation (1–3), regardless of distance to a supermarket. Distance did not affect food environment classification at this level of social deprivation because the socio-economic characteristics of this group suggest that they are capable of overcoming barriers of proximity through high incomes. Although they may live far away from a supermarket, they are likely able to drive to any preferred destination and readily purchase healthy food.

Food deserts (4.3 and 5.3) were identified as being areas both within the highest two quintiles of social deprivation (4 or 5) and the lowest category of ‘physical access to supermarket’ (3), which is beyond 1000 meters to a supermarket. Therefore, individuals in these areas have limited financial resources that make purchasing health food difficult in addition to

facing physical barriers to accessing supermarkets, as they are not within a walkable distance. Since accessing healthy food for people in food deserts can be difficult, timely, and expensive, individuals may then turn to closer, less healthy options at nearby corner stores.

The New Geography: Food Mirages

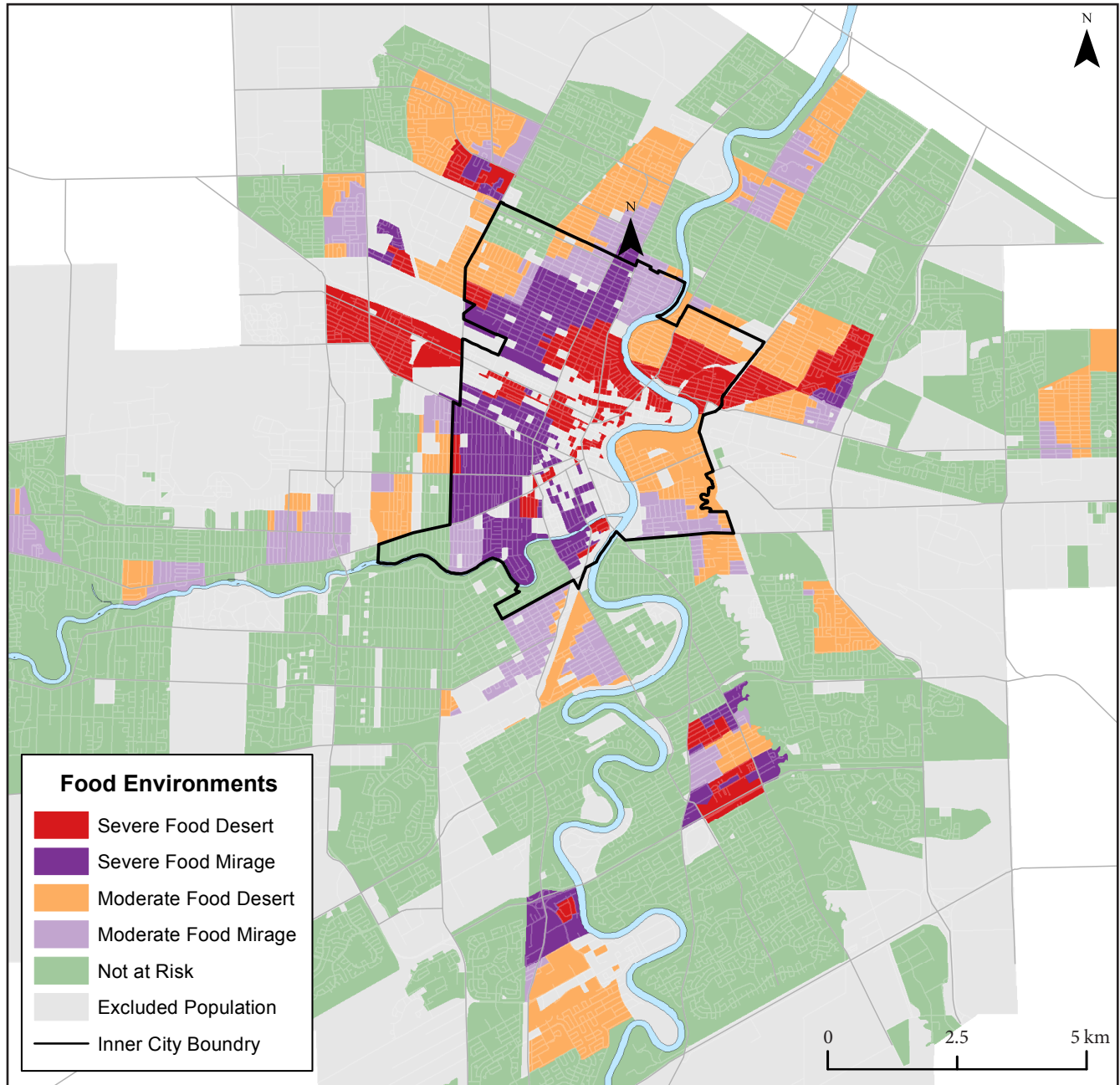
Living nearby a supermarket can falsely provide the impression of access, unless social deprivation is also considered. The emerging use of the concept of food mirages provides a more accurate estimate of the number of households struggling to afford food despite relatively good physical access. In this analysis, food mirages were identified within the highest two quintiles of the social deprivation index (4 or 5) and within the highest two categories of access to supermarkets (1 or 2), which are considered to be walkable distances. This suggests that while supermarkets are present in the area, residents face economic barriers to purchasing the food. These areas have often been unidentified or misidentified in conventional food landscape literature, despite accounting for individuals who face significant barriers to accessing healthy food.

Food deserts and food mirages were then further classified on the basis of their respective social deprivation scores. Areas with moderate social deprivation (4) were considered to be moderate food deserts (4.3) or moderate food mirages (4.1, 4.2), while those experiencing the highest levels of social

TABLE 7: Food Environments Determined by Social Deprivation and Access to Supermarket Categories

			Social Deprivation Score (X)				
			Low			Moderate	High
			1	2	3	4	5
Physical Access to Supermarket Categories (Y)	High Physical Access (< 500 m)	1	No Food Risk (1.1)	Low Food Risk (2.1)	Low Food Risk (3.1)	Moderate Food Mirage (4.1)	Severe Food Mirage (5.1)
	Moderate Physical Access (500–1000 m)	2	No Food Risk (1.2)	Low Food Risk (2.2)	Low Food Risk (3.2)	Moderate food Mirage (4.2)	Severe Food Mirage (5.2)
	Low Physical Access (> 1 km)	3	No Food Risk (1.3)	No Food Risk (2.3)	Low Food Risk (3.3)	Moderate Food Desert (4.3)	Severe Food Desert (5.3)

FIGURE 5: Food Environments in Winnipeg



deprivation (5) were considered to be severe food deserts (5.3) or severe food mirages (5.1, 5.2). This distinction between severity is included in the analysis because, while both experience relative social deprivation, severe food environments are more likely to affect a larger percentage of the population, and thus require more large-scale efforts, whereas moderate food environments may only affect a subsection of the residents.

THE SCALE OF UNSUPPORTIVE FOOD ENVIRONMENTS IN WINNIPEG

Inner City Food Environments

With a large percentage of high social deprivation in the inner city, it is not surprising that 25% of the area's dissemination blocks are characterized as severe food deserts. This represents 25,000 people, or almost 20% of the inner city population, (Figure 5 and Table 8). However, severe food mirages, which

have gone previously unidentified in Canadian food mapping research, were found to represent a larger area—37% of the inner city’s dissemination blocks comprising nearly 60,000 individuals. **In total, nearly 85,000 people live in inner city neighbourhoods classified as severely unsupportive food environments – either severe food mirages or deserts.** In addition to these severe food environments, 14% of inner city dissemination blocks are characterized as moderate food mirages (15,000 people); and 15% as moderate food deserts (14,700 people). However, it is critical to note that differences exist within these neighbourhoods and amongst residents; and **not all individuals in these areas experience barriers equally.**

With a high percentage of dissemination blocks that are unsupportive food environments, it is understandable that much of the food security work in Winnipeg is concentrated within the inner city. However, the identification and the prevalence of food mirages in the area should emphasize the importance of appropriately addressing barriers to healthy food. Walkable access to a supermarket is a barrier for the 31% of the inner city population living in moderate and severe food deserts. However, an even larger percentage of the inner city population’s primary barrier to purchasing healthy food is economic as 51% live in moderate and severe food mirages, which have a nearby supermarket. The identification of this inner city population living close to food, but unable to afford it, should guide future policy.

Non-Inner City Food Environments

Although often overlooked, our analysis also identified a large non-inner city population living in severely unsupportive food environments. Similar to the trends in social deprivation, these non-inner city unsupportive food environments were found in Transcona, St. Vital, South Pembina, and Elmwood (Figure 5). Unlike the inner city, only 4% of all non-inner city dissemination blocks are characterized as severe food deserts and 2% as severe food mirages.

Even though the proportion of severely unsupportive food environments in the non-inner city is much lower than in the inner city, these areas indicate a substantial number of people who experience barriers to physically and economically accessing food. In total, almost 22,000 people in the non-inner city live in areas classified as severe food deserts, and 14,000 in food mirages. **Together, this means that nearly 36,000 people are living in severely unsupportive food environments in the non-inner city.** As a whole, these non-inner city individuals represent almost 30% of all people living in severely unsupportive food environments across Winnipeg. This group presents unique challenges to improving access to food, because they are decentralized and reside in less densely populated areas.

TABLE 8: Population Living in Each Food Environment by Inner City and Non-Inner City

Area		Food Environment					Total
		No Risk (1.1-3.3)	Moderate Food Mirage (4.2, 4.1)	Moderate Food Desert (4.3)	Severe Food Mirage (5.2, 5.1)	Severe Food Desert (5.3)	
Inner City	Population % (n=)	10.12% (n=12,925)	11.97% (n=15,291)	11.51% (n=14,701)	46.51% (n=59,424)	19.89% (n=25,413)	100% (n=127,754)
	Dissemination Blocks % (n=)	9.38% (n=88)	13.64% (n=128)	14.5% (n=136)	37.53% (n=352)	24.95% (n=234)	100% (n=938)
Non-Inner City	Population % (n=)	71.91% (n=381,845)	8.88% (n=47,132)	12.49% (n=66,329)	2.56% (n=13,727)	4.14% (n=21,958)	100% (n=530,991)
	Dissemination Block % (n=)	71.93% (n=2,927)	8.77% (n=357)	13.79% (n=561)	1.5% (n=61)	4.01% (n=163)	100% (n=4069)
Winnipeg	Population % (n=)	59.93% (n=394,770)	9.48% (n=62,423)	12.3% (n=81,030)	11.1% (n=73,151)	7.19% (n=47,371)	100% (n=658,745)
	Dissemination Block % (n=)	60.21% (n=3015)	9.69% (n=485)	13.92% (n=697)	8.25% (n=413)	7.93% (n=397)	100% (n=5007)

SPATIAL CONCENTRATIONS OF SEVERE FOOD ENVIRONMENTS IN WINNIPEG

The method put forward by this In-Brief identifies food environments at the dissemination block level. When concentrations of dissemination blocks with similar food environments are grouped, the location of expansive and highly populated unresponsive food environments is revealed. By then grouping these spatial concentrations of

severe food environments into zones, this In-Brief provides a means to reference and address severely unresponsive food environments. (Figure 6 & Figure 7). Grouping took into consideration physical barriers that separate areas, such as the Red River and Assiniboine River. Furthermore, only areas with an aggregate of at least 2,000 people were considered to be a zone. In total, 7 severe food desert zones and 7 severe food mirage zones were identified (Table 9).

FIGURE 6: Severe Food Desert Zones

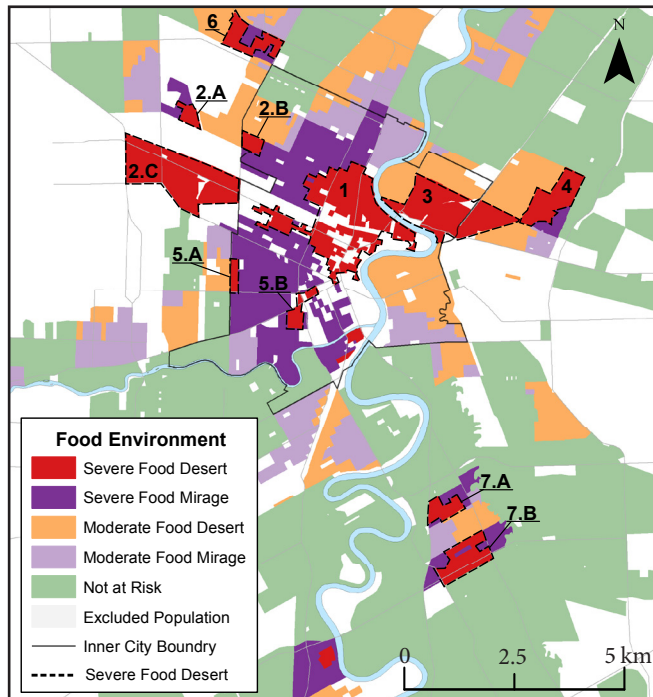


FIGURE 7: Severe Food Mirage Zones

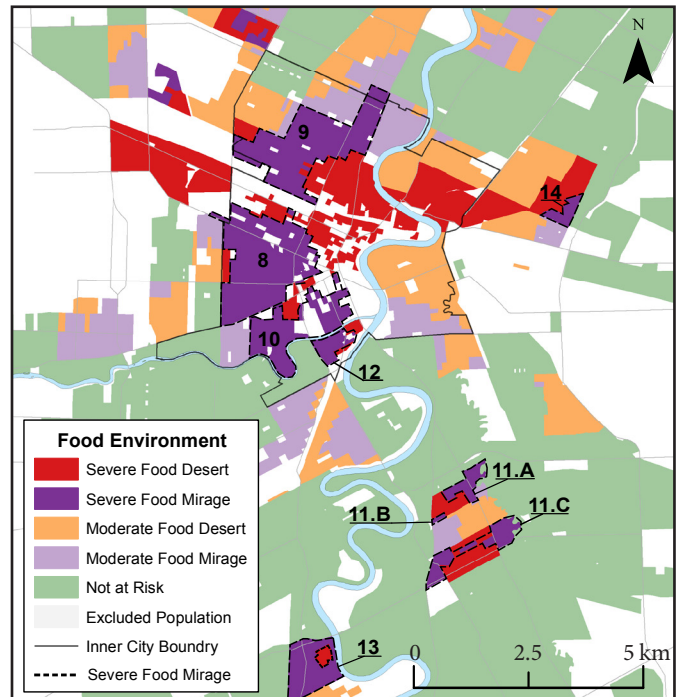


TABLE 9: Severe Food Desert Zones

Zone #	Example Neighborhoods in Zone	Pop.
1	William Whyte, North Point Douglas, Lord Selkirk Park, Logan-CPR, Dufferin, South Point Douglas	12,493
2 (2.A, 2.B, 2.C)	Burrows Central, Weston Shops, Burrows Keewatin, Weston, Brooklands, Shaughnessy Park	10,202
3	Talbot-Grey, Glenelm, Chalmers	9,411
4	Valley Gardens, w Munroe East	4,014
5 (5.A, 5.B)	Daniel McIntyre, Colony, West Broadway, Portage-Ellice	3,692
6	The Maples, Leila-McPhillips Triangle	2,422
7 (7.A, 7.B)	Worthington, Meadowood	2,129

TABLE 10: Severe Food Mirage Zones

Zone #	Example Neighborhoods in Zone	Pop.
8	Spence, Central Park, West Alexander, St. Matthews, Centennial, Portage Ellice	27,687
9	St. John's, Jefferson, William Whyte, Inkster-Faraday, Burrows Central, Dufferin, Weston Shops	15,124
10	West Broadway, Broadway-Assiniboine, South Portage	13,186
11 (11.A, 11.B, 11.C)	St. George, Lavalee, Alpine Place, Worthington	4,640
12	River-Osborne	3,808
13	Agassiz, Pembina Strip, Montcalm	3,758
14	Munroe East	2,157

The three largest severe food desert zones account for more than 32,000 people. The most populated of these areas, Zone 1, is located in the inner city and has over 12,000 people within its boundary (Table 9). The second most populated zone, Zone 2, is located on the periphery of the inner city, while the third most populated zone, Zone 3, crosses the inner city and non-inner city border. Among all food desert zones only one, Zone 6, is not located in or on the periphery of the inner city.

Similar to the spatial trends of food deserts, food mirages exist primarily in or around the inner-city boundary. Together, the three largest severe food mirage zones, Zone 8, 9 and 10, all of which are located within the inner city, represent an area with almost 56,000 residents (Table 10). Nearly half of these residents are located in Zone 8 alone, which covers an area of nearly 3.5 square kilometers. There are also three severe food mirages in the non-inner city. Combined, these non-inner city severe food mirage zones have a population of over 10,000. The largest of these non-inner city zones, Zone 11, accounts for nearly half of that population with 4,640 residents.

Conclusion

While the majority of food environment research in Canada has been concerned with identifying food deserts (Apparicio et al., 2007; Smoyer-Tomic et al., 2006; Larsen and Gillian, 2008), this In-Brief advances an emerging method to classify, identify and map both food deserts and food mirages. By using this method this In-Brief identifies the presence of both unsupportive food environments throughout Winnipeg, with the majority of these within the inner city. Food mirages would have remained unidentified or misidentified using conventional food environment methods since their proximity to healthy food provides the illusion of access.

In total, nearly 85,000 people in the inner city live in areas identified as severely unsupportive food environments, with almost 60,000 of those individual's living in severe food mirages. These findings challenge the often-touted claim that the inner city's main issue with accessing healthy food is the lack of supermarkets in the area. Furthermore, over 35,000 people in the non-inner city live in severely unsupportive food environments. This suggests that although the inner city is often regarded as a spatial concentration of poverty, social

deprivation exists in numerous neighbourhoods outside of the inner city, and many of these areas are also characterized as unsupportive food environments. This demonstrates the need for future policy concerned with food access and security to have a citywide focus.

These results, and our method, elaborate on the range of issues individuals face to accessing food, and present them in a more accurate analytical and conceptual form. This more comprehensive identification of unsupportive food environments is important, as food mirages and food deserts present unique barriers to ensuring food security and as such addressing each food environment requires distinct policy approaches. By grouping concentrations of similar severe food environments into zones, this In-Brief provides a frame of reference for these environments to be identified, discussed and addressed.

Individuals in food mirages may actually be able to walk to healthy food sources but face socio-economic challenges to obtaining a healthy diet. Addressing food mirages requires programs that target socio-economic issues, such as poverty, as well as the cost of food. In addition to socio-economic challenges, food deserts also present physical barriers to accessing healthy food. Addressing issues related to food accessibility in these areas may require either bringing healthy and affordable food into an area, or bringing individuals to healthy and affordable food. While these types of intervention can help address issues relating to economic and physical access to healthy food they must be done in conjunction with efforts to ensure the availability of culturally sensitive foods and the promotion of nutritional and food skills education in order to fulfill a holistic understanding of food security.

Although the method presented in this In-Brief improves the identification of problematic food environments, additional research could strengthen its accuracy. While this research uses a strict classification of supermarkets to identify healthy food sources, additional research is required to understand how smaller, independent, and specialty import grocery stores contribute to physical and economic access to food in Winnipeg. An understanding of food affordability could also be improved by including a Nutritious Food Basket study to assess the cost of healthy eating. However, what this In-Brief has developed is a framework to enhance and inform discussions about food security in Winnipeg that can be elaborated on in the future.

End Notes

- ¹ Food security is defined as “a situation that exists when all people, at all times, have physical, social and economic access to sufficient, safe and nutritious food that meets their dietary needs and food preferences for an active and healthy life” (FAO, 2002).
- ² While other literature has used a definition of affordability that is based on the relative price of food (Breyer and Voss-Andreae, 2013, p. 131; Short et al. 2007), this In-Brief uses a social deprivation index as a proxy variable to determine if individuals are economically able to purchase healthy food. For a more complete understanding of food affordability in Winnipeg, future research, which was outside the scope of this study, should include a Nutritious Food Basket study to assess the cost of healthy eating throughout the city.
- ³ Extra Foods on Main Street, Extra Foods on Notre Dame Avenue, Zellers on Portage Avenue, Foodfare on Arlington Street, and Riediger’s Supermarket on Isabel Street.
- ⁴ Safeway at Ness Avenue and Sturgeon Road, Safeway at Leila Avenue, and IGA on Jefferson Avenue.
- ⁵ We acknowledge that leaving large grocery stores, such as Neechi Commons, out of the analysis has a direct impact on a dissemination block’s distance to a nearest supermarket, especially in areas where there are no supermarkets. However, we did so to remain consistent in our classification of supermarkets. Further research is encouraged to understand the role large grocery stores in underserved areas have on access to food and food security
- ⁶ Specialty imported-good stores were excluded for consistency with previous Canadian research including Montreal (Apparicio et al., 2007), Edmonton (Smoyer-Tomic et al., 2006), and London (Larsen and Gillian, 2008). However, additional research should be conducted to understand the role of specialty imported-goods grocery stores on local and less traditional consumer habits to assess their potential inclusion in future mapping exercises.
- ⁷ The list of operating supermarkets is accurate as of August 2015. During the period between the identification of supermarkets and publication of this research some of the supermarkets retained for analysis have closed, including the Safeway at 731 Henderson Hwy, while others have opened, including Sobeys at 2850 Pembina Hwy.
- ⁸ The search for supermarkets extended 1000 meters beyond the City of Winnipeg limits to prevent border effects. However, none were identified within this additional buffer.
- ⁹ Statistics Canada’s definition of a dissemination block is “an area bounded on all sides by roads and/or boundaries of standard geographic areas. The dissemination block is the smallest geographic area for which population and dwelling counts are disseminated.”
- ¹⁰ The shortest route was calculated with ArcGIS using the network analysis tool and a City of Winnipeg road network.
- ¹¹ Because socio-economic disparities exist within Census Tracts, in some instances when Census Tract social deprivation scores were ascribed to dissemination blocks, the scores did not accurately represent the social deprivation of a particular dissemination block. An example of this is the area of Armstrong Point, which is a relatively affluent neighborhood. Since the dissemination blocks in Armstrong Point are included in a Census Tract that experiences high social deprivation, it is also identified as having high social deprivation. While the extent of this effect is minimal, further research is required to ensure accuracy at the dissemination block level for social deprivation.
- ¹² For the purpose of this analysis dissemination blocks with less than 150 people per square kilometer were excluded from the population density map, and the remainder of the analysis. This primarily eliminated dissemination blocks on the periphery of the city and alongside the railway lines in the inner city.
- ¹³ Since Lorch’s work in 2004, Sobeys’s, Walmart, and other big box retail stores have opened on Taylor Avenue. For the purposes of this analysis we have considered this agglomeration of stores to be a new power centre.

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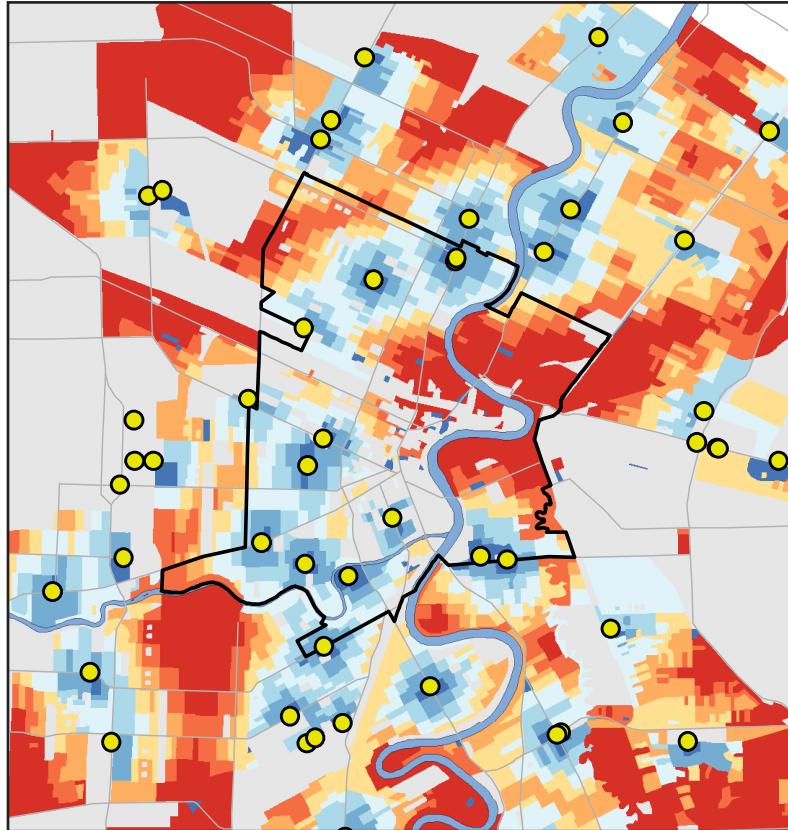
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