Mapping food access across Cape Town, South Africa

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Introduction

Cape Town is a multicultural metropolitan and the second most populous city in South Africa, home to some 3.7 million people [1]. Despite the end of Apartheid in 1994 with the first multiracial democratic elections, inequality across the city is still profoundly evident. Historically racially separated suburbs have remained demographically homogeneous and underprivileged areas have stayed impoverished. As the city's economy has grown and supermarket chains have expanded across the city, this has not necessarily led to an increase in food security or easier access for all citizens in the metropolitan. The State of Household Food Security Survey in 2018 revealed that almost half of Cape Town households were moderately or severely food insecure [2]. Despite post-Apartheid South Africa's increasing participation in the global economy and an average annual economic growth of 2.8% from 1994 to 2018, 25% of South African citizens lived below the food poverty line in 2015 [3], [4].

The Sustainable Development Goals prioritise ending hunger, achieving food security and improving nutrition [5]. Food security is therefore a focus for South Africa, a middle-income emerging economy with extensive inequality. Food security is defined by the United Nations as "all people, at all times, having 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" [6]. Access to economic resources is not the only barrier to food security for residents of Cape Town. The geography of a city influences the livelihood strategies a household can employ as well as their proximity to sources of food [7]. Furthermore, different food sources provide varying access to fresh and affordable food.

Problem

This short report seeks to describe the relationship between the geography of Cape Town, the location of poor households and their access to different types of food sources. Malnutrition in the city is a hidden hunger, partly due to wide access to energy-dense, nutrient-deficient foods. Many residents can reach their energy intake requirements, but not their macro- and micro-nutrient requirements for a healthy lifestyle [8]. As the State will shoulder the majority of the burden of diabetes, heart disease and obesity associated with poor diet, it is in the best interests of policymakers to address food insecurity across the city.

Approach

Census data from 2011 will be used to determine the number of people, number of households and percentage of indigent (impoverished) households per voting ward in the City of Cape Town municipality. A household is classified as indigent if their combined monthly income is R3 200 or less (about $175). A GeoJSON file will be used to construct a choropleth map of the 111 wards and the percentage of indigent households per ward. The Foursquare

Places API will be used to search for all venues around the center of each ward with a 2 500 m radius and a limit of 1 000 venues. The venues data returned is refined by removing all non-food venues and then classifying the food venues into fresh food (supermarkets, green grocers, butchers), fringe food (fast food, tuck shops) and restaurants. The wards will then be k-means clustered according to quintiles of indigent households and the number of food venues per category (fresh food, fringe food, restaurants). This will then be plotted over a map of Cape Town.

Background

History of segregation in Cape Town

Cape Town was first colonised by the Dutch East India Company in 1652, bringing with them slaves from Indonesia, Philippines, Madagascar, East Africa, India, and Sri Lanka. The British invaded the Cape in 1795, taking control of the area from the Dutch and forming the Cape Colony.

After the onset of British rule, many Dutch-speaking pastoral settlers, “Boers”, came to resent the administration. From 1836 onwards, Boers from the Cape migrated eastwards into the interior of the country in *The Great Trek*, founding three autonomous Boer republics and displacing tribal kingdoms [9]. The national economy flourished with the discovery of diamonds in Kimberley in 1867 and gold in Witwatersrand in 1884. Under colonial rule, official segregation and movement laws based on race were passed in 1923 [10]. This formed the precursor to Apartheid.

After the end of World War II, the South African economy enjoyed industrialised growth and many Black and Coloured people then moved to Cape Town for newly created jobs. Coloured people represent the multi-racial descendants of the ex-slave population [11]. This movement led to the emergence of shanty towns (“townships”) on the periphery of the city in the Cape Flats [10]. The location of the Cape Flats is indicated in an extract map from Cape Town Tourism, shown in Figure 1 [12].

In 1948, the pro-Afrikaner National Party won the national election whilst promoting the ideology of Apartheid. This set off the forced evictions of Black and Coloured people from “mixed” areas around the country, including suburbs of Cape Town. Before these removals began, one third of Cape Town residents lived in a mixed-race area. By 1982, under the Group Areas Act, 200 000 Black and Coloured people out of 1 million Cape Town residents were moved to purpose-built ghettos in the Cape Flats [10]. Figure 2 shows the suburbs Black, Coloured and Indian residents were evicted from and the suburbs they were moved to. The racial makeup of Cape Town in the 1980s was 55% Coloured, 30% White and 15% Black [10]. This is important to note, as Apartheid gave many social and economic preferences to Whites first, Coloureds second and Blacks last.

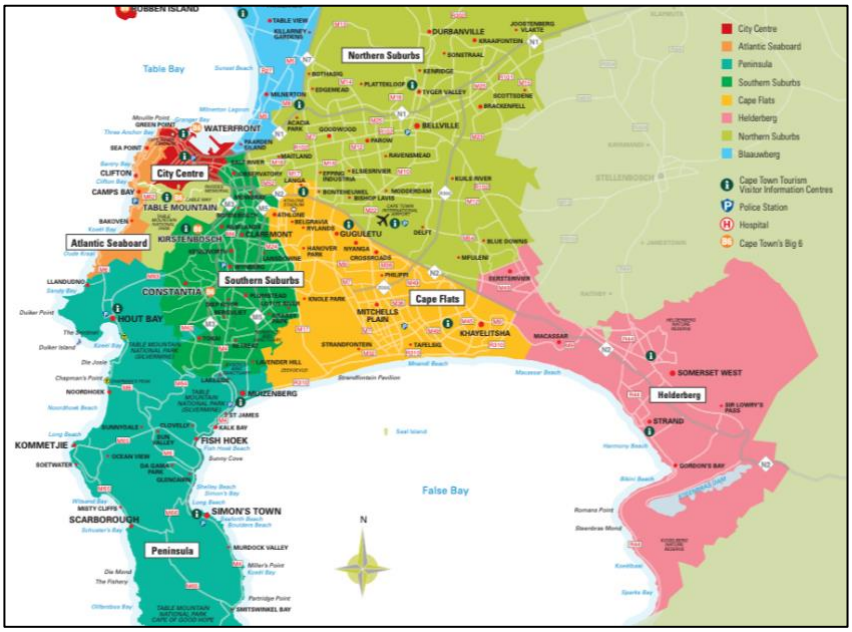

Figure 1: Map of Cape Town indicating the location of the city centre (red) and the Cape Flats (yellow) (retrieved from Cape Town Tourism)

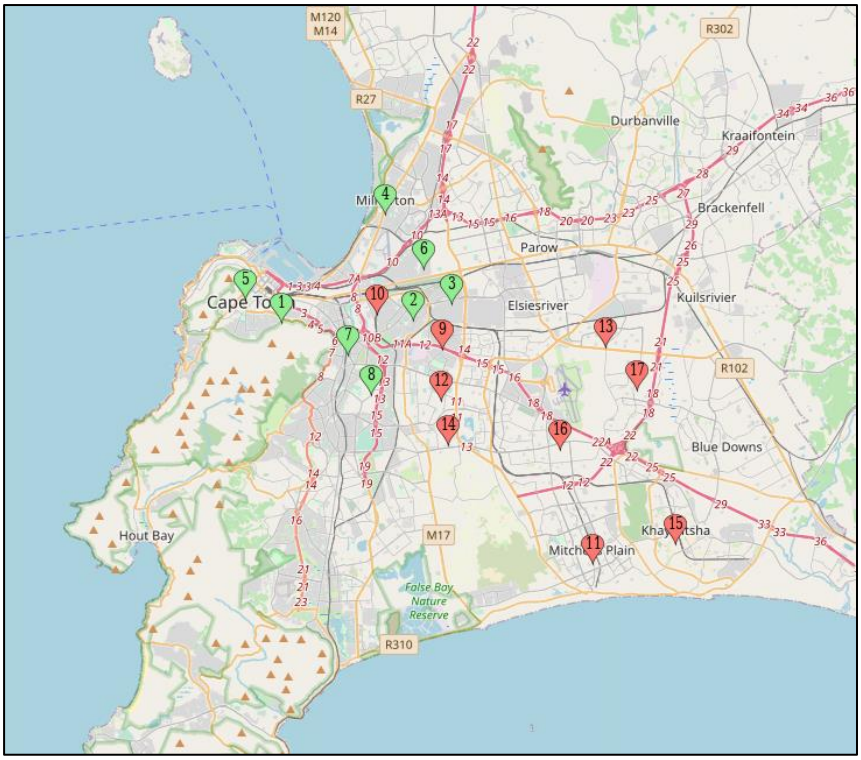

Figure 2: Map of Cape Town showing mixed race suburbs (green) that Black, Coloured and Indian residents were evicted from and the suburbs they were moved to (red) from 1948 - 1982 under the Group Areas Act [13]

By 1986, limited reforms of Apartheid were being rolled out and the Pass laws (movement restriction rules) were repealed. Many Black South Africans from the Eastern Cape moved to Cape Town in search of better opportunities, fleeing deliberately underdeveloped “Bantu homelands”. Townships on the outskirts of Cape Town, such as Khayelitsha, expanded because of this influx of migrants [10].

Despite the end of Apartheid, present day Cape Town suburb demographics still reflect Apartheid-era forced removals, enforced – in part – by the sustained economic exclusion of these groups. The Cape Flats and peripheral townships remain poorer and more densely populated than historically white suburbs [1].

Present day socioeconomics of Cape Town

Out of 1.07 million households in Cape Town, 48% have a combined household income of R3 200 a month or less (approximately $175 a month) [1]. This classifies the household as indigent (requiring social assistance with municipal services) and at the edge of the poverty line. The poverty line is defined as enough money to buy the minimum amount of food required for every household member as well as essential non-food items, such as toiletries [14].

Food deserts in Cape Town

A food desert is defined as an area with limited access to affordable and nutritious food and is often used to describe an economically-disadvantaged urban area [15]. Studies in food deserts often place an emphasis on the "proximity and density of retail food outlets in a specific neighbourhood as markers of access to affordable, healthy food" [16].

Supermarket expansion

As supermarkets and other food retail outlets have expanded across Cape Town in the last two decades, the effects of these on food security in the city are of interest. By the early 2000s, supermarket sales in South Africa already made up between 50% to 60% of food retail sales, despite only accounting for 2% of outlets [17]. The major drivers of supermarket expansion in the city have been urbanisation, economic growth, and improved household storage capacity. Improvements in transport infrastructure in townships have also made accessing large centralised stores easier [18].

Not all South African supermarkets are equal. Woolworths, Checkers, Pick n Pay, Spar and Food Lover's Market stores concentrate on high income customers. Shoprite and the OK Franchise stores focus on the mass of middle-income customers whilst USave, Cambridge Foods and Boxer stores focus on low income customers [19]. Supermarkets servicing lower income customers tend to stock little to no fresh produce, a limited supply of dairy and meat and an abundance of dry cereals, canned goods, oils, rice, and other non-perishable goods. As the average income of a customer base increases, supermarkets stock more dairy, meat and fresh produce [20].

Food retailers in Cape Town

A study on food insecurity in Cape Town demonstrated that residents in the city utilised three main food sources: supermarkets, small formal retail outlets (butchers, grocers, fast food chains) and informal retailers (street-side grocers and "spaza" shops) [7]. Spaza shops (informal convenience stores) are a key component of food access in low income suburbs as they are located close to poorer households than supermarkets [20].

These three major food retailer types are not evenly distributed across the city and not equally frequented by all income groups. In 2014, the richest quintile of Cape Town suburbs had eight times the number of supermarkets per 1 000 households as the poorest quintile of suburbs. Indigent households in Cape Town only visited supermarkets once a month on average, but visited informal retailers on a weekly or daily basis [2]. The advantages and disadvantages of these different food sources are outlined in the table below [7].

Food source	Advantages	Disadvantages
Supermarkets	• Large range of foods (in medium/high income stores) • Low price per unit goods • High safety standards	• Unit sizes unaffordable for poor households • Inconvenient location and hours • No credit offered
Spaza shops/ informal retailers	• Small unit sizes are more affordable • Often sell food on credit with low to no interest • Convenient hours and location	• Cost per unit is high • Perceived low quality of food • Limited variety of fresh foods (preference given to canned and dry food with a long shelf life)
Street-side grocer	• Convenient location near transport hubs and on residential streets • Restocked daily from farm supplier • Cheaper than supermarkets	• Short shelf life (no cold chain storage)
Street-side meat vendor	• Cultural meat preferences (e.g. offal) • Large variety of cuts • Perceived better taste from freshly slaughtered meat	• Low food safety standard

It has been argued that supermarket expansion in the city could negatively impact food security as it can drive out some smaller businesses by absorbing their demand [21]. The retail food sales of 1 700 supermarkets equalled that of 350 000 spaza shops in 2010 [22]. The informal sector is still very important in servicing poorer households' demand, making up 30% of national food retail sales [23].

Geography as a factor of food security

The proximity of food sources to a household is not the only way in which the geography of a city influences food security. The location of a household will influence what livelihood strategies a household can employ (for example, how far they are from workplaces) [7]. Time and transport costs also factor in when visiting different food sources. If a household member works in a more affluent and developed area, they can visit nearby food retail outlets as part

of their daily commute cost. For unemployed households, accessing supermarkets includes a large transport cost [24]. This is of importance in Cape Town, where 25% of working age people are not in education, employment, or training (NEET) [25].

Food security policy

Within urban areas, including Cape Town, food insecurity is complex as residents follow the nutrition transition typically found in developing countries. The nutrition transition represents a shift in dietary consumption and energy expenditure coinciding with economic growth. Diets traditionally high in cereal, fibre and vegetables are replaced with a more Western diet high in sugars, fats, and animal-source foods. The transition of diet often corresponds with epidemiological changes including a higher prevalence of chronic and degenerative diseases [26]. Current South African policy does not address the systemic issues that inform the food choices people make, but rather focuses on increasing food production. There is still a belief within the global community that African food insecurity is as a result of scarcity of food and people being simply too poor to access adequate foods [27].

Over half of South Africans are overweight or obese and it is often assumed that this is attributable to the personal failings of people to choose healthier diets. The response to this phenomenon has therefore been to provide nutrition education to help people choose better diets [8]. However, this reaction does not address the irregularities in food availability and variety in different areas. There has been a dramatic shift in the South African diet, with snack bars, ready meals and noodle sales volumes increasing by 40% from 2005 to 2010. The number of Coca-Cola products consumed per South African per year has increased from 130 products in 1992 to 254 products in 2010 [28] and the price of fresh foods has increased faster than that of processed foods [29].

As diet-related degenerative diseases are directly linked to urban food deserts and these will require state support and care [30], it is in the best interests of policy makers and the government to address food insecurity. It has been contended that addressing food deserts is not a problem that can or should be solved by large retailers, but rather through the agency of communities alongside policymakers [31].

Description of data

The City of Cape Town municipality was divided into 111 voting wards in 2011 with an average of 34 000 people and 9 600 households per ward [1]. In 2016, 4 new wards were added by sub-dividing larger wards. The 2011 ward classifications will be used as the census data on household income was collected the same year. The GeoJSON file for plotting these wards was retrieved from the City of Cape Town [32]. The centre of each ward was manually determined and the latitude and longitude thereof recorded. This was done as the wards were not of equal size.

The number of people, number of households and percentage of households classified as indigent were retrieved from the 2011 census [1]. The Foursquare Places API was used search for all venues within 2 500 m of a ward centre with a limit of 1 000 venues per ward.

How data will be used

A map of Cape Town and a choropleth of wards and the percentage of households classified as indigent will be plotted. This will give a view of the distribution of poverty around the city. The centres of each ward are included as markers.

The venues data will be cleaned to remove non-food venues types. This will be done by manually creating a list of "food" venues and dropping any venues from the main dataframe that did not meet this classification. The number of venues in the dataframe decreases from 12 145 venues to 1 865 food venues, which seems very low for a large metropolitan. This could be because few informal food vendors are listed within Foursquare's database and because Google Maps is much more popular in South Africa than Foursquare.

The food venues will then be grouped into three categories; **fresh food** (supermarkets, grocers, butchers, bakers), **fringe food** (fast food, tuck shops) and **restaurants**. The percentage of households classified as indigent will be categorised into five quartiles.

The wards will be categorised into 5 groups using k-means clustering. This will be done using the quartile of households classified as indigent and the number of venues per food category for each ward. These clustering will be displayed on a choropleth of Cape Town wards and their quintile of indigent households. This will hopefully show any trends in food access, geography, and income.

Preliminary data analysis

As a preliminary data analysis, all food venues will be plotted on the choropleth ward map. This shows that there are far more supermarkets listed in richer areas. There were few informal retailers listed in any area.

Example of ward data

Ward 1 is in Panorama in the Northern Suburbs of Cape Town. In 2011, there were 26 885 people and 9083 households. 15% of households earn less than R3 200 a month and are classified as indigent. The centre of the ward was located at -33.875731, 18.561381. The Foursquare Places API retrieved 123 venues, of which 26 are food venues.

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