Teaching Food Access Sociology Through Python

In this work, we use quantitative methods to study access to food in North Carolina. In particular, we present this work in a format targeted at students in traditional science, technology, engineering, and mathematics (STEM) curricula, to broaden their understanding of food sociology.

The food issue we study is that of equitable access to food. In the United States, save for families that produce their food entirely, e.g. through farming, access to food is synonymous with access to a market or store at which to buy it. Thus, access to food is inequitable when one community has fewer stores that members of that community can access, compared to other communities. For an individual, this access may be driven by several factors; most immediately, their access to transportation to those stores, their economic purchasing power or access to food assistance programs like SNAP, but may also involve personal food preference, dietary restrictions, and other sociological concerns like gender roles (Cairns & Johnston, 2015) and availability of culturally-appropriate foods (MacNell, 2018).

Colloquially, some may call areas of lower access “food deserts,” however, this term is problematic as it implies a natural occurrence of food inaccessibility and limits further interrogation of the causes of such deserts (Sevilla, 2021). The term “food apartheid” may be more accurate, in explicitly defining issues of access as the result of real policy choices that are often racially motivated (Sevilla, 2021). In this work, we will also eschew the term food apartheid, solely because the inclusion of demographic information proved beyond the scope of this work. We will instead adopt the practice of the United States Department of Agriculture (USDA) Food Access Research Atlas (FARA) and refer to issues of inequitable food access between communities that can be objectively quantified (USDA ERS, 2013). However, we emphasize that this is reductive, and can at best form a small part of an initial inquiry into the racial and other socio-economic differentiators that drive food access inevitabilities.

Here, we will study food access quantitatively; quantitative analyses of food access are grounded in the aforementioned sociological theory of food access and serve an important role in uncovering barriers to food access (MacNell, 2018) and informing policymakers in their attempts to increase food access (Ver Ploeg, 2015). We choose to use a quantitative lens because of its applicability to STEM students with quanta-heavy curricula. As our sociological topic, we choose to study food access because of this author's own experience with food access. With severe food allergies to dairy, peanuts, and tree nuts, and morally-informed vegetarianism, it has been difficult to find food that this author can eat; save for the past three years, some stores will often entirely lack food that fulfills complete nutrition requirements. Often, this author has had to look further afield for food, which is only possible with economic privilege; thus, in this work, we study the phenomenon of food access in society at large where such flexibility is not always available.

In this work, we seek to broaden the reach of sociology to current undergraduate students in STEM curricula that often lack exposure to sociology, particularly the sociology of food. Our pedagogical goals are two-fold. First, for our audience to learn the basic lesson that food access is not equitable, as a starting point for further investigation as to why this is so. Second, for our audience to appreciate how food sociology intersects their daily lives. We achieve these goals by providing tools familiar to STEM students that allow them to apply sociological theory, even without grounding in theory.

To make sociology accessible to quantitatively-minded students, we create a Python "Jupyter" programming notebook that applies a quantitative analysis of food access in North

Carolina similar to that of MacNell (2018). A Jupyter notebook allows a user to define short pieces of programming that can perform calculations, load data, and visually plot that data, alongside textual descriptions of the calculations being done. It will be familiar, either in passing or through direct use, to most STEM students, due to the ubiquity of programming in modern STEM curricula. We program our notebook to load metrics on food access from the USDA Food Access Research Atlas (FARA), and many different food stores in North Carolina counties from the OpenStreetMap (Bennett, 2010). We provide textual descriptions of these sources, e.g. a summary of the kinds of data provided by the USDA FARA. To demonstrate quantitatively that food access is a real issue supported by data, we plot the number of individuals, per county, classified as having low-access to food, from the FARA. Then, our notebook walks through the use of "active subspace analysis", a modern statistical technique that identifies the most influential variables in determining some quantity of interest, like food access in North Carolina counties (Constantine, 2015). We choose our input variables as the number of Walmart, Food Lion, Harris Teeter, Whole Foods Market, Family Dollar, Dollar Tree, and Dollar General stores, respectively, in each North Carolina county, to mirror the analysis-by-brands in part of MacNell (2018). In active subspace analysis, these input variables can be combined into an "active variable", which we use as a new metric to predict food access in a given North Carolina county. We focus our analysis on Wake County and nine additional counties (Harnett, Johnston, Wilson, Nash, Franklin, Granville, Durham, Orange, and Chatham) near the author's home institution of NC State, however, these counties can be easily changed by a user of the notebook. We plot the results of this analysis, finding that the number of Walmart-brand stores in a county most strongly predicts the number of individuals with low access to food in that county, even more so than the total population of that county. Our results and code are publicly available, at https://github.com/noahewolfe/soc350-final.

With this notebook, we apply a dramatically reduced version of the work of MacNell (2018), using a different statistical approach. MacNell (2018) studied barriers to food access in North Carolina, using a combination of a quantitative study of distance to stores in different communities and a qualitative, ethnographic study of community member experiences buying food. Among many interesting findings, MacNell (2018) observed that proximity alone does not predict individual preferences for food shopping, and that community members in Kingston and Smith counties preferred Food Lion and Walmart even if they were further than the nearest stores due to a combination of low prices and relatively large food selection. If we combine our results with that of MacNell (2018), we might conclude that stores like Walmart and Food Lion preferentially place themselves in communities with low food access, and target their prices and food selection at these communities, garnering loyal community customers. Thus, our active variable metric may actually identify a trend in how food access is privately organized, instead of acting as a causal predictor of food access. However, a more in-depth analysis of the data we collated would be required to call this conclusion significant.

To a student not versed in sociological theory, the text of MacNell (2018) may be daunting. Thus, our notebook applies similar principles to achieve similar conclusions in a way that is accessible beyond the field of food sociology. Although this does not address the issue of food access themselves, by walking quantitatively-minded students through analysis of data from communities they may be familiar with, we simultaneously teach more people, who may otherwise avoid sociological theory, that food access inequity is an issue and that it is tied to landmarks from their own lives.

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