

Vegan Restaurants to fight Climate Change

Amar Hegde

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1. Introduction

Climate change poses a threat to the security of our food supply. Rising temperatures, increased rain and more extreme weather events will all have an impact on crops and livestock. Food production also contributes to global warming. Agriculture - together with forestry - accounts for about a quarter of greenhouse gas emissions. Livestock rearing contributes to global warming through the methane gas the animals produce, but also via deforestation to expand pastures, for example. Feeding massive amounts of grain and water to farmed animals and then killing them and processing, transporting, and storing their flesh is extremely energy-intensive. And forests—which absorb greenhouse gases—are cut down in order to supply pastureland and grow crops for farmed animals. Finally, the animals themselves and all the manure that they produce release even more greenhouse gases into our atmosphere.

The environmental impact of meat production is important to many vegetarians and vegans. The impact is also important to many meat consumers who may not have many choices in their neighborhood for meat alternatives or Vegan food. In the US, vegan burger patties are made from plant-based meat substitutes to taste like the real thing thanks to an iron-rich compound called heme. Eating vegan foods rather than animal-based ones is the one of the best ways to reduce your carbon footprint. A University of Chicago study even showed that one can reduce carbon footprint more effectively by going vegan than by switching from a conventional car to a hybrid.

2. Business Problem

In this project we attempted to find one or several optimal locations for a Vegan restaurant. Specifically, this report is targeted to stakeholders interested in opening a Vegan restaurant in one of the populous cities in the most populous states in the U.S, California, and Texas.

Since there are lots of restaurants in the cities within these two states, we attempted to detect locations that are not already crowded with restaurants. We were also particularly interested in areas with hardly any Vegan restaurants in the vicinity.

We used the data science powers to generate a few most promising neighborhoods based on the population criterion. Populations in each neighborhood within the focus region is then clearly expressed so that best possible location(s) can be chosen by stakeholders. By no means this is a complete study which considers all possible factors in determining the best possible locations.

3. Data

We used the Foursquare API to collect data about locations of Vegan places in 4 US metros areas: Houston, TX, Dallas, TX, San Francisco, CA and Los Angeles, CA. These are two most populous metro areas within Texas and California. The open data available in the government catalog was then used to obtain zip codes, county names, neighborhoods population and other relevant data for the focus region.

Based on definition of our problem, factors that influenced our decisions were:

- Number of existing vegan restaurants in the metro area
- Mean distance to the vegan restaurants in the metro area.
- Population levels within the metro region and neighborhoods that have least number of Vegan restaurants.

Following data sources was be needed to extract/generate the required information:

- The number of vegan restaurants and their location in every neighborhood of the metro was be obtained using ****Foursquare API****
- The zip codes of the neighborhoods and population information was be obtained using open data available in <https://catalog.data.gov/dataset>.

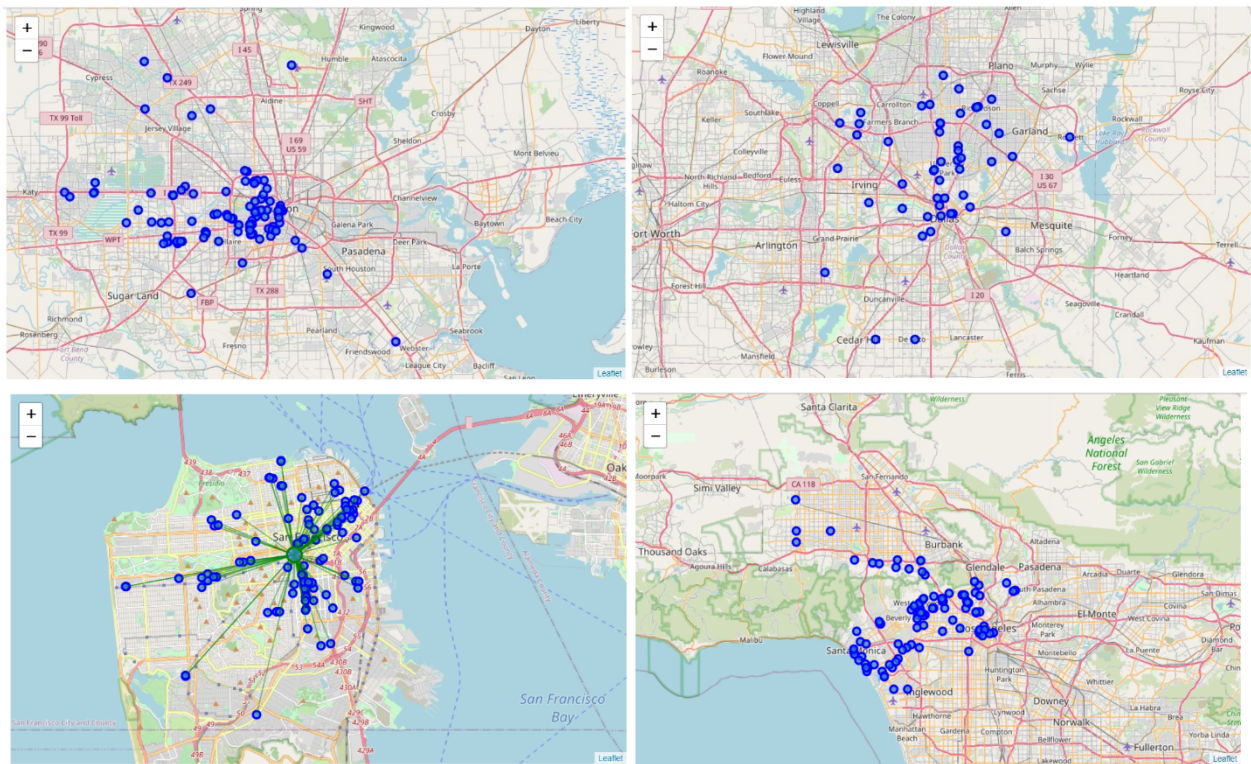


Figure 3.1 Map of existing Vegan places in all the 4 metro areas: (From top clockwise) Houston, TX, Dallas, TX, Los Angeles, CA and San Francisco, CA

4. Methodology and Assumptions

The objectives here are to assess which metro area would have the least established vegan restaurants density and further explore the focused area to determine possible neighborhoods for a new restaurant based on population levels. For the four metro areas, the main city within the metro is chosen initially for simplicity with Foursquare. For example, "San Francisco, CA" is chosen in lieu of "San Francisco-Oakland-Berkeley, CA"; "Dallas, TX in lieu of "Dallas-Fort Worth, TX". The number of Vegan places in the main city is assumed to be an indicator of the Vegan places in that entire metro region.

The Foursquare API is used via the venues query. The near query is used to get venues in the metros. Also, the Category ID <4bf58dd8d48988d1d3941735> that is available for Vegan/Vegetarian place is assumed for Vegan restaurants. The Foursquare limits us to max 100 venues per query. This request was repeated for the 4 studied metros and received their top 100 venues. The name and coordinate data were saved from the result and plotted them on the map for visual inspection.

Next, to get an indicator of the density of Vegan Places, a center coordinate of the venues was calculated to get the mean longitude and latitude values. Then the mean of the Euclidean distance from each venue was calculated to the mean coordinates. That was the indicator: mean distance to the mean coordinate.

Next the metro with least densely populated with Vegan places is determined. This was the focus area for further analysis. This project takes into account only the population levels and assumes more the people, more the demand for Vegan food. The zip codes, neighborhood names, coordinates and population information for this metro region are obtained. Each neighborhood within the largest county in the metro is analyzed with respective vegan places and population in them. The most populated neighborhoods with least number of vegan places are then obtained.

5. Analysis

5.1 Focus Area Determination

We saw that San Francisco and Los Angeles are the densest cities with established Vegan places. Dallas is least dense with established Vegan places.

To measure the density, some basic statistical metrics were obtained. First the mean location of the Vegan places (which should be near to most of them if they are really dense or far if not) is obtained. Then the average of the distance of the venues to the mean coordinates.

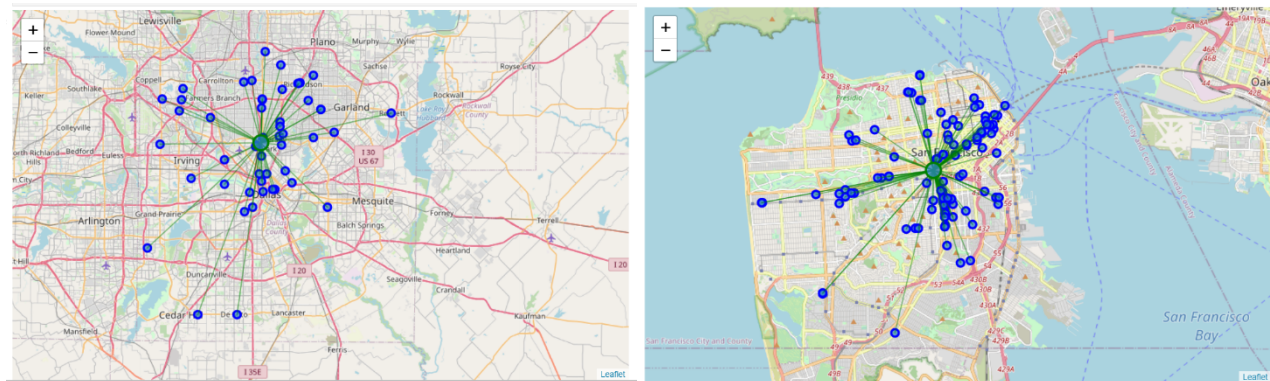


Figure 5.1 Map showing distance from mean coordinates for the least dense metro area in Dallas, TX (Left) and for the densest metro area in San Francisco, CA (right).

5.2 Further Analysis

We saw that Dallas, TX is the least favorable in terms of number of Vegan places and also the places in this metro area are farther apart. Houston comes next as least favorable.

Based on this, it is assumed Dallas-Fort Worth (DFW) metroplex has comparatively less Vegan restaurants than the other 3 metropolitan areas.

5.3 Neighborhood Data Processing

Raw data of Texas is cleaned up to create a new dataframe with only DFW counties and their neighborhoods.

Among the four DFW counties, Dallas county is the most populous with over 2.4 million residents. Dallas County is the focus area for this project. Similar studies can be extended to other counties of the metro.

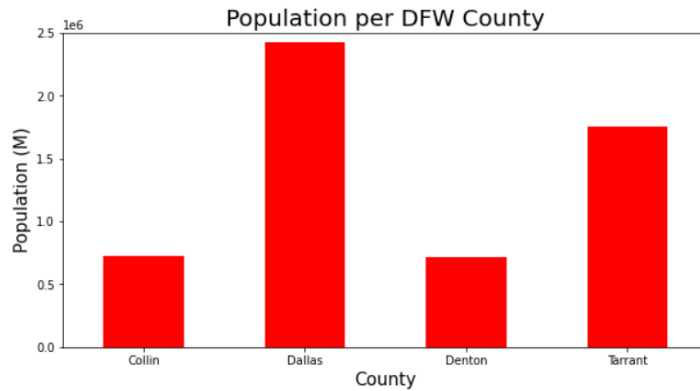


Figure 5.2 Bar graph showing population levels in the DFW counties.

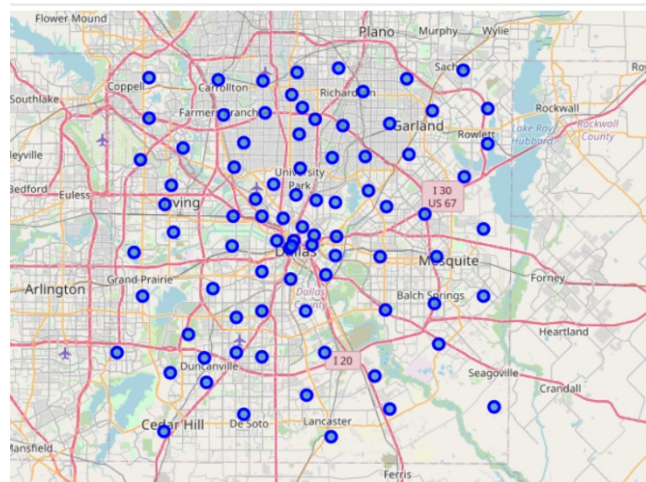


Figure 5.3 Map showing all the neighborhoods in Dallas County.

Within the Dallas County, most populous neighborhoods (or cities) with 50K or more residents are chosen for further analysis. These neighborhoods are Dallas, Garland, Grand Prairie, Irving, Mesquite, Richardson, and Rowlett.

6. Results and Discussion

Per the above analysis, among the 4 most populous metro areas within the most populous states in U.S, Dallas, TX metro area has the least number of Vegan restaurants. The Dallas metro area or DFW includes mainly 4 counties with the greatest number of residents. Dallas County is the largest among these 4 counties. With Dallas County as the focus, the most populous neighborhoods/cities are considered to be ones with 50K or more residents. This filtered down to 7 neighborhoods: Dallas, Irving, Richardson, Rowlett,

Garland, Grand Prairie and Mesquite. From above population and restaurant density analysis, we arrived at the following results –

Table 6.1 Dallas County Neighborhood Cities population and their current count of Vegan Places

Dallas County Neighborhood/City	Population (Rounded Number)	No. of Vegan Places
Dallas	1.2 million	51
Garland	227,000	48
Grand Prairie	170,000	58
Irving	218,000	65
Mesquite	141,000	35
Richardson	78,000	47
Rowlett	55,000	11

Dallas has 1 Vegan place for approximately every 23K residents. Garland has 1 Vegan place for approximately every 4K residents. Grand Prairie has 1 Vegan place for approximately every 3K residents. Irving has 1 Vegan place for about approximately every 3K residents also. Mesquite has 1 Vegan place for approximately every 4K residents. Richardson has 1 Vegan place for approximately every 1.7K residents; and finally, Rowlett has 1 Vegan place for approximately every 5K residents.

7. Conclusion

Based on an analysis of the population and amount of established Vegan places in the 4 largest metros within the two populous U.S states, Dallas TX metro provides opportunities for the stake holders to open Vegan restaurant and encourage Vegan food among residents to help fight climate change. Within the DFW metro, the top 4 neighborhoods within Dallas county area for opening new business for Vegan food are Dallas, Rowlett, Garland and Mesquite.

8. Future Directions

This project took into account only the population levels and assumed more the people, more demand for Vegan food. Further analysis can be conducted taking into the account the education and employment levels in the neighborhoods, the income levels and age groups. The analysis can be repeated for a greater number of cities or metro areas.