

Mapping Toronto's Libraries*

Are Libraries Distributed Equally Throughout the City?

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This report analyzes the Library Branch General Information dataset, which is made available to the public from Open Data Toronto. It uses the library branches, square footage, and ward information to determine how well libraries are spread across the city. In summary, library facilities are available in every ward, and there is little correlation between the number of branches and space available to users. These findings are relevant because they can help ascertain how accessible libraries are to residents of Toronto, and guide policy decisions on where new locations should be opened.

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*Code and data are available at: <https://github.com/hadi-q/toronto-public-libraries>.

1 Introduction

Libraries are a critical form of social infrastructure in modern society. They serve many functions, ranging from providing access to books and WiFi, to programs on self-improvement, to providing places of shelter to study or work. More importantly, however, they offer most or all of this functionality for free. Thus, libraries are not just places for any specific demographic: they act as third spaces, allowing users of different ages, ethnicities, and backgrounds to all exist in the same space. In a society where most services are monetized or paid, libraries remain a vestige of a more egalitarian era.

The Toronto Public Library in particular excels in these functions due to its size, cross-branch integration, and volume of services available. With 100 physical branches in its network, users can borrow books from any branch and have it delivered to their home branch. This increases the access to information that Toronto Public Library users benefit from. As well, users can borrow movies, internet hotspot devices, video game consoles, and even get free passes for museums or other attractions. A Toronto Public Library card also gives users access to third party platforms like Libby, OverDrive, Hoopla, and Consumer Reports, providing additional online resources that users can benefit from.

In October 2023, the Toronto Public Library was victim to a major cybersecurity attack that took down their website and online systems. This incident also led to some user data being compromised to hackers. As of January 2024, their website services remain offline. This prevents users from being able to borrow or renew books online, create or renew a library card, or access many of Toronto Public Library's services. As a result, physical proximity to a library branch has become more important than ever before, as it remains the only way to borrow books or access other library services until full services are restored.

This paper aims to analyze the distribution of Toronto Public Library branches across the 25 wards of Toronto. The distribution of branches will be viewed in two ways: number of branches and square feet of branch space within a given ward. The resulting analyses will determine if certain wards are over- or underrepresented in terms of the quantity and size of library branches, which could provide cursory information on where future libraries could be built or current libraries that could benefit from expansion. Future analyses may explore demographic factors to determine if libraries are disproportionately located in neighbourhoods of higher or lower income, to get a sense of equality of access to libraries.

The Data Section 2 of this paper explores the `opendatatoronto` data holistically, outlining tools and methods used to analyze the data and some preliminary observations from the data. The Results Section 3 introduces more observations found from the data analysis. The Discussion Section 4 ties back the findings to its real world relevance. Lastly, the Conclusion Section 5 summarizes key findings and outlines future areas of study.

2 Data

All relevant data was sourced from the Open Data Toronto portal, and extracted using the `opendatatoronto` library for R (Gelfand 2022). In particular, one dataset was used for the graphs and analyses in this paper, which included information about all Toronto Public Library branches, their addresses, phone numbers, square footage, year of construction of the building, among other variables like whether there is a park adjacent to the library, if adult literacy classes are available, and GPS coordinates of the building.

2.1 Data Tools

The data was generated, extracted, and cleaned using R (R Core Team 2022), leveraging functions from `tidyverse` (Wickham et al. 2019), `ggplot2` (Wickham 2016), `dplyr` (Wickham et al. 2023), `readr` (Wickham, Hester, and Bryan 2023), `janitor` (Firke 2023), `opendatatoronto` (Gelfand 2022), `knitr` (Xie 2014), and `here` (Müller 2020).

2.2 Overview of Dataset

The selected dataset was published by the Toronto Public Library to share information on libraries located in its network, and was last updated on 29 June, 2023 in accordance with its annual updating guideline. The chosen variables of analysis were the branch name, the square footage of the library, the ward number and ward name of where the library is located, and the year of construction of the site. See Table 1 for an overview of the data.

Branch	Square Footage	Ward Number	Ward Name	Year Built
Albion	29000	1	Etobicoke North	2017
Albert Campbell	28957	20	Scarborough Southwest	1971
Alderwood	7341	3	Etobicoke-Lakeshore	1999
Agincourt	27000	22	Scarborough-Agincourt	1991
Armour Heights	2988	8	Eglinton-Lawrence	1982
Annette Street	7806	4	Parkdale-High Park	1908

Table 1: Sample of Toronto Public Library Data

Libraries are present in each of the 25 wards in the city of Toronto. (Note that at the time of the 2018 election, wards were redrawn from 44 wards down to the present 25.) While neighbourhood data is available from the dataset, it is excluded from this analysis, as neighbourhood classifications and counts varied between different `opendatatoronto` datasets, and because not all neighbourhoods are listed in this dataset.

The original dataset had entries for codes that did not correspond to physical locations, such as the phone line. These were filtered out, leaving a total of 100 library branches.

2.3 Distribution of Branches Per Ward by Count

On average, there were four library branches per ward. However, in practice, this ranges from one branch in wards like Willowdale, up to seven in branches like Toronto-Danforth. See **Table 2** for a sample of the dataset.

Ward Name	Number of Branches
Beaches-East York	4
Davenport	4
Don Valley East	4
Don Valley North	4
Don Valley West	4
Eglinton-Lawrence	4
Etobicoke Centre	3
Etobicoke North	4
Etobicoke-Lakeshore	6
Humber River-Black Creek	5

Table 2: Sample of Count of Library Branches by Ward

2.4 Distribution of Branches Per Ward by Square Footage

There is significant range in the square footage of libraries. The smallest library in the dataset, Todmorden Room, measures just 554 square feet, while the largest, the Toronto Reference Library, amounts to over 400,000 square feet. Clearly, both of these branches are outliers from the dataset - the mean square footage of a library branch is 18,129.32 square feet, whereas the median is 8,496.50 square feet. This highlights the need to analyze the distribution of library branches beyond absolute counts, to better understand if library space is evenly allocated across the city. See **Table 3** for a sample of the dataset.

Ward Name	Total Square Footage of Branches
Beaches-East York	33021
Davenport	40312
Don Valley East	42129
Don Valley North	97349
Don Valley West	40510

Ward Name	Total Square Footage of Branches
Eglinton-Lawrence	91449
Etobicoke Centre	63055
Etobicoke North	43772
Etobicoke-Lakeshore	61053
Humber River-Black Creek	68108

Table 3: Sample of Total Square Footage of Library Branches by Ward

2.5 Merged Branch Count and Square Footage

To better understand any links between the number of branches and square footage of library space, the two datasets were merged into a single dataframe using the `merge` function.

Ward Name	Number of Branches	Total Square Footage of Branches
Beaches-East York	4	33021
Davenport	4	40312
Don Valley East	4	42129
Don Valley North	4	97349
Don Valley West	4	40510
Eglinton-Lawrence	4	91449
Etobicoke-Lakeshore	6	61053
Etobicoke Centre	3	63055
Etobicoke North	4	43772
Humber River-Black Creek	5	68108
Parkdale-High Park	6	65855
Scarborough-Agincourt	3	40453
Scarborough-Guildwood	2	36083
Scarborough-Rouge Park	4	44834
Scarborough Centre	5	49252
Scarborough North	3	24444
Scarborough Southwest	4	48816
Spadina-Fort York	3	33784
Toronto-Danforth	7	57331
Toronto-St. Paul's	5	78705
Toronto Centre	3	27267
University-Rosedale	6	494632
Willowdale	1	168022
York Centre	2	26882
York South-Weston	4	35814

Table 4: Count and Total Square Footage of Library Branches by Ward

3 Results

The distribution of the number of branches per ward range from one branch in Ward 18 (Willowdale), to seven branches in Ward 14 (Toronto-Danforth). Overall, the distribution follows a normal curve, with 10 of the 25 wards falling squarely on the median and mode of having four branches. Only one ward each falls in either upper or lower extremity. See Figure 1 for more details.

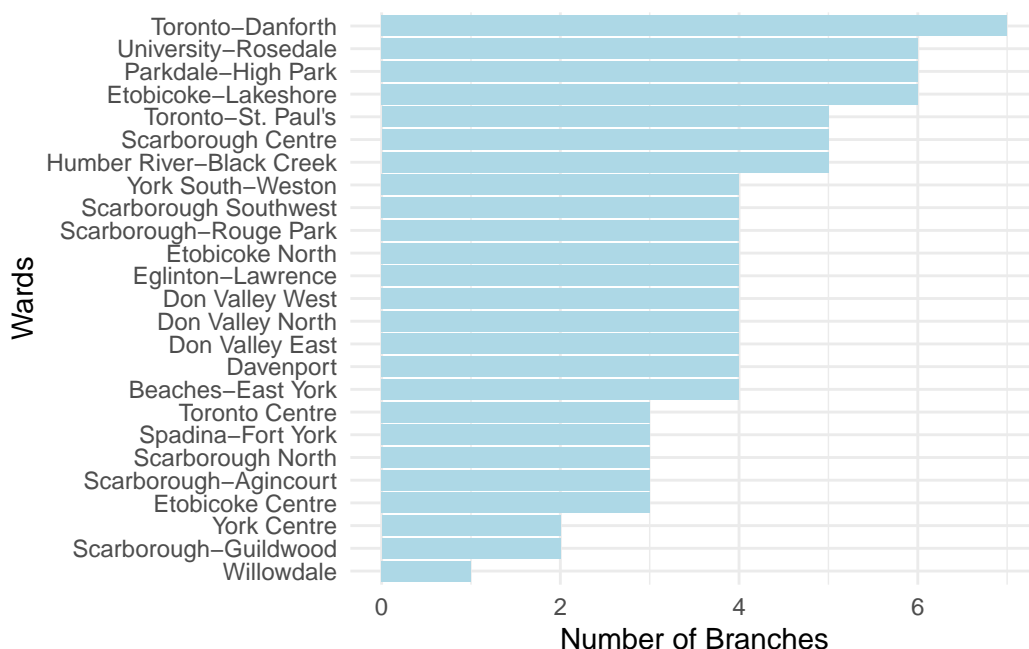


Figure 1: Library Branches by Ward by Count

The distribution of square footage of library space tells a different picture. The ward with the greatest amount of library space, Ward 11 (University-Rosedale), is home to six libraries, yet it would still have the most library space even with only one branch: the Toronto Reference Library. Likewise, the second highest ward, Ward 18 (Willowdale), only has one library, yet it too retains a significant amount of library space. A total of 1,812,923 square feet of library space is available across the 100 branches, averaging out to 72,517 square feet per ward. After removing Toronto Reference Library, the mean falls to 54,929 square feet. The median is 44,303 square feet. See Figure 2 for more details.

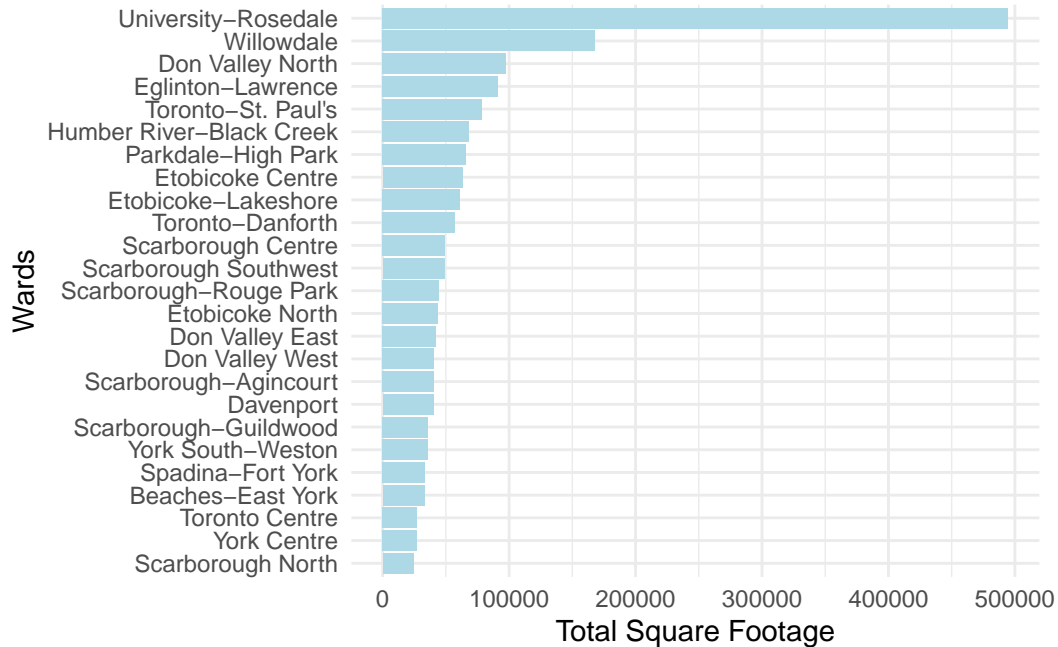


Figure 2: Library Branches by Ward by Square Footage

4 Discussion

The figures above show that there is some disparity in the distribution of library branches compared to the availability of library space. However, the flatter distribution of library space compared to the number of branches suggests that all wards are served with an adequate amount of library space. It also brings into question, which is a better metric of library accessibility? Merely having more library branches does not guarantee all users will have enough space to use its facilities. But on the other hand, having more space within fewer branches does not assure that all users can reasonably get to the premises. Could wards with fewer library branches have enough space, but still leave residents living further away in food desert style ‘library deserts’?

Without access to demographic data, determining the density of library space relative to population density, or proximity of population to libraries, is not possible. However, the results do indicate some overlying trends. For instance, the three wards with the greatest amount of branches all fall squarely on subway lines - Ward 14 (Toronto-Danforth) corresponds to the Toronto Transit Commission’s (TTC) Bloor-Danforth subway line, Ward 11 (University-Rosedale) corresponds to the Yonge-University subway line, and Ward 4 (Parkdale-High Park) has its own subway station. This is also demonstrated in terms of square footage of library space - like Ward 11’s (University-Rosedale) and Ward 18’s (Willowdale) locations along the TTC’s Line 1, the third place ward, Ward 17 (Don Valley North), falls along Line 4. This

could suggest that the higher density associated with transit corridors correlates to more library branches, but further research is needed to draw conclusions.

One major strength of the Toronto Public Library network is its presence in every ward in the city. Even if this means a single room acting as the library space, in the case of Ward 14's (Toronto-Danforth) Todmorden Room, it provides access to facilities from a larger network nonetheless.

5 Conclusion

This paper investigates the distribution of library branches and library space within Toronto's 25 wards to determine if the facilities are distributed equally. It demonstrates that, while there is a large spread of the number of library branches in any single ward, ranging from one to seven, the distribution of library space is less skewed. Further research on demographic factors, like population distribution, density, access to transit, or other factors could better determine the equity of library access across the city.

6 LLMs

Statement on LLM usage: no LLMs were used in the making of this paper.

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