

Vancouver Green Bus Atlas

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Why I did it.

The **City of Vancouver** in Canada aims to reduce its greenhouse gas emissions by about 20% by 2050¹. Encouraging the use of public transportation, such as buses, is one way city officials plan to reach this goal. However, using buses for primary transportation is not typically preferred by commuters if other options are available. Existing literature has largely focused on objectively measuring transit accessibility, and very little research has been done to investigate the overall riding experience of transit users. Improving that experience is crucial to encourage greater transit use in Vancouver in order to reduce carbon emissions. **Urban green spaces** are spaces in urban areas with trees and other vegetation, which include parks, urban forests, and even lush street verges². These spaces positively impact our physical health^{3,4}, mental health^{5,6}, and overall wellbeing⁷.

Maps that show which Vancouver bus routes provide the most and constant green space exposure is an innovative way measure part of the public transit ridership experience. My assumption, based on previous literature, is that bus routes with more visible vegetation greenness will provide a more pleasant riding experience, and thus encourage greater ridership of that route. Constratingly, routes that have less visible vegetation greenness should be prioritized by the City of Vancouver to increase the amount of urban trees and other greenery. Traditional geospatial measures of green spaces from aerial photography or satellites do not directly correlate with what transit users actually see during their rides since these technologies use a bird's-eye view. **Google street view images** offer a more relatable measure of street-level vegetation greenness as their imagery are taken at about eye level from a vehicle.

How I did it.

My **Green Bus Atlas** shows which Vancouver bus routes provide the greenest experience. Green for the context of this project refers to the amount of trees that are visible in the space. To do this, I have downloaded Translink's (Vancouver's Transit company) bus route data⁸ and selected the regularly-scheduled bus routes that have the majority of their route within the City of Vancouver. Additionally, I acquired street-level tree fraction data extracted from 2018 Google Street View images, sourced from Middel and others⁹.

To create these maps, I followed several steps in ArcMap. First, I **spatially joined** the tree fraction point features with the bus route line features. This was done using a matching radial distance of 25 m to allow for spatial inconsistencies between the tree fraction and bus route datasets. Next, I **generated points along a line** to create equally spaced points along each bus route feature. The points created were spaced 12.5 m apart so that each point would correspond with at least two tree fraction point features. Then, using these generated points and the **split line at point** function, I separated each bus route line feature into 500 m segments. Next, using the **field map of join features** option in the **spatial join** function, I calculated the median and standard deviation of tree fractions for each 500 m bus route segment, as well as for each entire bus route. I normalized the median tree fractions for comparative analysis using the **field calculator**. Lastly, I categorized the normalized median tree fractions (median greenness) and standard deviations of tree fractions (variability in greenness) into five intervals for all bus routes to create the 5 x 5 greenness matrix.

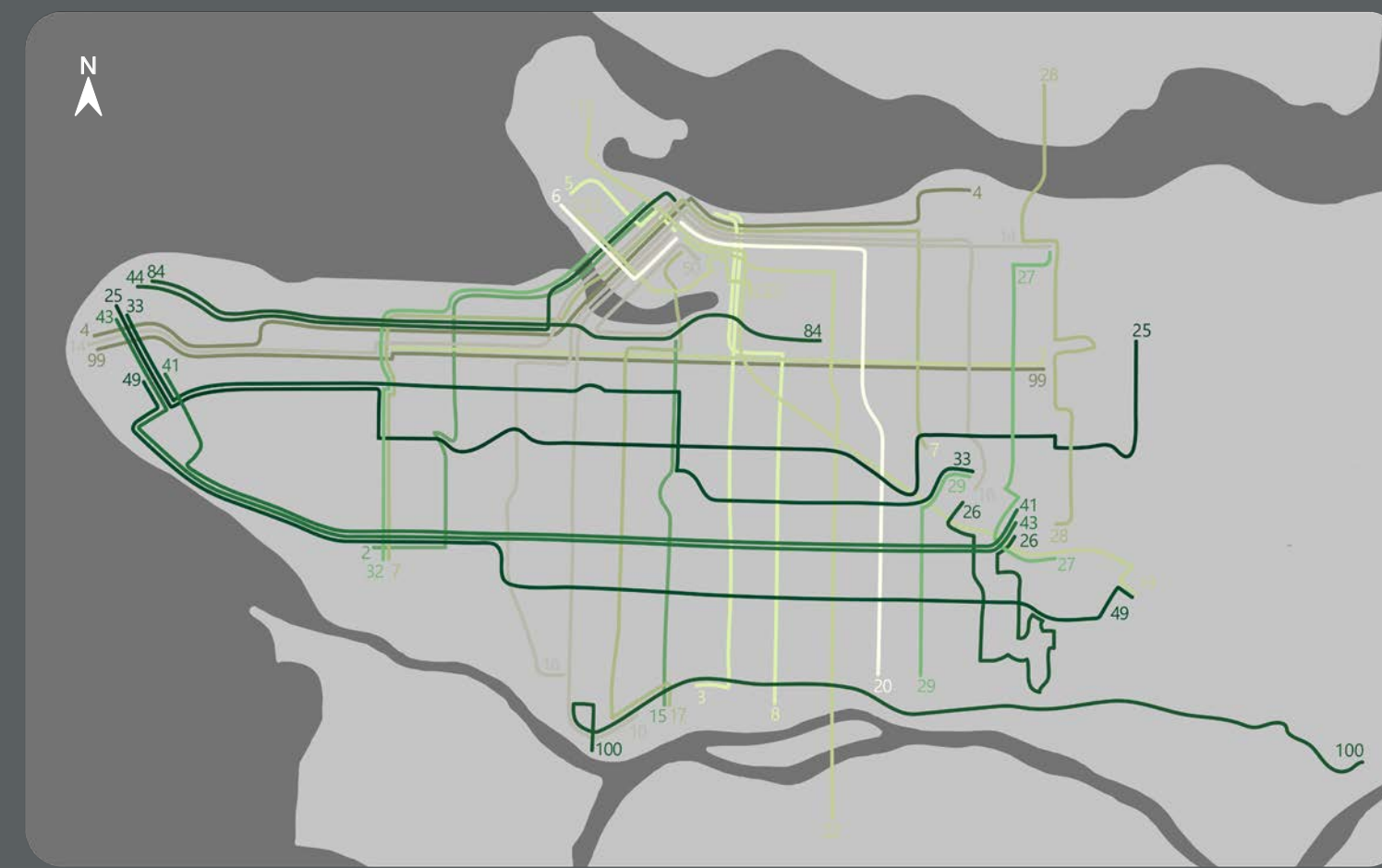
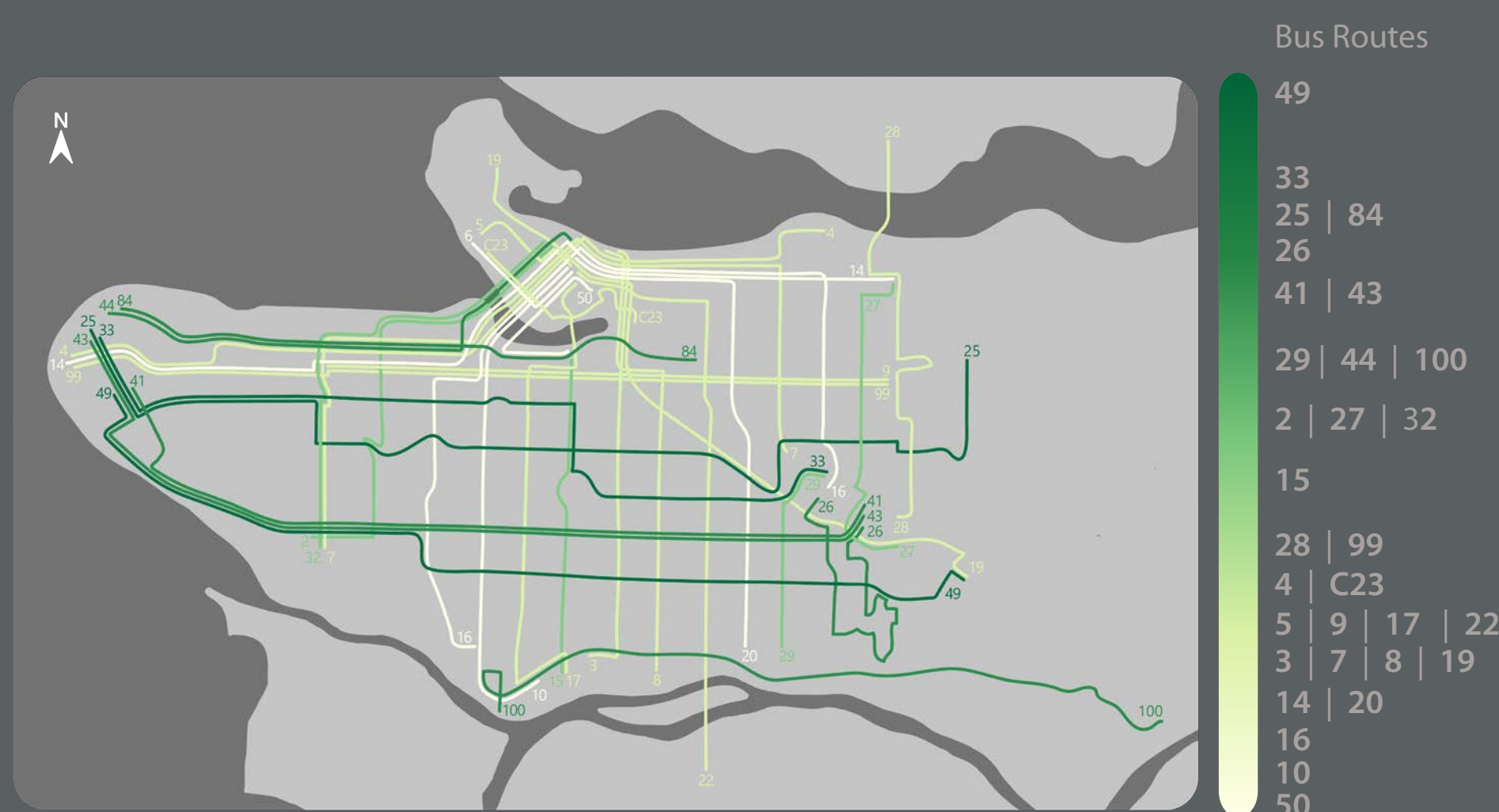
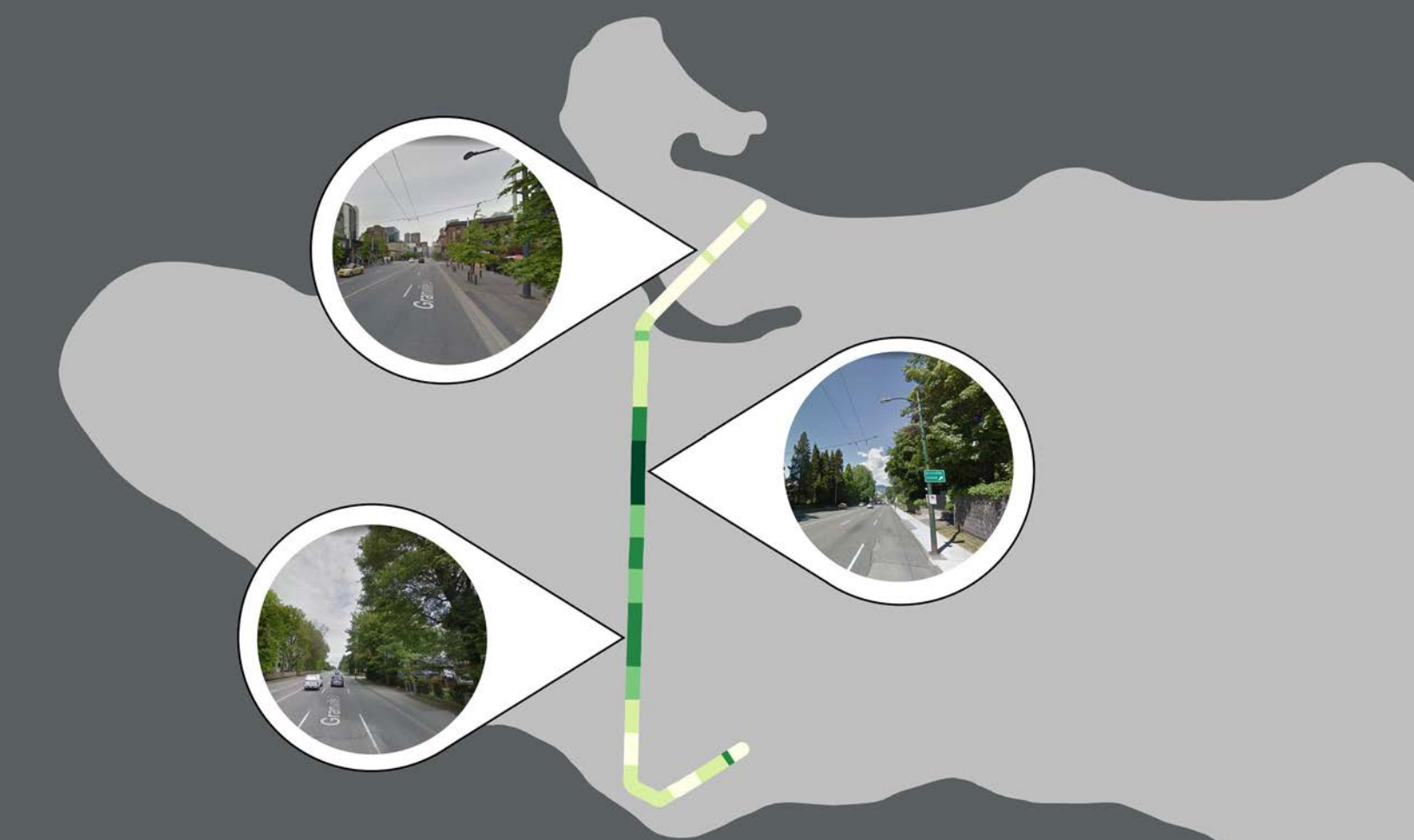
The # **49** (Metrotown / Dunbar / UBC) is the **greenest** bus route. It passes by two large parks: Pacific Spirit Park on the UBC Endowment Lands and Central Park on the Vancouver-Burnaby city boundary. This route also passes through the lush Dunbar Southlands neighbourhood.



The # **99** B-Line (Commercial-Broadway / UBC) is the **busiest** route in Metro Vancouver¹⁰. However, the amount of trees along this route is quite **average**. Notable green spaces along this route include Pacific Spirit Park, as well as street trees between Granville St. and Cambie St., and between Nanaimo St. and Rupert St.



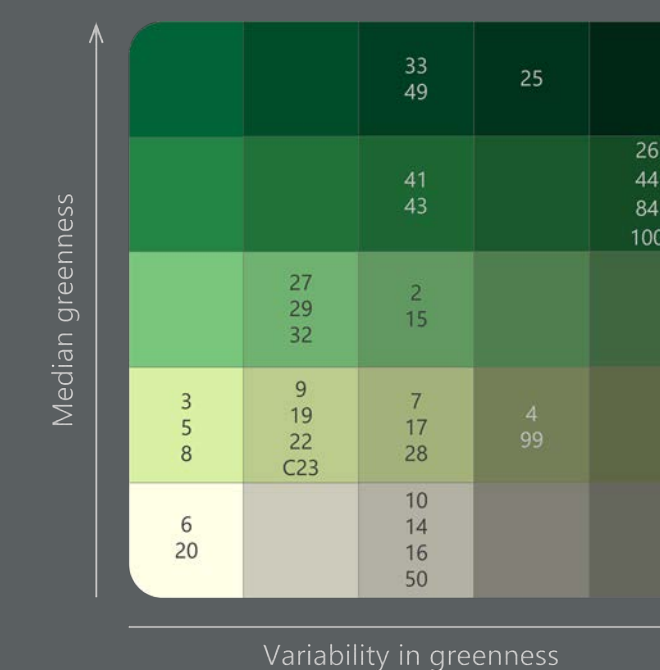
The # **10** (Downtown / Granville / Marpole) is one of Vancouver's **least green** bus routes. Although it passes through the tree-rich neighbourhood of Shaughnessy, a lot of this route also runs through densely developed areas like Downtown, South Granville, and Kerrisdale-Oakridge.



Of the **32 bus routes** analyzed, the majority exhibit low median greenness (i.e. median tree fraction). This is not a surprise as busses tend to use major roads for their routes. The **top 5** greenest bus routes in the City of Vancouver are:

- #49 (Metrotown - Dunbar - UBC)
- #33 (29th Avenue Station - UBC)
- #25 (Brentwood Station - UBC)
- #84 (VCC-Clark Station - UBC)
- #26 (Joyce Station - 29th Avenue Station)

When the median greenness is considered with the variability of greenness in the greenness matrix, it becomes clear which green routes use busier and more developed roads. The **#49** and **#33** use lower density roads and show less variability in greenness. On the other hand the **#84** and **#44** travel on busier roads closer to downtown, show higher greenness variability.



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