Access to Green Space and Bicycle Infrastructure in Vancouver - GROUP 19

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INTRODUCTION

The transportation sector is a major source of atmospheric pollution, responsible for more than 24% of national greenhouse gas emissions in Canada (Statistics Canada, 2023). Of this 24%, a considerable portion is caused by single passenger road vehicles such as cars. Generally speaking, cities are often modeled around car centric transport and the convenience of having a car leads to many individuals owning a vehicle. Although electric vehicles (EVs) are on the rise, 86.8% of motor vehicle registrations in 2022 were gasoline or diesel powered, which adds up to a considerable carbon footprint (Statistics Canada, 2023). Using a bicycle for transport on the other hand, is one of the most sustainable modes of transport; it does not create pollution or traffic to the extent that vehicles do and also creates health benefits for the cyclists. Despite this, only 2.3% of commuters in Vancouver cycled as their main form of transportation (Statistics Canada). Though it is becoming more popular, cycling remains marginalised in urban areas that are designed first and foremost for cars. Our analysis considers the accessibility of parks by bike as well as the quantity of vegetation around bike lanes over two distinct periods. consider how accessible parks are with bikes and the quantity of vegetation surrounding bike lanes over two different periods. Our research objective is to determine, if there is a connection between green spaces areas and the development of bike lanes in Vancouver?

DATA SOURCES

Dataset name	Data Type: Vector, raster, or tabular	Key Attributes: What features/phenomena does this dataset represent?	Source
Bikeways- City of Vancouver	Vector	This data shows all bike lanes within the city of Vancouver. The dataset has relevant attributes such as type (ie- protected/painted lane, etc) and segment length.	City of Vancouver - Open Data portal
LANDSAT 7 Satellite Data	Raster	We are using the Band 3 and 4 (red and near infrared) surface reflectance data to determine the mean NDVI of Vancouver 1999-2000	Google Earth Engine
LANDSAT 8 Satellite Data	Raster	Vancouver NDVI data for 2021-2022, with a more recent satellite.	Google Earth Engine
SimplyAnalytics CT population	Vector	This dataset subdivides Metro Vancouver into Census Tracts which we need for our mapping. Population data not used	Simply Analytics
SimplyAnalytics DA population	Vector	We will dissolve this data set to get a boundary file of the area we are looking at, the City of Vancouver.	SimplyAnalytics

METHODS

When obtaining our LANDSAT NDVI data we input 1999 and 2000 as well as 2021 and 2022 to our query to get an average NDVI period that is more representative of the greenery. This is to eliminate cloud cover variation or other factors that may interfere with our data. Due to limitations in the dataset we were not able to find when parks were established so we used the current data on parks for our analysis.

For the parks we sorted them so as not to include the parks that are less than 0.5 hectares which will be considered an urban plaza and not relevant to our analysis. We then buffered the parks by 200m to create a park zone. We then used a select layer by location and created a field determining whether or not a park zone had a bike lane in its zone.

Using Landsat NDVI data we reclassified the data to separate and classify residential, urban, and vegetated areas. We clipped the Vancouver census data with the boundary data to obtain the land area and census tracts of the city of Vancouver which is our area of interest. This is because the Census Tracts extend out over the water and need to be cut down. Using the park buffer zone layer we had before, we intersected all the layers together to get NDVI park zones with CT separation. Using the Vancouver census tracts, and parkzone data and NDVI classes we used the union tool to create one layer. To create our main map we intersected our bike zones with the NDVI and followed the steps on the flowchart. This was in order to create a total bike lane length in each CT which was a measure of bike lane connectivity. For the other variable of our map we intersected the NDVI data with the CT layer and calculated the PCT green area of the census tract. We thought it may be useful to get the PCT green area of the census tract because using the percentage vegetation of the bike zone would not be applicable in many of the tracts in 2000 where there were no bike lanes whatsoever. This was repeated for the second time period.

Our model uses normal quantiles in its symbology which gives us a relative understanding of how to qualify these different zones. We created a bike zone layer with PCT vegetation by bike lane type so we could compare the different % of vegetation in different bike lane types.

RESULTS

We can see in Map 1 an increase in bike lane development in many areas around the city, most notably Vancouver West and in downtown. The central areas of Vancouver such as Oakridge that have become purple from green shades indicate that bike lane development is indeed being carried out in areas with relatively more vegetation in their area. Of course we know that greenery is not the only factor that influences bike lane development, the bike lane development in the downtown area can likely be attributed to the population density there. We also see significant development in downtown areas with little to no vegetation. Dense urban areas are placed where we would likely not see a connection with our research goals.. However the map does indicate an increase in bike lane connectivity in relatively green suburban areas. The difference in the number of parks accessible by bike also provides a useful indicator for what we are studying. As we see with Figures 3 and 4, in 2022, 84% of park zones excluding urban plazas are accessible by bike, compared to 56% in 2000. This coincides with what we see on the map below, with large residential networks of Local street lanes being built for Vancouver's suburban parks. We also note that the Arbutus Greenway, the protected bikeway in the North/South direction, passes through several areas where large parks are present. If we only study the initial 2000 map we see that many established protected lanes, such as those along Kitsilano, Spanish banks and Stanley are already in the greenest spaces of continuous park zone cover. More recent developments connect diverse areas of Vancouver to smaller neighborhood parks as well as to these beach/park areas. There may be discrepancies when comparing the data sets, for instance an area becoming green when it was purple in 2000. This can be explained not because there are less bikelanes now but because since it is categorised in quantiles, there are relatively fewer bike lanes in comparison to development in other areas.

Differentiating the bike lanes close to park zones by type indicates that there is significant development of protected bike lanes and local street lanes. The continued development of the safer, more costly protected bike lanes near parks indicates that there is a will to provide high quality bike infrastructure close to green areas. The marked increase of local street lanes and notably protected lanes of more than 50km in total length within park range between 2000 and 2022 is indicative of a trend of greater bike lane development around smaller, neighborhood parks across Vancouver. This is because the major green bike routes exist already (i.e. along the beach, Stanley Park) and we see on Map 2 that these bigger networks exist today mainly within residential areas across Vancouver and near other parks like Queen Elizabeth and the botanical gardens.

This finding is backed up by our analysis of NDVI in bike zones. Figure 5 shows the percentage of bike zones as vegetation, we see that Protected bike lanes have the highest. Inversely, we see the least developed lanes, shared lanes, having the % greenery in their area, these bike lanes are mainly in urban environments, are dangerous for cyclists and as a result are unlikely to be near green spaces. The better bike infrastructure, as seen by the green and blue bands below do show marked increases in park zones, as seen in Figure 1 and 2 which shows directed efforts to build better bike lanes near parks.

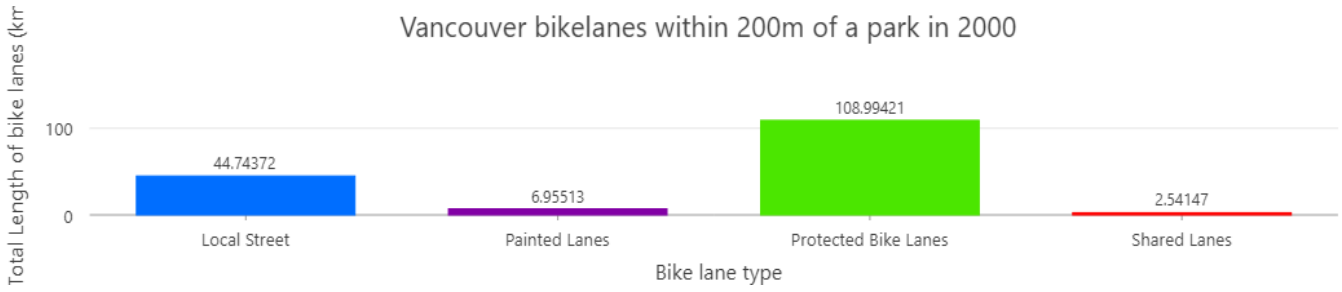


Figure 1- Vancouver bikelanes within 200m of a park in 2000

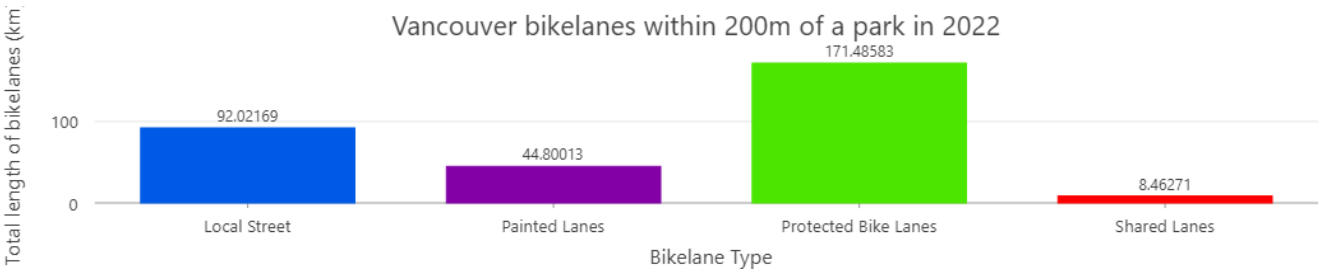


Figure 2- Vancouver bikelanes within 200m of a park in 2022

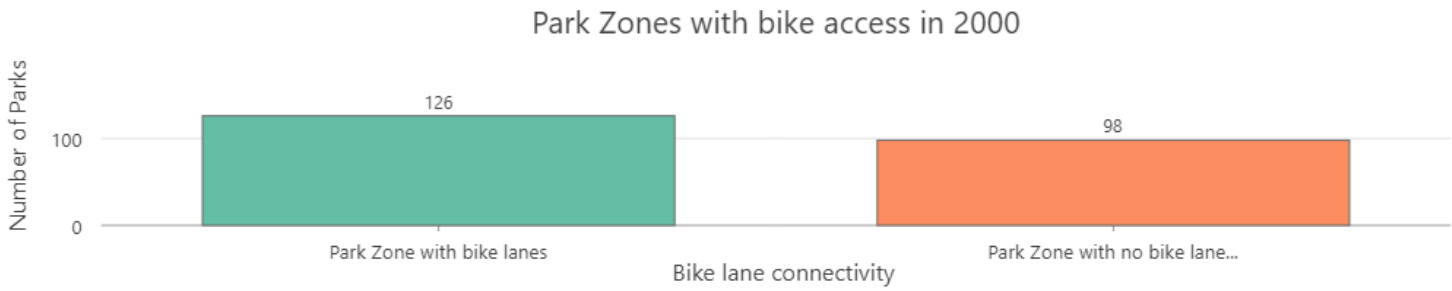


Figure 3 - Number of Park Zones with bike access in 2000

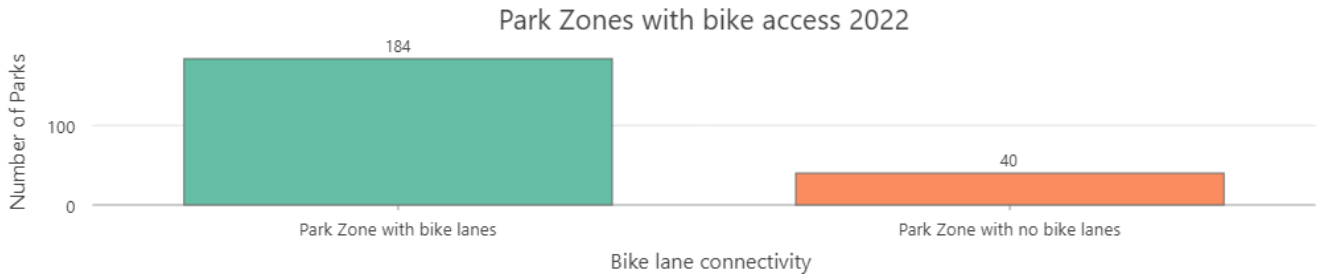


Figure 4 -Number of Park zones with bike access in 2022

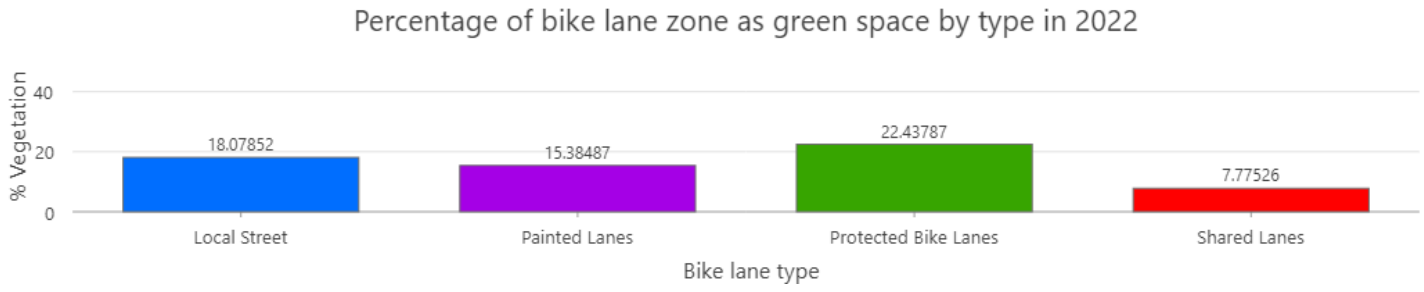
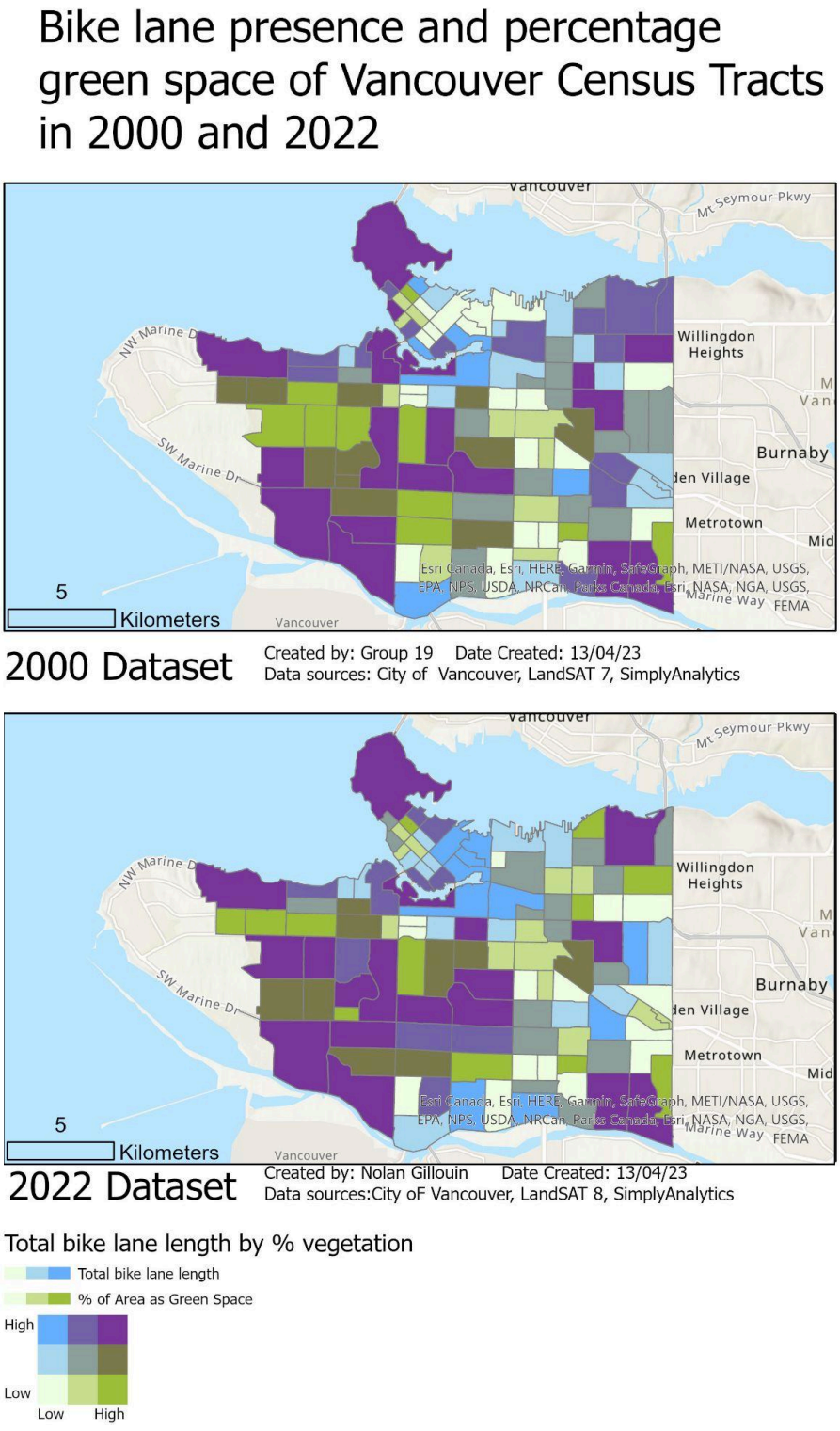
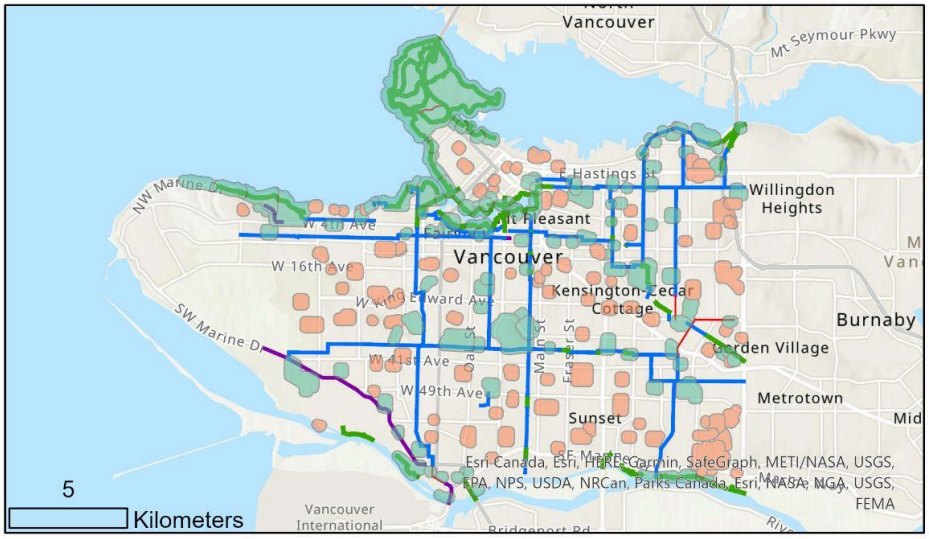


Figure 5 -Percentage of bike lane zone as green space by type in 2022



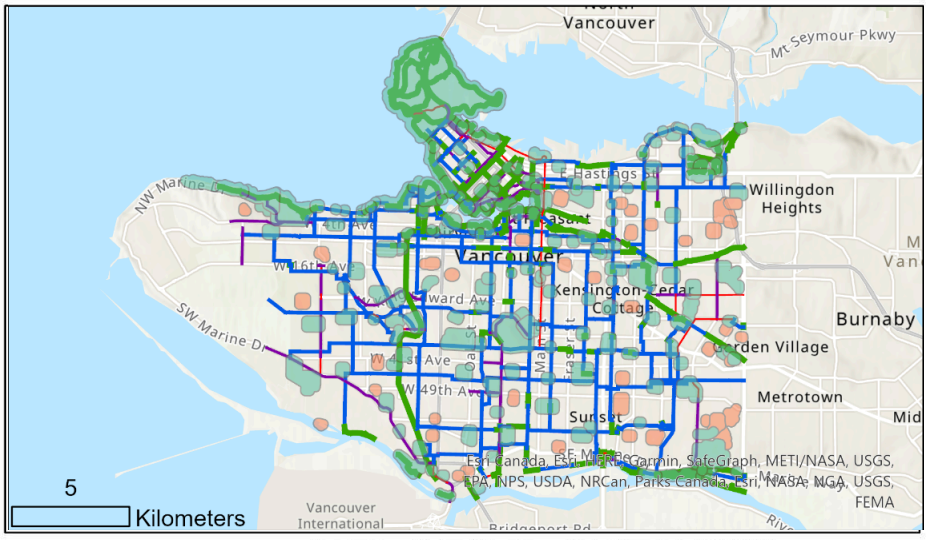
Map 1 - Bike lane presence and percentage green space of Vancouver Census Tracts

Bike lane types and access to Vancouver Park Zones in 2000 and 2022



2000 Dataset

Created by: Group 19 Date Created: 13/04/23
Data sources: City of Vancouver



2022 Dataset

Created by: Nolan Gillouin Date Created: 13/04/23
Data sources:City of Vancouver

Bike lanes

Bike lane type
- Local Street
- Painted Lanes
- Protected Bike Lanes
- Shared Lanes

Bike lane connectivity
- Park Zone with bike lanes
- Park Zone with no bike lanes

Map 2:Bike lanes types and access to Vancouver Park zones in 2000 and 2022

Conclusion

Our analysis identifies that there seems to be a relation between vegetated areas and bike lane development. We see in the past 20 years significant improvement in bike accessibility to parks and projects and increasingly better bike infrastructure surrounding these green spaces. We also have observed higher % vegetation in better quality bike zones which supports our claim that they are related. It is important to note however that correlation is not causation and that there are other factors that may be present such as population density. This being said, in addition to our data, the development of the Arbutus Greenway, which the city created to encourage sustainable transport and for users to “enjoy the landscape” is an indication that these two factors are considered together in development. Despite restrictions with urban planning, a potential solution to further encourage cycling in Vancouver would be to create safer lanes for cyclists in these dense urban areas. According to the city of Vancouver, some of the most dangerous areas for cyclists in terms of accidents are in the inner city and Main street, especially on shared lanes which are the least developed. It’s crucial to be able to understand the different factors that lead to bike infrastructure creation in a time when it's more important than ever with the climate crisis. Limited space in the city may be a barrier to developing better bike lanes that keep users safe, however it would be crucial for city planners to continue in the direction of promoting bicycle transit across Vancouver, while also encouraging use of green spaces and providing new ones.

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