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# A Spatial Analysis on the Increasing Crime Rate in Vancouver, BC

GGR463 - Geographic Information Analysis and

Processing

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# Agenda

- Introduction
- Objective
- Methods
- Current Status/Roadblocks
- Questions

# Crime Rate Increase

- Noticed an increase in small crimes
- There could be a correlation between Vancouver being a metropolitan city and increasing crime



# Objective

What are the safest areas in Vancouver, BC based on crime data and analysing its relationship with additional socioeconomic variables such as employment and education background.



# Methods



## Data Collection

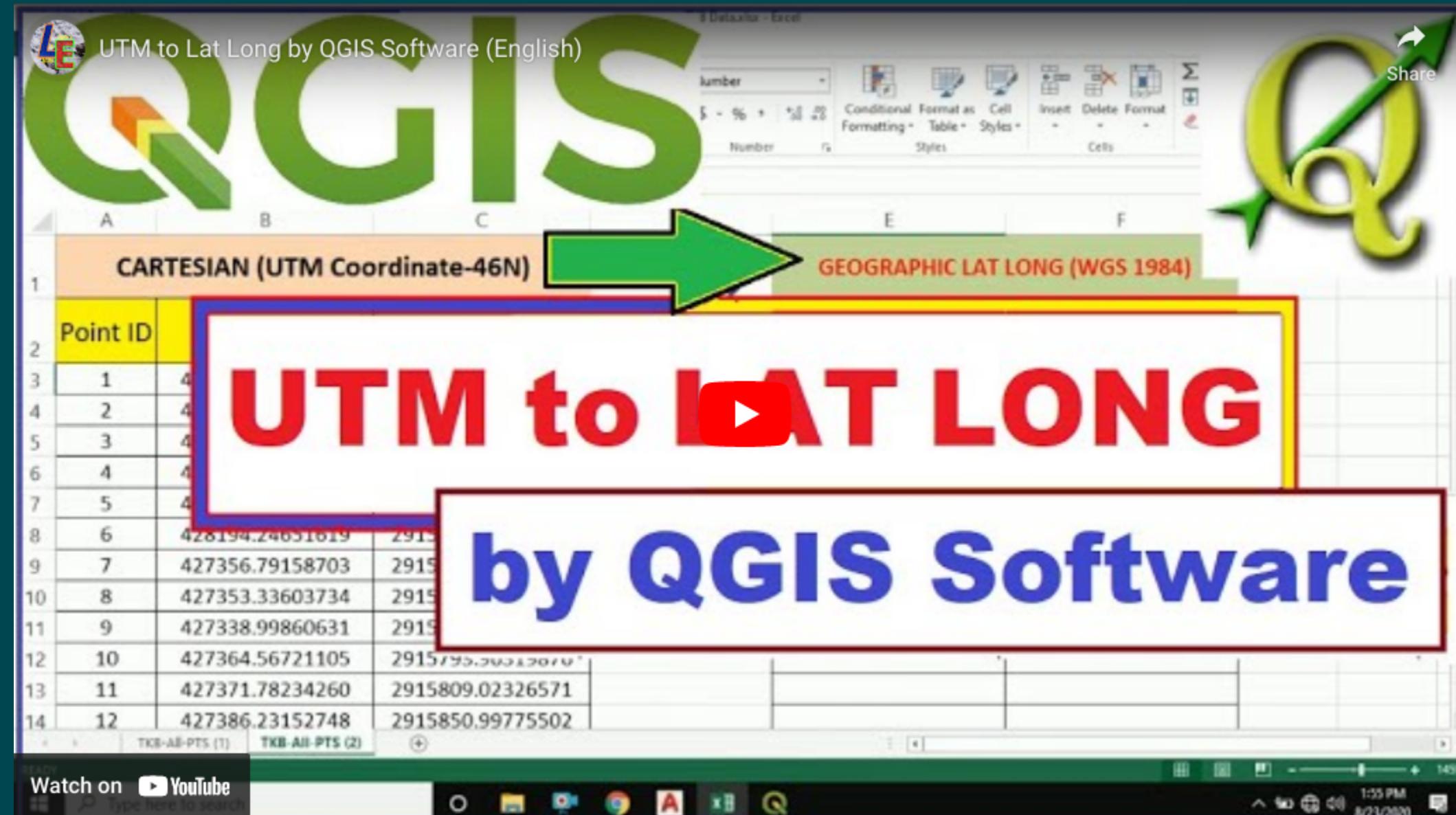
- Collected from Vancouver Police Department
- Included certain crimes in 2021 such as Break and Enter, Homicide, Mischief, Offence Against a Person, Theft of Vehicle.



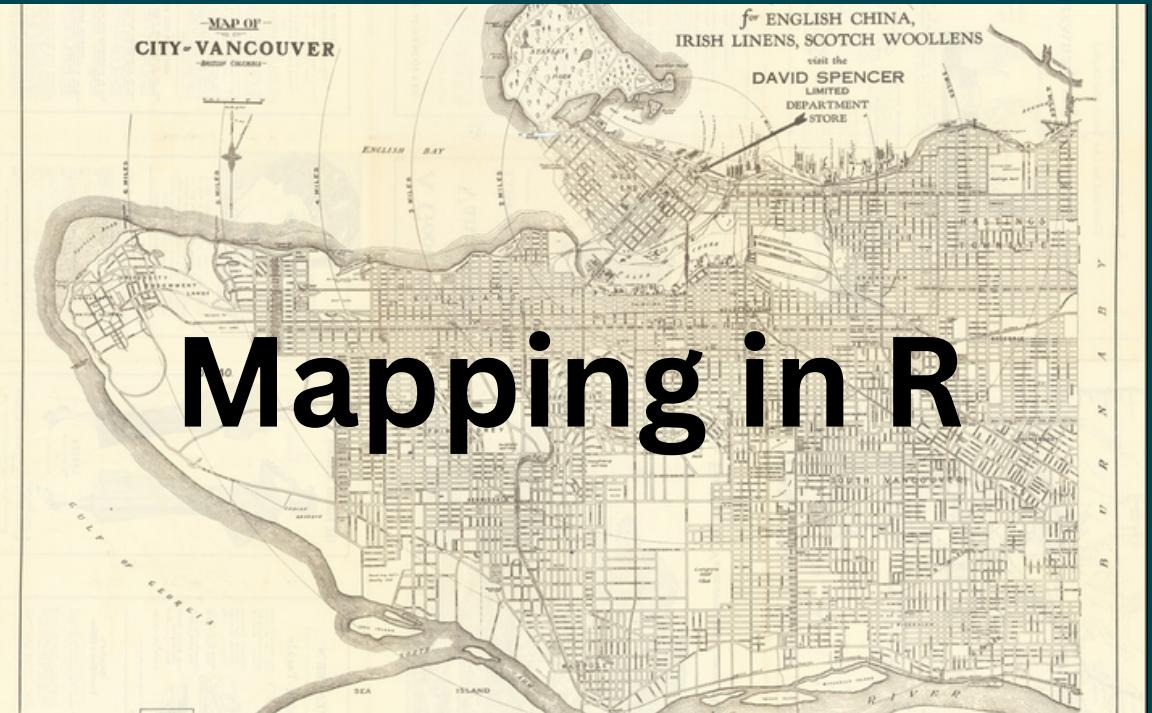
## Data Cleansing and Manipulation

- Initially dataset was quite large:
  - Filtered to include only 10 entries of each crime
- Lat Long coordinates were not given, only Easting Northing.
  - Converted to Lat Long in QGIS

# Easting Northing to Lat Long



# Methods



Mapping in R

- Mapped using Leaflet in R by latitude and longitude
- Map the polygons representing the neighbourhoods or census tracts



Census Data

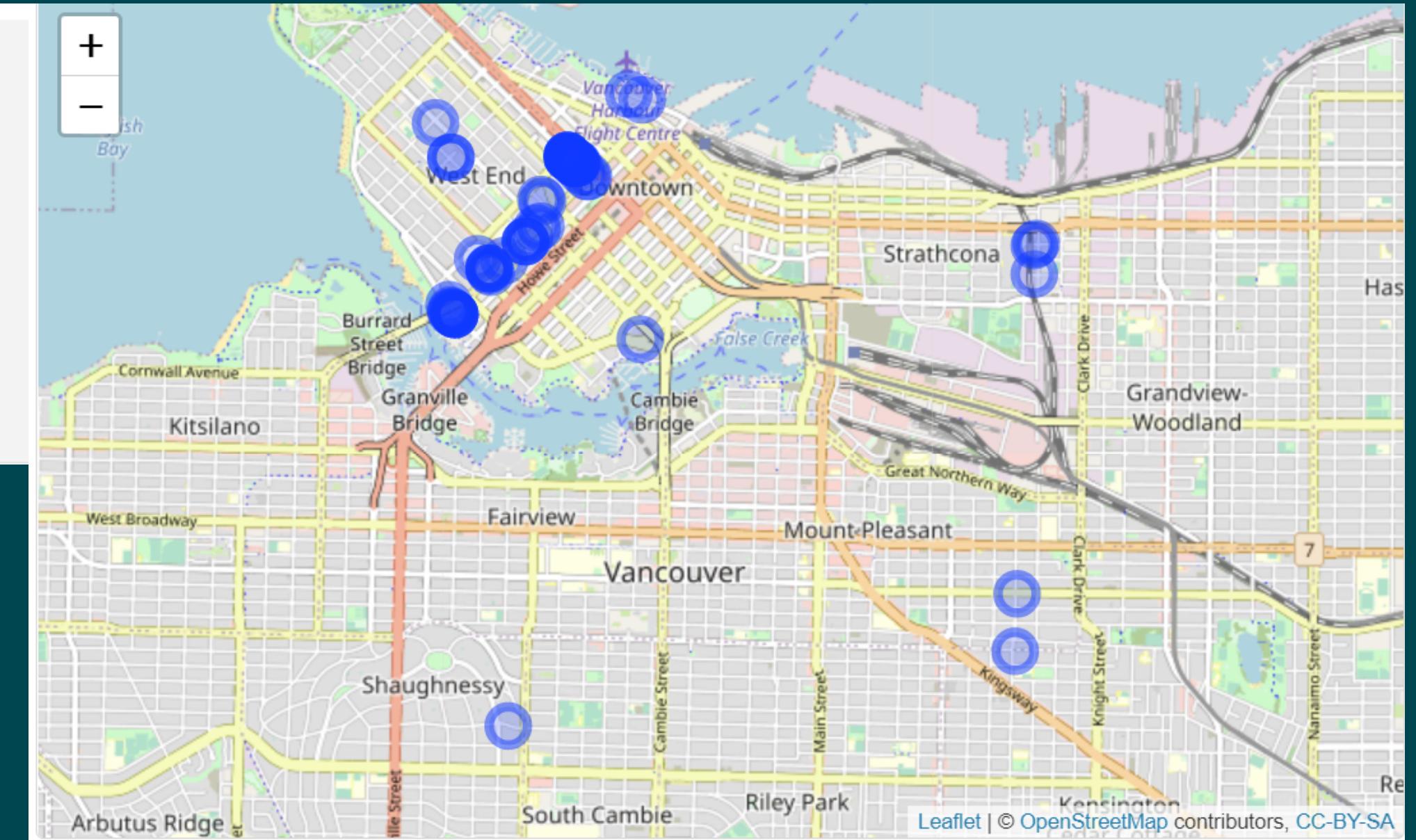
- Look at the Census Data with specific variables related to housing, income, education, etc.

# Mapping in R

```
```{r}
library(leaflet)
vancouver_data <- read.csv("Vancouver_crimedata.csv")

latitude <- c(vancouver_data$LATITUDE)
longitude <- c(vancouver_data$LONGITUDE)

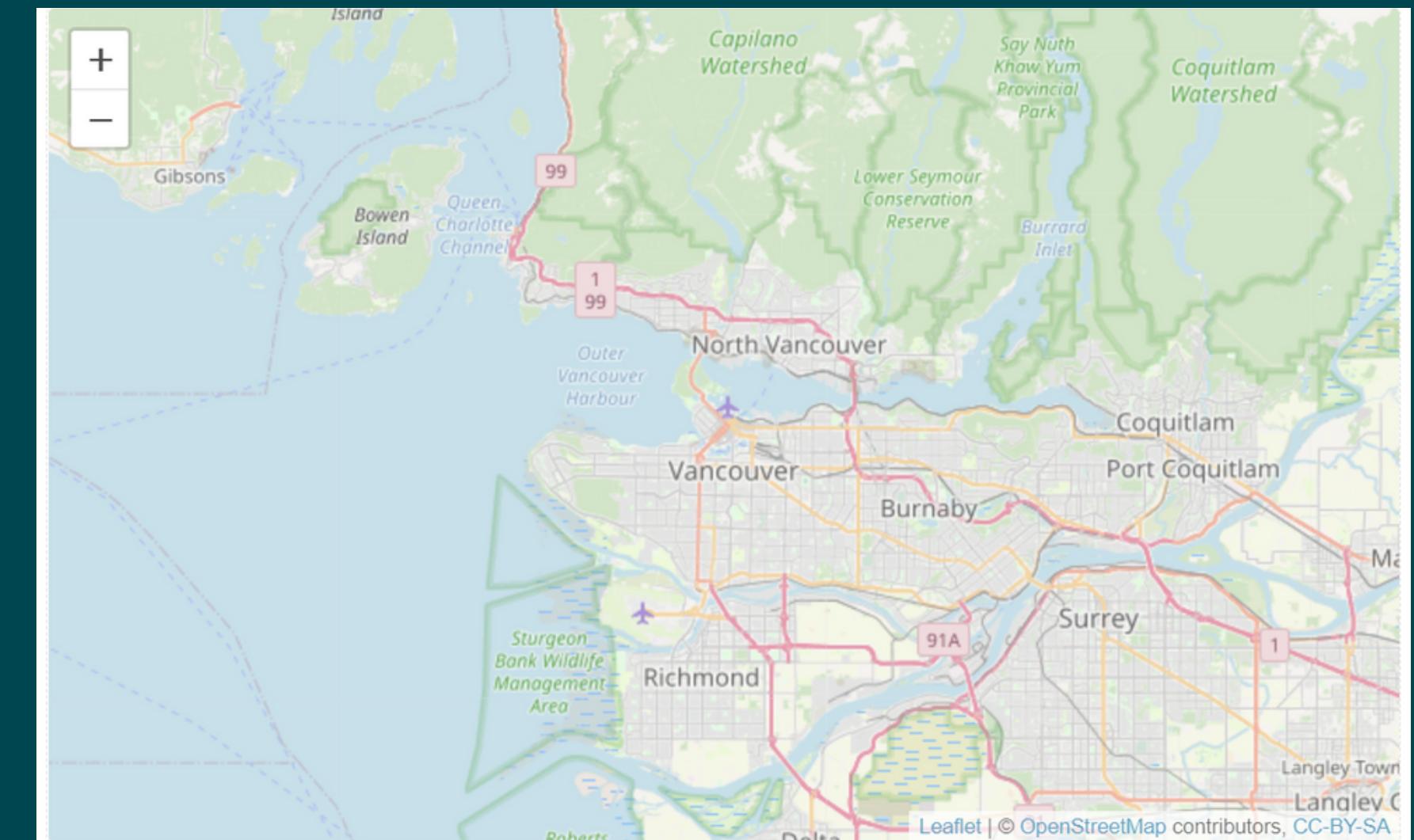
leaflet(vancouver_data) %>% addTiles() %>%
  addCircleMarkers(lng = ~longitude, lat = ~latitude,
  popup = ~vancouver_data$TYPE)
```
```



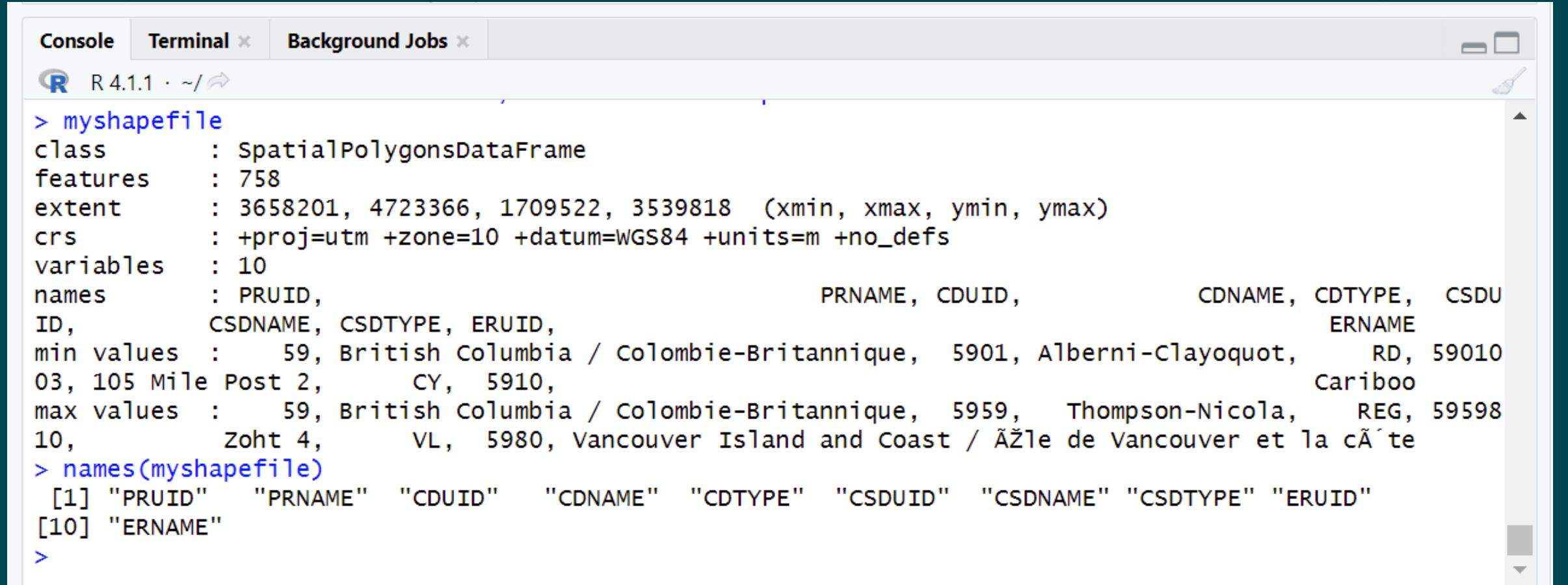
# Current Status/Roadblocks

```
134 ~~~{r read census boundary shapefile}
135 myshapefile <- readOGR(dsn = "BC_boundary.shp", layer="BC_boundary")
136 layers <- ogrListLayers("C:/Users/Shreya Tanguturi/Desktop/GGR463 Project
  Data/BC_boundary.shp")
137
138 leaflet() %>%
139   addTiles()%>%
140   setView(lng = -123.1207, lat = 49.2827, zoom=10)%>%
141   addPolygons(data = myshapefile, fillColor = "blue", color = "black")
142 ## this code is displaying correctly, the issue is likely with the shapefile.
143 ~~~
```

```
"BC_boundary"
with 758 features
It has 10 fields
Warning: OGR support is provided by the sf and t
"BC_boundary"
attr(,"driver")
[1] "ESRI Shapefile"
attr(,"nlayers")
[1] 1
```



# Current Status/Roadblocks



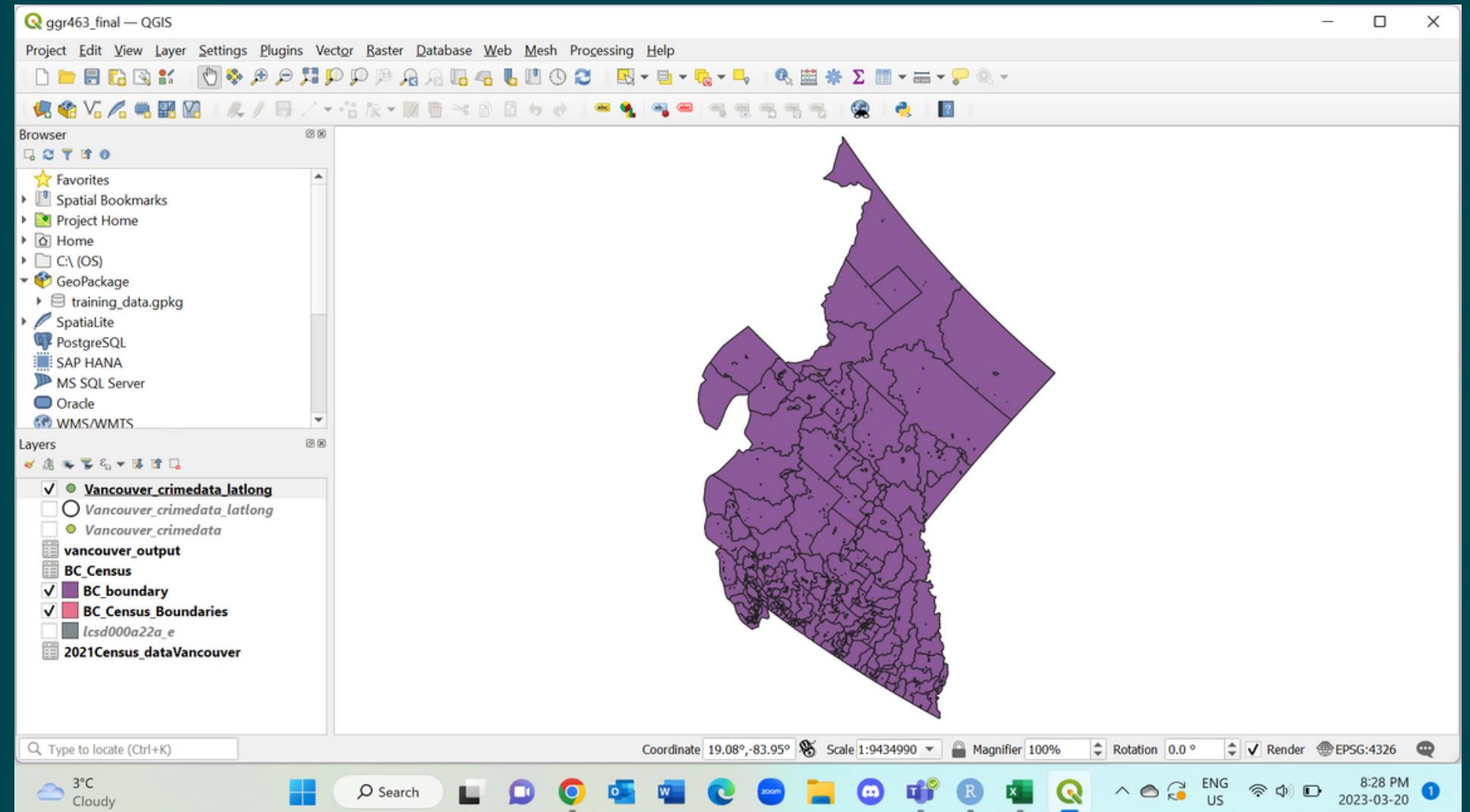
The screenshot shows the RStudio interface with the 'Console' tab selected. The console window displays the following R session:

```
R 4.1.1 · ~/r
> myshapefile
class      : SpatialPolygonsDataFrame
features   : 758
extent     : 3658201, 4723366, 1709522, 3539818 (xmin, xmax, ymin, ymax)
crs        : +proj=utm +zone=10 +datum=WGS84 +units=m +no_defs
variables  : 10
names      : PRUID, PRNAME, CDUID, CDNAME, CDTYPE, CSDU
ID,        CSDNAME, CSDTYPE, ERUID, ERNAME
min values : 59, British Columbia / Colombie-Britannique, 5901, Alberni-clayoquot, RD, 59010
03, 105 Mile Post 2, CY, 5910, cariboo
max values : 59, British Columbia / Colombie-Britannique, 5959, Thompson-Nicola, REG, 59598
10, Zohz 4, VL, 5980, Vancouver Island and Coast / la côte
> names(myshapefile)
[1] "PRUID"   "PRNAME"  "CDUID"   "CDNAME"  "CDTYPE"  "CSDU"
[6] "CSDNAME" "CSDTYPE" "ERUID"   "ERNAME"
[10] "ERNAME"
>
```

- This file is set as a SpatialPolygonsDataFrame
- Boundary shapefile does not have coordinates
- Goal is to map the census tract boundaries or neighbourhoods

# Current Status/Roadblocks

- What I tried to do



- Switched over to QGIS to map census boundary shapefile
- Basemap and coordinates of crimes are in different places, indicating the coordinates are not attached to this boundary map

# Current Status/Roadblocks

Vancouver\_crime data\_latlong — Features Total: 89, Filtered: 89, Selected: 0

| TYPE                   | X           | Y           | YEAR | MONTH | DAY | HOUR | MINUTE | HUNDRED_BLOCK | NEIGHBOURHOOD    | LATITUDE            | LONGITUDE   |              |
|------------------------|-------------|-------------|------|-------|-----|------|--------|---------------|------------------|---------------------|-------------|--------------|
| 1 Break and Enter ...  | 491015.9434 | 5459166.14  | 2021 |       | 11  | 21   | 6      | 33            | 10XX ALBERNI ST  | West End            | 49.28518111 | -123.1235363 |
| 2 Break and Enter ...  | 490833.8455 | 5458886.535 | 2021 |       | 11  | 26   | 13     | 58            | 10XX BARCLAY ... | West End            | 49.28266332 | -123.1260338 |
| 3 Break and Enter ...  | 490252.3815 | 5458162.723 | 2021 |       | 12  | 14   | 2      | 2             | 10XX BEACH AVE   | Central Business... | 49.27614352 | -123.1340113 |
| 4 Break and Enter ...  | 490255.3982 | 5458158.788 | 2021 |       | 7   | 17   | 5      | 0             | 10XX BEACH AVE   | Central Business... | 49.27610817 | -123.1339697 |
| 5 Break and Enter ...  | 490258.4148 | 5458154.853 | 2021 |       | 6   | 15   | 4      | 0             | 10XX BEACH AVE   | Central Business... | 49.27607282 | -123.1339281 |
| 6 Break and Enter ...  | 490269.91   | 5458141.126 | 2021 |       | 7   | 23   | 6      | 12            | 10XX BEACH AVE   | Central Business... | 49.27594953 | -123.1337698 |
| 7 Break and Enter ...  | 490247.4903 | 5459171.385 | 2021 |       | 9   | 2    | 0      | 0             | 10XX BROUGHT...  | West End            | 49.28521651 | -123.1341031 |
| 8 Break and Enter ...  | 490495.4166 | 5458443.882 | 2021 |       | 7   | 20   | 14     | 26            | 10XX BURNABY ... | West End            | 49.27867642 | -123.1306767 |
| 9 Break and Enter ...  | 490500.2381 | 5458425.917 | 2021 |       | 8   | 25   | 12     | 0             | 10XX BURNABY ... | West End            | 49.27851489 | -123.13061   |
| 10 Break and Enter ... | 490615.4787 | 5455465.085 | 2021 |       | 9   | 17   | 12     | 15            | 10XX BALFOUR ... | Shaughnessy         | 49.25188346 | -123.1289561 |
| 11 Break and Enter ... | 490268.432  | 5458142.577 | 2021 |       | 6   | 27   | 16     | 20            | 10XX BEACH AVE   | Central Business... | 49.27596256 | -123.1337901 |
| 12 Break and Enter ... | 490729.8291 | 5458622.342 | 2021 |       | 4   | 28   | 16     | 52            | 10XX BURRARD...  | West End            | 49.28028529 | -123.1274579 |
| 13 Break and Enter ... | 491411.5888 | 5459576.692 | 2021 |       | 12  | 22   | 12     | 3             | 10XX CANADA PL   | Central Business... | 49.28887977 | -123.1181048 |
| 14 Break and Enter ... | 491493.3778 | 5459541.947 | 2021 |       | 5   | 21   | 1      | 26            | 10XX CANADA PL   | Central Business... | 49.28856838 | -123.1169793 |
| 15 Break and Enter ... | 493939.3763 | 5456323.958 | 2021 |       | 12  | 14   | 12     | 31            | 10XX E 12TH AVE  | Mount Pleasant      | 49.25965115 | -123.0832943 |
| 16 Break and Enter ... | 494050.8375 | 5458395.85  | 2021 |       | 6   | 21   | 18     | 0             | 10XX E GEORGI... | Strathcona          | 49.2782893  | -123.0817932 |
| 17 Break and Enter ... | 494051.8177 | 5458588.158 | 2021 |       | 3   | 27   | 9      | 45            | 10XX E PENDER... | Strathcona          | 49.28001915 | -123.0817826 |
| 18 Break and Enter ... | 494073.171  | 5458596.735 | 2021 |       | 10  | 16   | 14     | 0             | 10XX E PENDER... | Strathcona          | 49.28009651 | -123.0814892 |
| 19 Break and Enter ... | 491482.7426 | 5457975.993 | 2021 |       | 2   | 6    | 15     | 21            | 10XX EXPO BLVD   | Central Business... | 49.27448223 | -123.1170922 |
| Show All Features      |             |             |      |       |     |      |        |               |                  |                     |             |              |

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BC\_boundary — Features Total: 758, Filtered: 758, Selected: 0

| PRIUID            | PRNAME              | CDUID | CDNAME        | CDTYPE | CSDUID  | CSDNAME           | CSDTYPE | ERUID | ERNAME   |
|-------------------|---------------------|-------|---------------|--------|---------|-------------------|---------|-------|----------|
| 1 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901003 | Elkford           | DM      | 5940  | Kootenay |
| 2 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901006 | Sparwood          | DM      | 5940  | Kootenay |
| 3 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901012 | Fernie            | CY      | 5940  | Kootenay |
| 4 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901017 | East Kootenay A   | RDA     | 5940  | Kootenay |
| 5 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901019 | East Kootenay B   | RDA     | 5940  | Kootenay |
| 6 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901022 | Cranbrook         | CY      | 5940  | Kootenay |
| 7 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901028 | Kimberley         | CY      | 5940  | Kootenay |
| 8 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901035 | East Kootenay C   | RDA     | 5940  | Kootenay |
| 9 59              | British Columbia... | 5901  | East Kootenay | RD     | 5901037 | East Kootenay E   | RDA     | 5940  | Kootenay |
| 10 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901039 | Invermere         | DM      | 5940  | Kootenay |
| 11 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901040 | Radium Hot Spr... | VL      | 5940  | Kootenay |
| 12 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901043 | Canal Flats       | VL      | 5940  | Kootenay |
| 13 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901046 | East Kootenay F   | RDA     | 5940  | Kootenay |
| 14 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901048 | East Kootenay G   | RDA     | 5940  | Kootenay |
| 15 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901801 | Tobacco Plains 2  | IRI     | 5940  | Kootenay |
| 16 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901802 | Isidore's Ranch 4 | IRI     | 5940  | Kootenay |
| 17 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901803 | Kootenay 1        | IRI     | 5940  | Kootenay |
| 18 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901804 | Columbia Lake 3   | IRI     | 5940  | Kootenay |
| 19 59             | British Columbia... | 5901  | East Kootenay | RD     | 5901805 | Cassimayooks (... | IRI     | 5940  | Kootenay |
| Show All Features |                     |       |               |        |         |                   |         |       |          |

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Attribute table of the crime data including crime, address, latitude, longitude, year, x and y

Attribute table of the BC boundary file

# Census Data Collected of Additional Variables

The screenshot shows an Excel spreadsheet titled "2021Census\_dataVancouver". The data is organized into five columns:

- A (GEO UID):** Contains numerical values representing geographic identifiers.
- B (Census Tract Name):** Contains names such as "9330000", "9330001.01", "9330001.02", etc.
- C (Income - Total Sex / Total - Income statistics in 2020 for the population aged 15 years and over in private households - 100% data ; Both sexes):** Contains values like 2235455, 5150, 6915, etc.
- D (Education - Total Sex / Total - Secondary (high) school diploma or equivalency certificate for the population aged 15 years and over in private households - 25% sample data ; Both sexes):** Contains values like 2235450, 5245, 6820, etc.
- E (Housing - Total Sex / Total - Occupied private dwellings by dwelling condition - 25% sample data Major repairs needed):** Contains values like 5518, 20, 12, etc.

The rows represent 15 different census tracts, numbered 1 to 15. The data spans from row 1 to row 15. The entire spreadsheet is contained within a single sheet tab labeled "2021Census\_dataVancouver".

| A (GEO UID)   | B (Census Tract Name) | C (Income - Total Sex / Total - Income statistics in 2020 for the population aged 15 years and over in private households - 100% data ; Both sexes) | D (Education - Total Sex / Total - Secondary (high) school diploma or equivalency certificate for the population aged 15 years and over in private households - 25% sample data ; Both sexes) | E (Housing - Total Sex / Total - Occupied private dwellings by dwelling condition - 25% sample data Major repairs needed) |
|---------------|-----------------------|---|---|---|
| 1 GEO UID     | Census Tract Name     | Income - Total Sex / Total - Income statistics in 2020 for the population aged 15 years and over in private households - 100% data ; Both sexes     | Education - Total Sex / Total - Secondary (high) school diploma or equivalency certificate for the population aged 15 years and over in private households - 25% sample data ; Both sexes     | Housing - Total Sex / Total - Occupied private dwellings by dwelling condition - 25% sample data Major repairs needed     |
| 2 9330000     | 0                     | 2235455   | 2235450   | 5518  |
| 3 9330001.01  | 1.01                  | 5150  | 5245  | 20  |
| 4 9330001.02  | 1.02                  | 6915  | 6820  | 12  |
| 5 9330002.01  | 2.01                  | 5900  | 5925  | 20  |
| 6 9330002.03  | 2.03                  | 3455  | 3490  | 3   |
| 7 9330002.04  | 2.04                  | 3705  | 3680  | 11  |
| 8 9330003.01  | 3.01                  | 3235  | 3075  | 6   |
| 9 9330003.02  | 3.02                  | 3815  | 3965  | 6   |
| 10 9330004.01 | 4.01                  | 6225  | 6205  | 14  |
| 11 9330004.02 | 4.02                  | 4870  | 4880  | 9   |
| 12 9330005    | 5                     | 6565  | 6565  | 36  |
| 13 9330006.01 | 6.01                  | 4275  | 4320  | 10  |
| 14 9330006.02 | 6.02                  | 4995  | 4950  | 10  |
| 15 9330007.01 | 7.01                  | 5010  | 4960  | 18  |

# Future Steps/Questions

- What are some steps I can take to map this boundary shapefile
- Is it better to shift my analysis to QGIS instead of R
- Suggestions on merging the Census data along with the Census Tract boundary file
- Does the Leaflet map look good?



Thank you!

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