Week 3 Group Assignment

January 24, 2022

0.1 Group Week 3 Asssignment - Foreign-Born Populations in a Half-Mile Radius of the Metro L Line Highland Park Station

0.1.1 Relevant modules

We first have to import specific modules that will allow us to visualize, analyze our data.

[9]:
```
import pandas as pd

import geopandas as gpd
```

```
/opt/conda/lib/python3.9/site-packages/geopandas/_compat.py:106: UserWarning:
The Shapely GEOS version (3.9.1-CAPI-1.14.2) is incompatible with the GEOS
version PyGEOS was compiled with (3.10.1-CAPI-1.16.0). Conversions between both
will be slow.
  warnings.warn(
```

Now we can load our data

[10]:
```
yoe = gpd.read_file('acs2019_5yr_B05015_14000US06037222001.geojson')
```

0.1.2 Exploring Our Data

Now that our data is uploaded, let's run a quick query to understand what information is at our fingertips.

[11]:
```
yoe.info()
```

```
<class 'geopandas.geodataframe.GeoDataFrame'>
RangeIndex: 2347 entries, 0 to 2346
Data columns (total 65 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   geoid             2347 non-null   object
 1   name              2347 non-null   object
 2   B05015001         2347 non-null   float64
 3   B05015001, Error  2347 non-null   float64
 4   B05015002         2347 non-null   float64
 5   B05015002, Error  2347 non-null   float64
 6   B05015003         2347 non-null   float64
```

```
7   B05015003, Error  2347 non-null   float64
8   B05015004         2347 non-null   float64
9   B05015004, Error  2347 non-null   float64
10  B05015005         2347 non-null   float64
11  B05015005, Error  2347 non-null   float64
12  B05015006         2347 non-null   float64
13  B05015006, Error  2347 non-null   float64
14  B05015007         2347 non-null   float64
15  B05015007, Error  2347 non-null   float64
16  B05015008         2347 non-null   float64
17  B05015008, Error  2347 non-null   float64
18  B05015009         2347 non-null   float64
19  B05015009, Error  2347 non-null   float64
20  B05015010         2347 non-null   float64
21  B05015010, Error  2347 non-null   float64
22  B05015011         2347 non-null   float64
23  B05015011, Error  2347 non-null   float64
24  B05015012         2347 non-null   float64
25  B05015012, Error  2347 non-null   float64
26  B05015013         2347 non-null   float64
27  B05015013, Error  2347 non-null   float64
28  B05015014         2347 non-null   float64
29  B05015014, Error  2347 non-null   float64
30  B05015015         2347 non-null   float64
31  B05015015, Error  2347 non-null   float64
32  B05015016         2347 non-null   float64
33  B05015016, Error  2347 non-null   float64
34  B05015017         2347 non-null   float64
35  B05015017, Error  2347 non-null   float64
36  B05015018         2347 non-null   float64
37  B05015018, Error  2347 non-null   float64
38  B05015019         2347 non-null   float64
39  B05015019, Error  2347 non-null   float64
40  B05015020         2347 non-null   float64
41  B05015020, Error  2347 non-null   float64
42  B05015021         2347 non-null   float64
43  B05015021, Error  2347 non-null   float64
44  B05015022         2347 non-null   float64
45  B05015022, Error  2347 non-null   float64
46  B05015023         2347 non-null   float64
47  B05015023, Error  2347 non-null   float64
48  B05015024         2347 non-null   float64
49  B05015024, Error  2347 non-null   float64
50  B05015025         2347 non-null   float64
51  B05015025, Error  2347 non-null   float64
52  B05015026         2347 non-null   float64
53  B05015026, Error  2347 non-null   float64
54  B05015027         2347 non-null   float64
```

```
 55  B05015027, Error  2347 non-null   float64
 56  B05015028         2347 non-null   float64
 57  B05015028, Error  2347 non-null   float64
 58  B05015029         2347 non-null   float64
 59  B05015029, Error  2347 non-null   float64
 60  B05015030         2347 non-null   float64
 61  B05015030, Error  2347 non-null   float64
 62  B05015031         2347 non-null   float64
 63  B05015031, Error  2347 non-null   float64
 64  geometry          2347 non-null   geometry
dtypes: float64(62), geometry(1), object(2)
memory usage: 1.2+ MB
```

We have a geoid and geometry datatype which will be useful for mapping later.

[12]:
```
yoe.head()
```

[12]:

	geoid	name	B05015001	\
0	05000US06037	Los Angeles County, CA	3430507.0	
1	14000US06037101110	Census Tract 1011.10, Los Angeles, CA	1424.0	
2	14000US06037101122	Census Tract 1011.22, Los Angeles, CA	810.0	
3	14000US06037101210	Census Tract 1012.10, Los Angeles, CA	3167.0	
4	14000US06037101220	Census Tract 1012.20, Los Angeles, CA	1749.0	

	B05015001, Error	B05015002	B05015002, Error	B05015003	B05015003, Error	\
0	14119.0	288054.0	4584.0	76162.0	2634.0	
1	326.0	13.0	25.0	0.0	12.0	
2	180.0	0.0	12.0	0.0	12.0	
3	438.0	0.0	17.0	0.0	17.0	
4	251.0	0.0	12.0	0.0	12.0	

	B05015004	B05015004, Error	…	B05015027, Error	B05015028	\
0	211892.0	3307.0	…	1076.0	87568.0	
1	13.0	25.0	…	12.0	0.0	
2	0.0	12.0	…	12.0	0.0	
3	0.0	17.0	…	17.0	0.0	
4	0.0	12.0	…	12.0	0.0	

	B05015028, Error	B05015029	B05015029, Error	B05015030	B05015030, Error	\
0	2277.0	989775.0	8062.0	173834.0	3797.0	
1	12.0	910.0	256.0	130.0	79.0	
2	12.0	690.0	149.0	36.0	36.0	
3	17.0	2054.0	299.0	198.0	182.0	
4	12.0	1120.0	252.0	147.0	118.0	

	B05015031	B05015031, Error	\
0	815941.0	6993.0	
1	780.0	249.0	

```
2      654.0             140.0
3     1856.0             279.0
4      973.0             226.0

                                                 geometry
0  MULTIPOLYGON (((-118.70339 34.16859, -118.7033…
1  MULTIPOLYGON (((-118.30229 34.25870, -118.3009…
2  MULTIPOLYGON (((-118.30334 34.27371, -118.3033…
3  MULTIPOLYGON (((-118.29945 34.25598, -118.2979…
4  MULTIPOLYGON (((-118.28593 34.25227, -118.2859…

[5 rows x 65 columns]
```

[7]:
```
yoe.tail()
```

[7]:
```
                   geoid                                    name  B05015001  \
2342  14000US06037980031  Census Tract 9800.31, Los Angeles, CA      146.0
2343  14000US06037980033  Census Tract 9800.33, Los Angeles, CA        0.0
2344  14000US06037990100     Census Tract 9901, Los Angeles, CA        0.0
2345  14000US06037990200     Census Tract 9902, Los Angeles, CA        0.0
2346  14000US06037990300     Census Tract 9903, Los Angeles, CA        0.0

      B05015001, Error  B05015002  B05015002, Error  B05015003  \
2342              71.0        0.0              12.0        0.0
2343              12.0        0.0              12.0        0.0
2344              12.0        0.0              12.0        0.0
2345              12.0        0.0              12.0        0.0
2346              12.0        0.0              12.0        0.0

      B05015003, Error  B05015004  B05015004, Error  …  B05015027, Error  \
2342              12.0        0.0              12.0  …              12.0
2343              12.0        0.0              12.0  …              12.0
2344              12.0        0.0              12.0  …              12.0
2345              12.0        0.0              12.0  …              12.0
2346              12.0        0.0              12.0  …              12.0

      B05015028  B05015028, Error  B05015029  B05015029, Error  B05015030  \
2342        0.0              12.0       37.0              23.0        0.0
2343        0.0              12.0        0.0              12.0        0.0
2344        0.0              12.0        0.0              12.0        0.0
2345        0.0              12.0        0.0              12.0        0.0
2346        0.0              12.0        0.0              12.0        0.0

      B05015030, Error  B05015031  B05015031, Error  \
2342              12.0       37.0              23.0
2343              12.0        0.0              12.0
2344              12.0        0.0              12.0
```

```
2345              12.0        0.0              12.0
2346              12.0        0.0              12.0

                                                 geometry
2342  MULTIPOLYGON (((-118.29105 33.75378, -118.2905…
2343  MULTIPOLYGON (((-118.24897 33.75590, -118.2470…
2344  MULTIPOLYGON (((-118.95114 33.99643, -118.9505…
2345  MULTIPOLYGON (((-118.63598 34.03255, -118.6325…
2346  MULTIPOLYGON (((-118.47656 33.75038, -118.4661…

[5 rows x 65 columns]
```

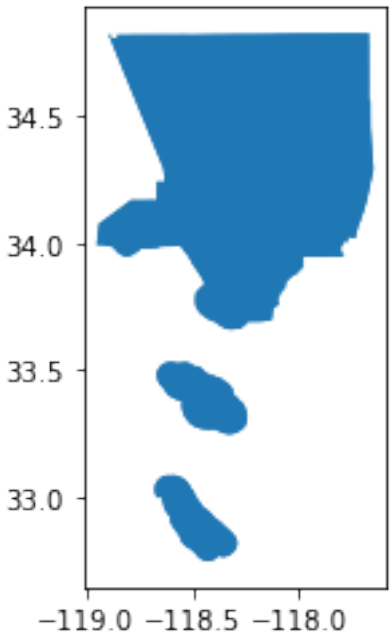
[9]:
```
yoe.shape
```

[9]:
```
(2347, 65)
```

We have 2347 census tracts! But we're only concerned with those that are within a half-mile of the Highland Park Station. Plus one of these is the entire LA County.

[13]:
```
yoe.plot()
```

[13]:
```
<AxesSubplot:>
```



There's LA County! Now let's isolate the census tracts we've already identified through Google Earth to be within a half-mile of the station.

0.1.3 Trimming Our Data

[14]:
```
keep_rows = yoe[yoe["geoid"].isin(['14000US06037183610',
 '14000US06037183510',
 '14000US06037183520',
 '14000US06037183810',
 '14000US06037183820',
 '14000US06037183701',
 '14000US06037183702',
 '14000US06037183101',
 '14000US06037183620'])]
```

Let's run a query to see if all nine made it over.

[15]:
```
keep_rows.shape
```

[15]:
```
(9, 65)
```

There they are! Let's take a look at them in more detail.

[16]:
```
keep_rows.head()
```

[16]:

	geoid	name	B05015001	\
359	14000US06037183101	Census Tract 1831.01, Los Angeles, CA	1086.0	
368	14000US06037183510	Census Tract 1835.10, Los Angeles, CA	750.0	
369	14000US06037183520	Census Tract 1835.20, Los Angeles, CA	1311.0	
370	14000US06037183610	Census Tract 1836.10, Los Angeles, CA	1231.0	
371	14000US06037183620	Census Tract 1836.20, Los Angeles, CA	1185.0	

	B05015001, Error	B05015002	B05015002, Error	B05015003	\
359	208.0	47.0	46.0	0.0	
368	159.0	10.0	13.0	0.0	
369	244.0	0.0	12.0	0.0	
370	191.0	27.0	26.0	7.0	
371	227.0	13.0	20.0	0.0	

	B05015003, Error	B05015004	B05015004, Error	…	B05015027, Error	\
359	12.0	47.0	46.0	…	12.0	
368	12.0	10.0	13.0	…	12.0	
369	12.0	0.0	12.0	…	12.0	
370	10.0	20.0	25.0	…	12.0	
371	12.0	13.0	20.0	…	12.0	

	B05015028	B05015028, Error	B05015029	B05015029, Error	B05015030	\
359	9.0	17.0	129.0	64.0	51.0	
368	10.0	13.0	141.0	58.0	42.0	
369	11.0	18.0	63.0	50.0	14.0	
370	20.0	23.0	157.0	64.0	21.0	

```
371       26.0              36.0       47.0              25.0       10.0

     B05015030, Error  B05015031  B05015031, Error  \
359              45.0       78.0              42.0
368              28.0       99.0              43.0
369              21.0       49.0              35.0
370              17.0      136.0              60.0
371              11.0       37.0              23.0

                                                 geometry
359  MULTIPOLYGON (((-118.18743 34.12817, -118.1855…
368  MULTIPOLYGON (((-118.20800 34.11272, -118.2080…
369  MULTIPOLYGON (((-118.20733 34.11181, -118.2062…
370  MULTIPOLYGON (((-118.19796 34.11446, -118.1977…
371  MULTIPOLYGON (((-118.19448 34.11592, -118.1942…

[5 rows x 65 columns]
```

[17]:
```
keep_rows.info()
```

```
<class 'geopandas.geodataframe.GeoDataFrame'>
Int64Index: 9 entries, 359 to 375
Data columns (total 65 columns):
 #   Column            Non-Null Count  Dtype
---  ------            --------------  -----
 0   geoid             9 non-null      object
 1   name              9 non-null      object
 2   B05015001         9 non-null      float64
 3   B05015001, Error  9 non-null      float64
 4   B05015002         9 non-null      float64
 5   B05015002, Error  9 non-null      float64
 6   B05015003         9 non-null      float64
 7   B05015003, Error  9 non-null      float64
 8   B05015004         9 non-null      float64
 9   B05015004, Error  9 non-null      float64
 10  B05015005         9 non-null      float64
 11  B05015005, Error  9 non-null      float64
 12  B05015006         9 non-null      float64
 13  B05015006, Error  9 non-null      float64
 14  B05015007         9 non-null      float64
 15  B05015007, Error  9 non-null      float64
 16  B05015008         9 non-null      float64
 17  B05015008, Error  9 non-null      float64
 18  B05015009         9 non-null      float64
 19  B05015009, Error  9 non-null      float64
 20  B05015010         9 non-null      float64
 21  B05015010, Error  9 non-null      float64
```

```
 22  B05015011         9 non-null      float64
 23  B05015011, Error  9 non-null      float64
 24  B05015012         9 non-null      float64
 25  B05015012, Error  9 non-null      float64
 26  B05015013         9 non-null      float64
 27  B05015013, Error  9 non-null      float64
 28  B05015014         9 non-null      float64
 29  B05015014, Error  9 non-null      float64
 30  B05015015         9 non-null      float64
 31  B05015015, Error  9 non-null      float64
 32  B05015016         9 non-null      float64
 33  B05015016, Error  9 non-null      float64
 34  B05015017         9 non-null      float64
 35  B05015017, Error  9 non-null      float64
 36  B05015018         9 non-null      float64
 37  B05015018, Error  9 non-null      float64
 38  B05015019         9 non-null      float64
 39  B05015019, Error  9 non-null      float64
 40  B05015020         9 non-null      float64
 41  B05015020, Error  9 non-null      float64
 42  B05015021         9 non-null      float64
 43  B05015021, Error  9 non-null      float64
 44  B05015022         9 non-null      float64
 45  B05015022, Error  9 non-null      float64
 46  B05015023         9 non-null      float64
 47  B05015023, Error  9 non-null      float64
 48  B05015024         9 non-null      float64
 49  B05015024, Error  9 non-null      float64
 50  B05015025         9 non-null      float64
 51  B05015025, Error  9 non-null      float64
 52  B05015026         9 non-null      float64
 53  B05015026, Error  9 non-null      float64
 54  B05015027         9 non-null      float64
 55  B05015027, Error  9 non-null      float64
 56  B05015028         9 non-null      float64
 57  B05015028, Error  9 non-null      float64
 58  B05015029         9 non-null      float64
 59  B05015029, Error  9 non-null      float64
 60  B05015030         9 non-null      float64
 61  B05015030, Error  9 non-null      float64
 62  B05015031         9 non-null      float64
 63  B05015031, Error  9 non-null      float64
 64  geometry          9 non-null      geometry
dtypes: float64(62), geometry(1), object(2)
memory usage: 4.6+ KB
```

We currently have lots of columns with "Error" in it. This column represents the margin of error of the column above it. We don't need it for our purposes so let's scrub these.

[18]:
```
columns_to_keep = ['geoid',
'name',
'B05015001',
'B05015002',
'B05015003',
'B05015004',
'B05015005',
'B05015006',
'B05015007',
'B05015008',
'B05015009',
'B05015010',
'B05015011',
'B05015012',
'B05015013',
'B05015014',
'B05015015',
'B05015016',
'B05015017',
'B05015018',
'B05015019',
'B05015020',
'B05015021',
'B05015022',
'B05015023',
'B05015024',
'B05015025',
'B05015026',
'B05015027',
'B05015028',
'B05015029',
'B05015030',
'B05015031',
 'geometry']
```

[19]:
```
keep_rows[columns_to_keep]
```

[19]:

	geoid	name	B05015001	\
359	14000US06037183101	Census Tract 1831.01, Los Angeles, CA	1086.0	
368	14000US06037183510	Census Tract 1835.10, Los Angeles, CA	750.0	
369	14000US06037183520	Census Tract 1835.20, Los Angeles, CA	1311.0	
370	14000US06037183610	Census Tract 1836.10, Los Angeles, CA	1231.0	
371	14000US06037183620	Census Tract 1836.20, Los Angeles, CA	1185.0	
372	14000US06037183701	Census Tract 1837.01, Los Angeles, CA	988.0	
373	14000US06037183702	Census Tract 1837.02, Los Angeles, CA	767.0	
374	14000US06037183810	Census Tract 1838.10, Los Angeles, CA	1680.0	
375	14000US06037183820	Census Tract 1838.20, Los Angeles, CA	1565.0	

```
     B05015002  B05015003  B05015004  B05015005  B05015006  B05015007  \
359       47.0        0.0       47.0       68.0        0.0       68.0
368       10.0        0.0       10.0       13.0        0.0       13.0
369        0.0        0.0        0.0        0.0        0.0        0.0
370       27.0        7.0       20.0       13.0        0.0       13.0
371       13.0        0.0       13.0        0.0        0.0        0.0
372        5.0        0.0        5.0       30.0        0.0       30.0
373       64.0        0.0       64.0       17.0        0.0       17.0
374       10.0        0.0       10.0        0.0        0.0        0.0
375       60.0        0.0       60.0        0.0        0.0        0.0

     B05015008  …  B05015023  B05015024  B05015025  B05015026  B05015027  \
359        0.0  …      116.0        0.0      116.0        9.0        0.0
368        0.0  …       94.0       18.0       76.0       10.0        0.0
369        0.0  …       40.0        0.0       40.0       11.0        0.0
370        0.0  …      131.0        0.0      131.0       20.0        0.0
371        0.0  …      173.0        0.0      173.0       26.0        0.0
372        0.0  …      107.0       21.0       86.0       39.0        0.0
373        0.0  …       62.0        0.0       62.0       26.0        0.0
374        0.0  …        0.0        0.0        0.0        0.0        0.0
375        0.0  …      150.0       78.0       72.0        9.0        0.0

     B05015028  B05015029  B05015030  B05015031  \
359        9.0      129.0       51.0       78.0
368       10.0      141.0       42.0       99.0
369       11.0       63.0       14.0       49.0
370       20.0      157.0       21.0      136.0
371       26.0       47.0       10.0       37.0
372       39.0       71.0        5.0       66.0
373       26.0       94.0        9.0       85.0
374        0.0      166.0       15.0      151.0
375        9.0      130.0       66.0       64.0

                                                 geometry
359  MULTIPOLYGON (((-118.18743 34.12817, -118.1855…
368  MULTIPOLYGON (((-118.20800 34.11272, -118.2080…
369  MULTIPOLYGON (((-118.20733 34.11181, -118.2062…
370  MULTIPOLYGON (((-118.19796 34.11446, -118.1977…
371  MULTIPOLYGON (((-118.19448 34.11592, -118.1942…
372  MULTIPOLYGON (((-118.19266 34.10966, -118.1920…
373  MULTIPOLYGON (((-118.19121 34.10124, -118.1899…
374  MULTIPOLYGON (((-118.20374 34.10718, -118.2024…
375  MULTIPOLYGON (((-118.20290 34.10275, -118.2028…

[9 rows x 34 columns]
```

We have our trimmed rows and colums. Now let's rename our variable for easier coding.

[20]:
```
yoe = keep_rows[columns_to_keep]
```

[21]:
```
yoe.shape
```

[21]:
```
(9, 34)
```

Awesome! We have our nine census tracts and trimmed rows. But our column titles are still written in a way that makes it difficult to understand what the data in its columns represents. Referring to the metadata file in the download, we update our column titles accordingly.

[22]:
```
list(yoe)
```

[22]:
```
['geoid',
 'name',
 'B05015001',
 'B05015002',
 'B05015003',
 'B05015004',
 'B05015005',
 'B05015006',
 'B05015007',
 'B05015008',
 'B05015009',
 'B05015010',
 'B05015011',
 'B05015012',
 'B05015013',
 'B05015014',
 'B05015015',
 'B05015016',
 'B05015017',
 'B05015018',
 'B05015019',
 'B05015020',
 'B05015021',
 'B05015022',
 'B05015023',
 'B05015024',
 'B05015025',
 'B05015026',
 'B05015027',
 'B05015028',
 'B05015029',
 'B05015030',
 'B05015031',
 'geometry']
```

[23]:
```
yoe.columns = ['geoid',
 'name',
 'Total',
 'China, H.K., Taiwan',
 'China et al Entered 2010 or later',
 'China et al Before 2010',
 'Cuba',
 'Cuba Entered 2010 or later',
 'Cuba Entered Before 2010',
 'Dominican Republic',
 'D.R. Entered 2010 or later',
 'D.R. Entered Before 2010',
 'El Salvador',
 'E.S. Entered 2010 or later',
 'E.S. Entered Before 2010',
 'Guatemala',
 'Guatemala Entered 2010 or later',
 'Guatemala Entered Before 2010',
 'India',
 'India Entered 2010 or later',
 'India Entered Before 2010',
 'Mexico',
 'Mexico Entered 2010 or later',
 'Mexico Entered Before 2010',
 'Philippines',
 'Philippines Entered 2010 or later',
 'Philippines Entered Before 2010',
 'Vietnam',
 'Vietnam Entered 2010 or later',
 'Vietnam Entered Before 2010',
 'All Other Countries',
 'A.O.C. Entered 2010 or later',
 'A.O.C. Entered Before 2010',
 'geometry']
```

[24]:
```
yoe.head()
```

[24]:

	geoid	name	Total	\
359	14000US06037183101	Census Tract 1831.01, Los Angeles, CA	1086.0	
368	14000US06037183510	Census Tract 1835.10, Los Angeles, CA	750.0	
369	14000US06037183520	Census Tract 1835.20, Los Angeles, CA	1311.0	
370	14000US06037183610	Census Tract 1836.10, Los Angeles, CA	1231.0	
371	14000US06037183620	Census Tract 1836.20, Los Angeles, CA	1185.0	

	China, H.K., Taiwan	China et al Entered 2010 or later	\
359	47.0	0.0	
368	10.0	0.0	

```
369                 0.0                                0.0
370                27.0                                7.0
371                13.0                                0.0

     China et al Before 2010  Cuba  Cuba Entered 2010 or later  \
359                     47.0  68.0                         0.0
368                     10.0  13.0                         0.0
369                      0.0   0.0                         0.0
370                     20.0  13.0                         0.0
371                     13.0   0.0                         0.0

     Cuba Entered Before 2010  Dominican Republic  …  Philippines  \
359                      68.0                 0.0  …        116.0
368                      13.0                 0.0  …         94.0
369                       0.0                 0.0  …         40.0
370                      13.0                 0.0  …        131.0
371                       0.0                 0.0  …        173.0

     Philippines Entered 2010 or later  Philippines Entered Before 2010  \
359                                0.0                            116.0
368                               18.0                             76.0
369                                0.0                             40.0
370                                0.0                            131.0
371                                0.0                            173.0

     Vietnam  Vietnam Entered 2010 or later  Vietnam Entered Before 2010  \
359      9.0                            0.0                          9.0
368     10.0                            0.0                         10.0
369     11.0                            0.0                         11.0
370     20.0                            0.0                         20.0
371     26.0                            0.0                         26.0

     All Other Countries  A.O.C. Entered 2010 or later  \
359                129.0                          51.0
368                141.0                          42.0
369                 63.0                          14.0
370                157.0                          21.0
371                 47.0                          10.0

     A.O.C. Entered Before 2010  \
359                        78.0
368                        99.0
369                        49.0
370                       136.0
371                        37.0

                                                geometry
```

```
359  MULTIPOLYGON (((-118.18743 34.12817, -118.1855…
368  MULTIPOLYGON (((-118.20800 34.11272, -118.2080…
369  MULTIPOLYGON (((-118.20733 34.11181, -118.2062…
370  MULTIPOLYGON (((-118.19796 34.11446, -118.1977…
371  MULTIPOLYGON (((-118.19448 34.11592, -118.1942…

[5 rows x 34 columns]
```

Looks great! Let's start getting a sense of the foreign born population around the Highland Park Station, and where they're from.

0.1.4 Statistical Analysis of Our Data

[25]:
```
yoe['Total']
```

[25]:
```
359    1086.0
368     750.0
369    1311.0
370    1231.0
371    1185.0
372     988.0
373     767.0
374    1680.0
375    1565.0
Name: Total, dtype: float64
```

Looks like row 374 has the highest foreign born population whereas row 373 has the least. This will be communicated more meaningfully once we map it later. Let's run a query to get a general sense of the foreign born demographics around our station area.

[27]:
```
yoe['Total'].describe()
```

[27]:
```
count       9.000000
mean     1173.666667
std       319.925773
min       750.000000
25%       988.000000
50%      1185.000000
75%      1311.000000
max      1680.000000
Name: Total, dtype: float64
```

The average foreign population around the Highland Park Station Area is 1,173. That is a lot of people! We don't have available to us how many total people are in each census tract, but if each census tract is holding around the optimum size population of 4,000 - that would mean more than a quarter of residents around the Highland Park Station are foreign born.

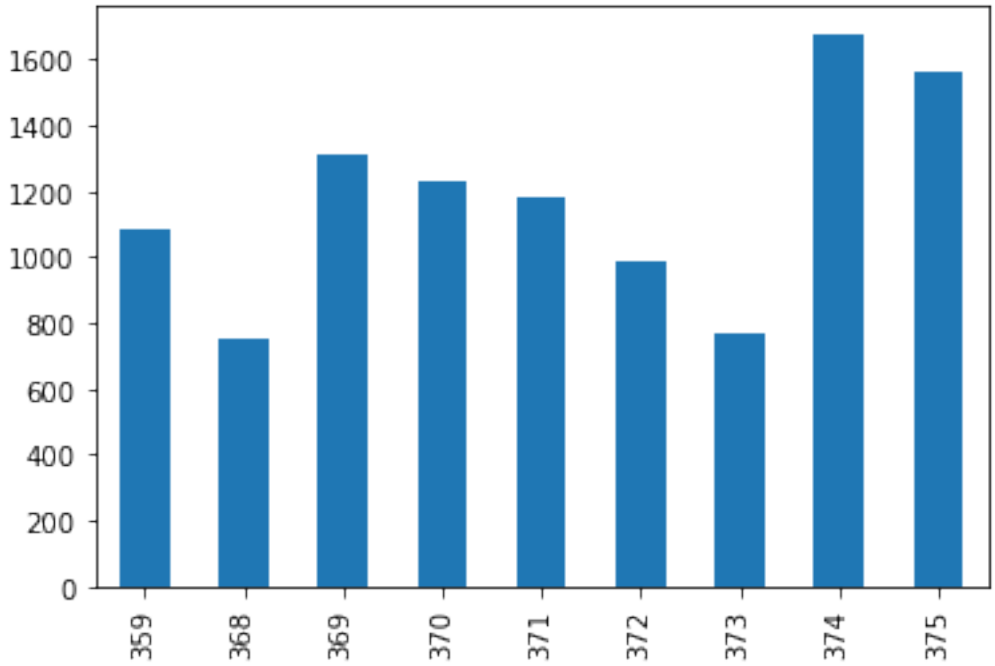
[28]:
```
yoe['Total'].sum()
```

[28]: 10563.0

In a half-mile radius of the Highland Park Station there are 10,563 foreign born residents. Now is a good time to import a module to help us plot our data and create some better visuals.

[29]:
```
import matplotlib.pyplot as plt
```

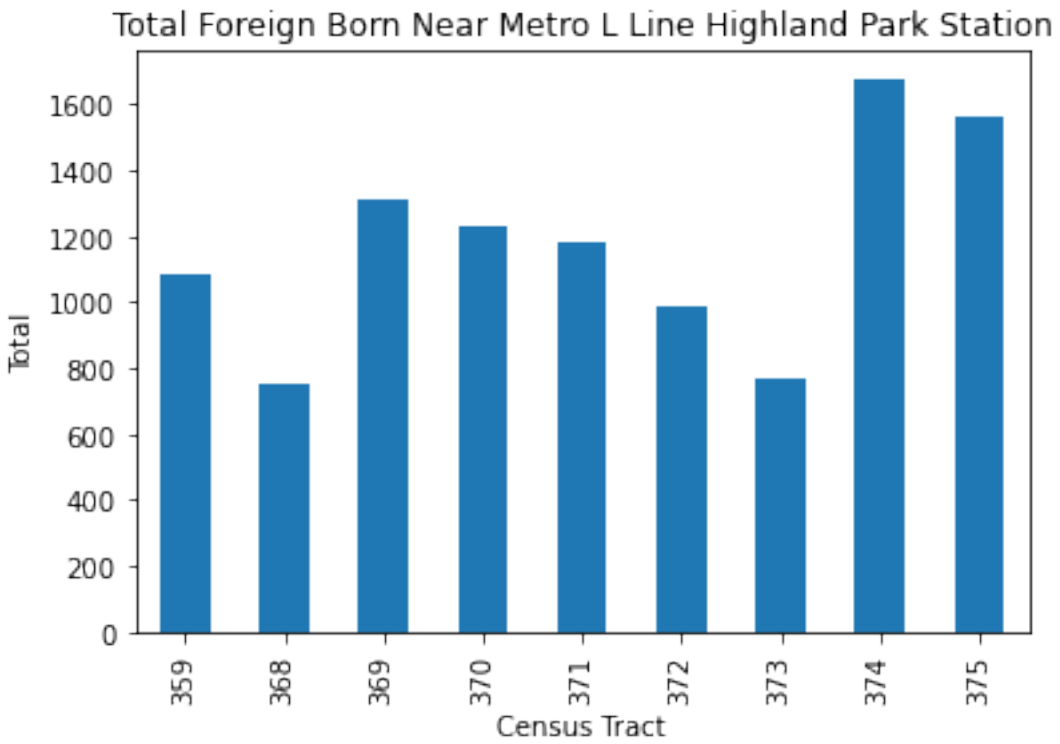
[30]:
```
yoe_plot = yoe['Total'].plot(kind='bar')
```



Just as we've already established, our graph shows that the census tract in row 374 has the higest foreign born population, with 373 having the lowest. Let's add some labels to this bar graph.

[ ]:
```
yoe_plot = yoe['Total'].plot(kind='bar', title="Total Foreign Born Near Metro L␣
↪Line Highland Park Station")
yoe_plot.set_xlabel("Census Tract")
yoe_plot.set_ylabel("Total")
```

[ ]: Text(0, 0.5, 'Total')



[95]:
```
###Statistical Analysis by Nationality
```

Let's learn a little more about our foreign-born population, specifically, where they're from. Based on my knowledge of the area, I'm going to run queries for a few Latin American countries and a couple Asian countries to see if one has a more pronounced presence.

[32]:
```
yoe['Mexico'].describe()
```

[32]:
```
count       9.000000
mean      645.222222
std       217.350396
min       331.000000
25%       515.000000
50%       665.000000
75%       669.000000
max      1048.000000
Name: Mexico, dtype: float64
```

[33]:
```
 yoe['Philippines'].describe()
```

[33]:
```
count      9.000000
mean      97.000000
std       54.879413
```

```
min        0.000000
25%       62.000000
50%      107.000000
75%      131.000000
max      173.000000
Name: Philippines, dtype: float64
```

[34]:
```
yoe['China, H.K., Taiwan'].describe()
```

[34]:
```
count     9.000000
mean     26.222222
std      24.595618
min       0.000000
25%      10.000000
50%      13.000000
75%      47.000000
max      64.000000
Name: China, H.K., Taiwan, dtype: float64
```

[35]:
```
yoe['El Salvador'].describe()
```

[35]:
```
count      9.000000
mean     197.555556
std      140.072402
min       14.000000
25%      134.000000
50%      172.000000
75%      264.000000
max      489.000000
Name: El Salvador, dtype: float64
```

[36]:
```
yoe['Guatemala'].describe()
```

[36]:
```
count      9.000000
mean      61.000000
std       48.507731
min       15.000000
25%       30.000000
50%       59.000000
75%       62.000000
max      173.000000
Name: Guatemala, dtype: float64
```

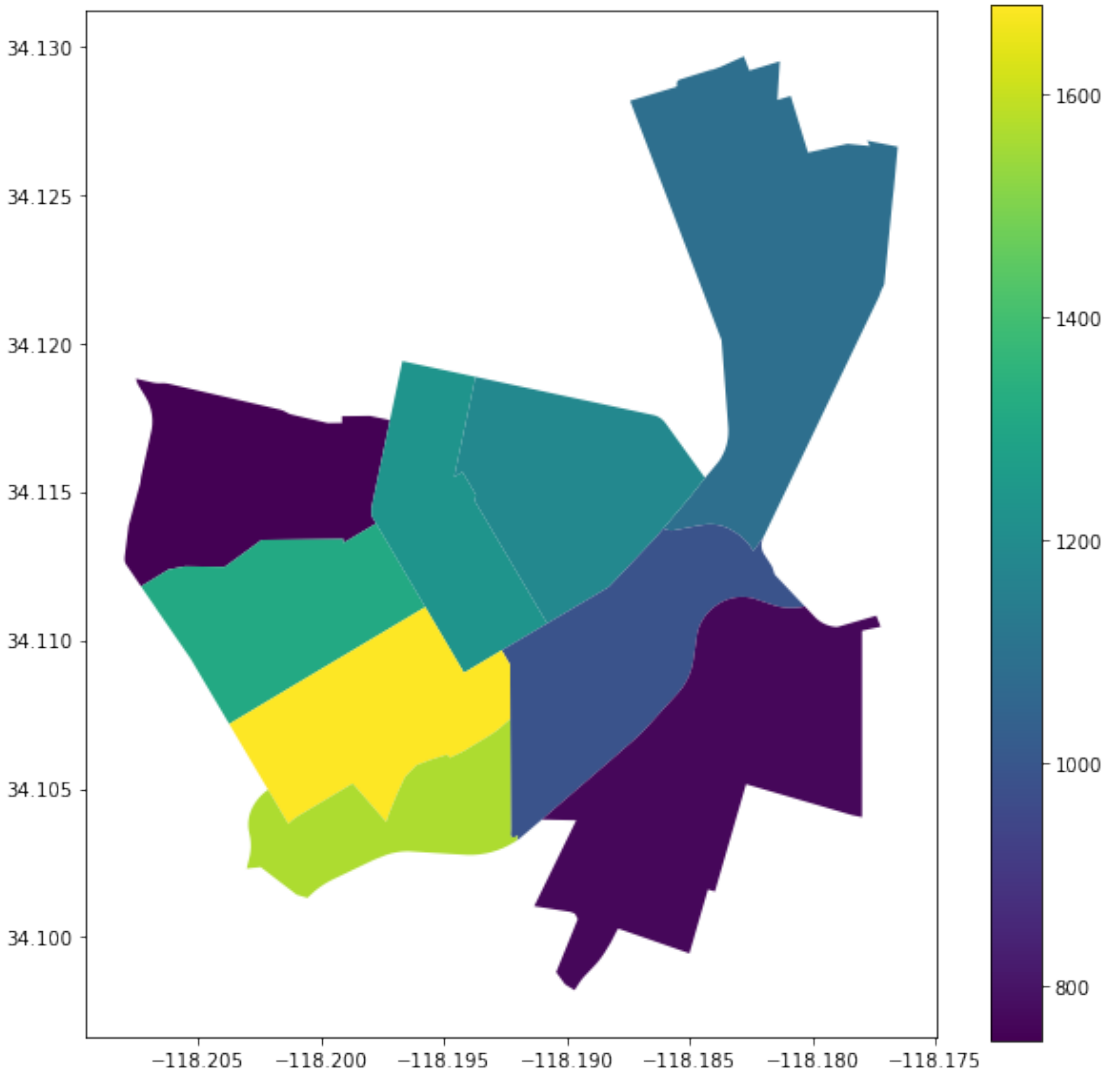
0.1.5 Mapping Our Data

It appears that based on the countries I analyzed, Mexicans are by far the largest foreign born population near the Highland Park Station, followed by El Salvadorians. Since our group project is

focused on all foreign born residents, let's plot a map of the station area with population densities.

[37]:
```
yoe.plot(figsize=(10,10),
                            column='Total',
                            legend=True)
```

[37]: <AxesSubplot:>



Now that data bar graph is being turned into a stronger visualization. The census tract that we had identified with largest foreign born population is represented on the map as yellow. Based on my knowledge of the area, this census tract is on North Figueroa St between the Highland Park Station and Ave 52. The census tracts with the least foreign born population are also the least residential - they are home to Franklin High School, Arroyo Seco Park, and Ernest E. Debbs Park. As we learned earlier, Mexicans have the highest foreign-born population in the area. But how much of the foriegn born population do they represent? Also, where do other foreign born residents

primarily live? Is there a high concentration of Asian residents in a certain census tract? To better understand these relationships, we normalize our data.

[38]:
```
list(yoe)
```

[38]:
```
['geoid',
 'name',
 'Total',
 'China, H.K., Taiwan',
 'China et al Entered 2010 or later',
 'China et al Before 2010',
 'Cuba',
 'Cuba Entered 2010 or later',
 'Cuba Entered Before 2010',
 'Dominican Republic',
 'D.R. Entered 2010 or later',
 'D.R. Entered Before 2010',
 'El Salvador',
 'E.S. Entered 2010 or later',
 'E.S. Entered Before 2010',
 'Guatemala',
 'Guatemala Entered 2010 or later',
 'Guatemala Entered Before 2010',
 'India',
 'India Entered 2010 or later',
 'India Entered Before 2010',
 'Mexico',
 'Mexico Entered 2010 or later',
 'Mexico Entered Before 2010',
 'Philippines',
 'Philippines Entered 2010 or later',
 'Philippines Entered Before 2010',
 'Vietnam',
 'Vietnam Entered 2010 or later',
 'Vietnam Entered Before 2010',
 'All Other Countries',
 'A.O.C. Entered 2010 or later',
 'A.O.C. Entered Before 2010',
 'geometry']
```

[39]:
```
yoe['Percent Mexico'] = yoe['Mexico']/yoe['Total']*100
yoe['Percent China, H.K., Taiwan'] = yoe['China, H.K., Taiwan']/yoe['Total']*100
yoe['Percent Philippines'] = yoe['Philippines']/yoe['Total']*100
```

```
/opt/conda/lib/python3.9/site-packages/geopandas/geodataframe.py:1322:
SettingWithCopyWarning:
A value is trying to be set on a copy of a slice from a DataFrame.
Try using .loc[row_indexer,col_indexer] = value instead
```

```
See the caveats in the documentation: https://pandas.pydata.org/pandas-
docs/stable/user_guide/indexing.html#returning-a-view-versus-a-copy
  super(GeoDataFrame, self).__setitem__(key, value)
```

[40]:
```
yoe['Percent Mexico']
```

[40]:
```
359    47.421731
368    44.133333
369    66.590389
370    54.021121
371    56.455696
372    61.639676
373    56.323338
374    62.380952
375    42.492013
Name: Percent Mexico, dtype: float64
```

All the census tracts around a half-mile of the Highland Park Station have foreign born Mexican populations above 42%, with the highest being 66%

[41]:
```
yoe['Percent China, H.K., Taiwan']
```

[41]:
```
359    4.327808
368    1.333333
369    0.000000
370    2.193339
371    1.097046
372    0.506073
373    8.344198
374    0.595238
375    3.833866
Name: Percent China, H.K., Taiwan, dtype: float64
```

There is one census tract around a half-mile of the Highland Park Station that has zero foreign born residents from China, Hong Kong or Taiwan.

[42]:
```
yoe['Percent Philippines']
```

[42]:
```
359    10.681400
368    12.533333
369     3.051106
370    10.641755
371    14.599156
372    10.829960
373     8.083442
374     0.000000
375     9.584665
```

```
Name: Percent Philippines, dtype: float64
```

Census tracts around a half-mile of the Highland Park Station have foreign born Filipino populations that range from 0%-15%.

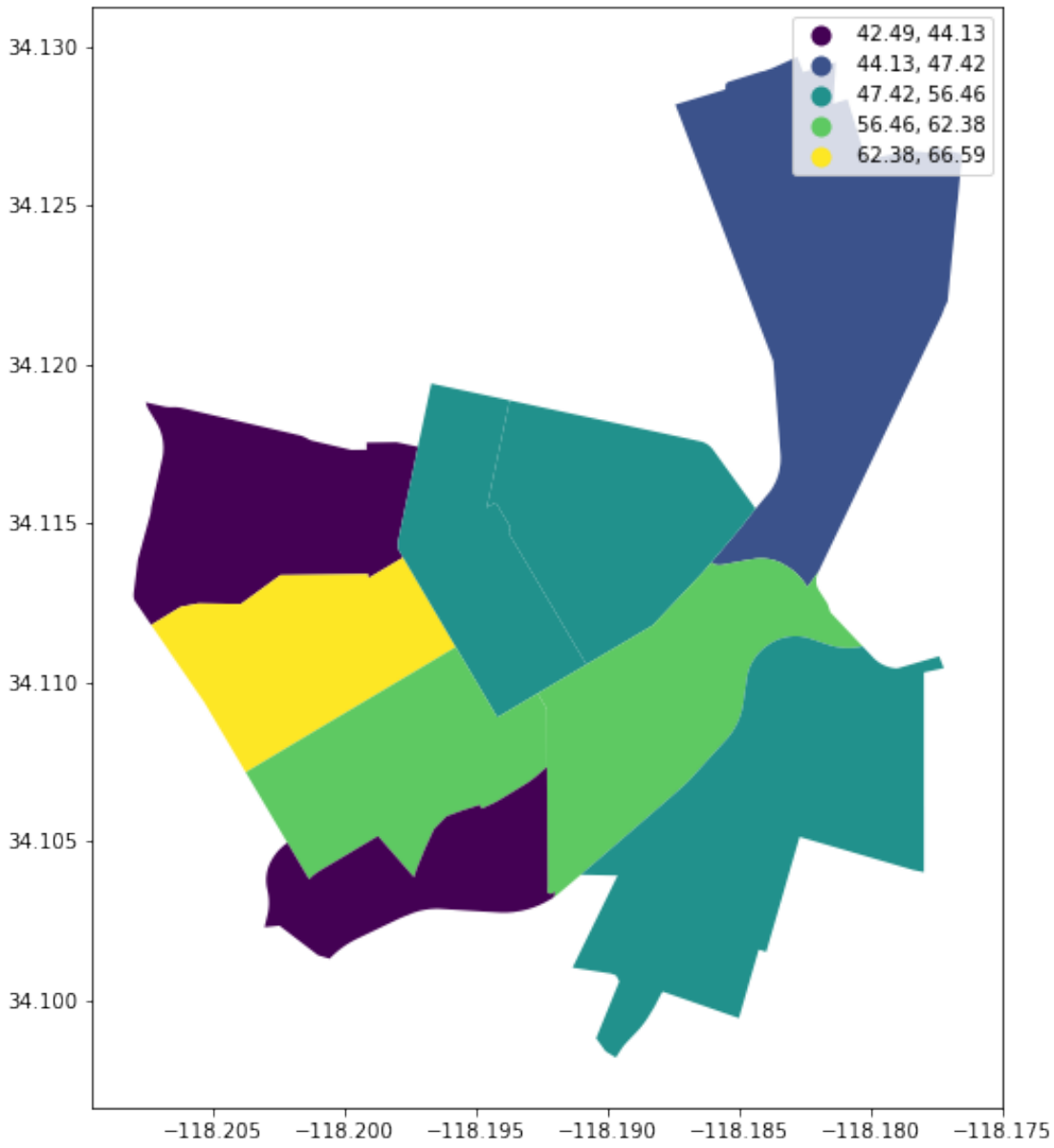
Let's project some of this data onto a map. To do so, we import our base map module.

[43]:
```
import contextily as ctx
```

Let's do a basic plot map of foreign born Mexican residents.

[45]:
```
yoe.plot(figsize=(10,10),
                  column='Percent Mexico',
                  legend=True,
                  scheme='NaturalBreaks')
```

[45]:
```
<AxesSubplot:>
```

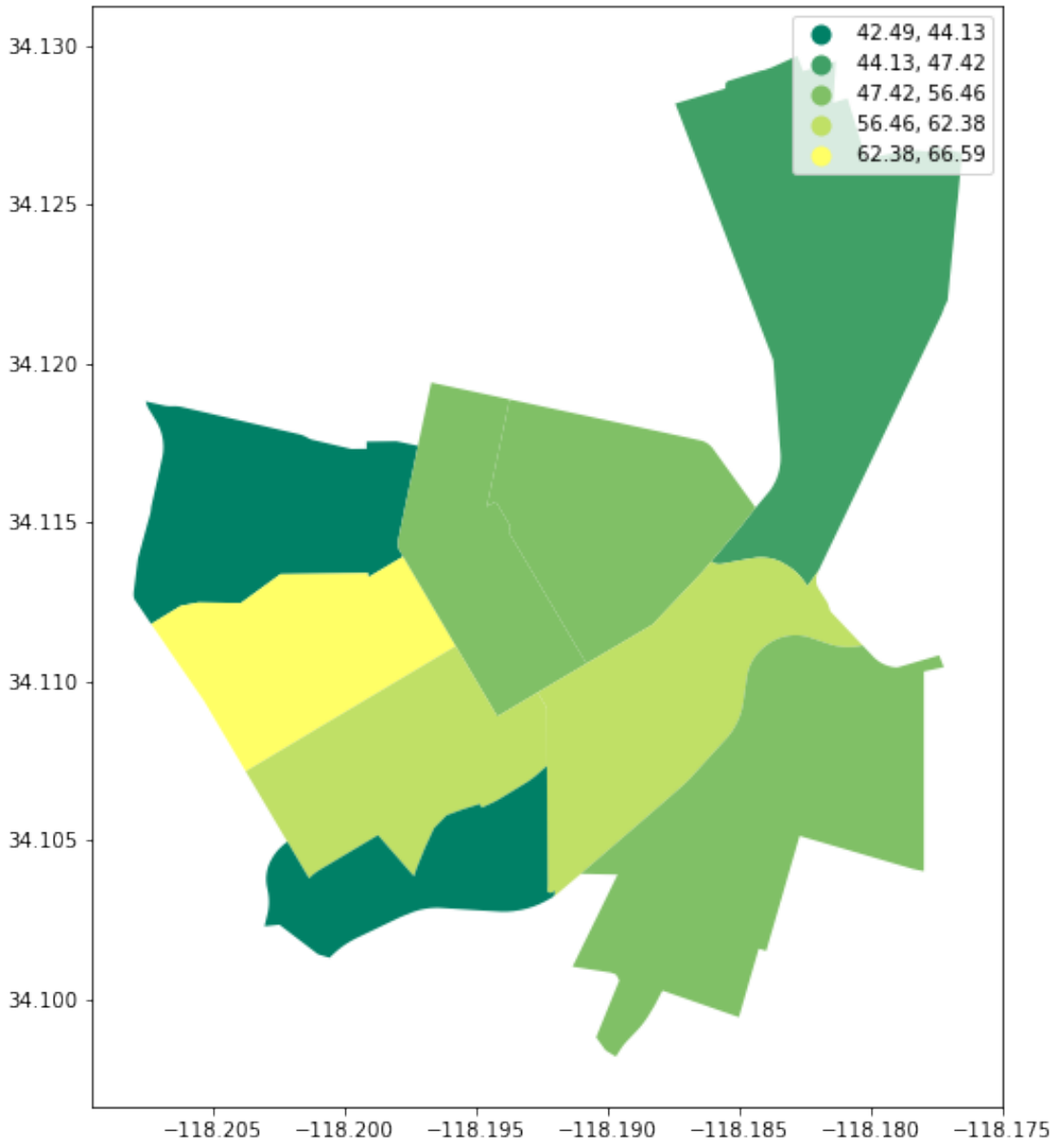


Note that the census tract in our southeast quadrant is now less dark. This means that though there is a relatively small number of foreign born Mexican residents as illustrated on our last map, there is still a relatively larger proprotion of foreign born Mexican residents here compared to the proportion of Mexican foreign born residents in other census tracts. Before we move on, let's change the color scheme to this map.

[47]:
```
yoe.plot(figsize=(10,10),
                 column='Percent Mexico',
                 legend=True,
                 scheme='NaturalBreaks',
                 cmap='summer'
```

```
        )
```

[47]: <AxesSubplot:>

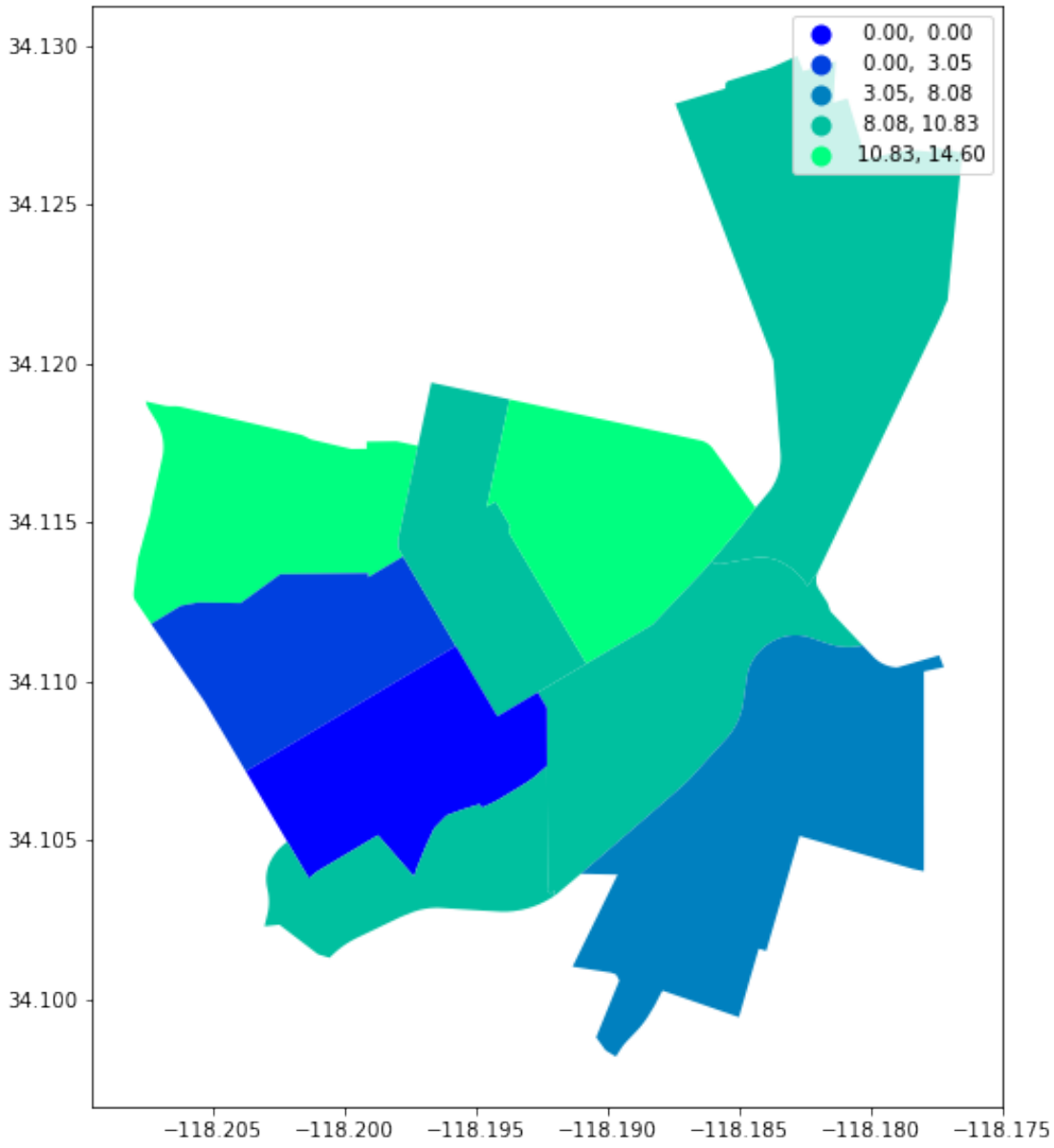


Let's do the same for foreign born Filipinos

[48]:
```
yoe.plot(figsize=(10,10),
                 column='Percent Philippines',
                 legend=True,
                 scheme='NaturalBreaks',
                 cmap='winter'
```

```
        )
```

[48]: <AxesSubplot:>

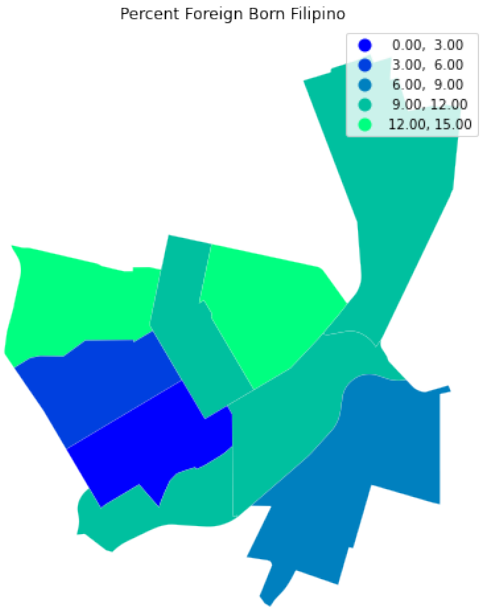


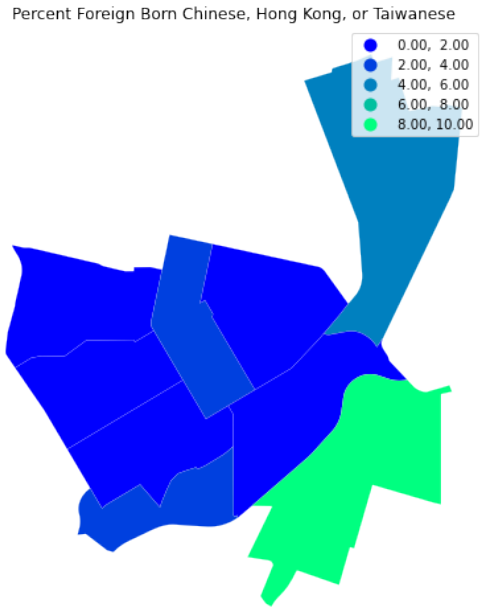
It looks like the highest concentration of Filipinos are found in the bright green census tracts, one of which sits at the intersection of N Figueroa St and York Boulevard. More than 10.8% of foreign born Filipinos live in this census tract.

Let's set foreign born Filipino residents next to residents from China, Hong Kong and Taiwan to see what relationships we find.

[49]:
```
fig, axs = plt.subplots(1, 2, figsize=(15, 12), sharex=True, sharey=True)
ax1, ax2 = axs

yoe.plot(column='Percent Philippines',
             cmap='winter',
             scheme='user_defined',
             classification_kwds={'bins':[3,6,9,12,15]},
             edgecolor='white',
             linewidth=0.1,
             ax=ax1,
             legend=True
            )

ax1.axis("off")
ax1.set_title("Percent Foreign Born Filipino")

yoe.plot(column='Percent China, H.K., Taiwan',
             cmap='winter',
             scheme='user_defined',
             classification_kwds={'bins':[2,4,6,8,10]},
             edgecolor='white',
             linewidth=0.1,
             ax=ax2,
             legend=True
            )

ax2.axis("off")
ax2.set_title("Percent Foreign Born Chinese, Hong Kong, or Taiwanese")
```

[49]:
```
Text(0.5, 1.0, 'Percent Foreign Born Chinese, Hong Kong, or Taiwanese')
```





The census tract in the southeast quadrant has the highest foreign born Chinese, Hong Kong, and Taiwanese population in the station area. Filipinos represent 9-12% of the foreign born population in this census tract. Based on the map, the foreign born population in this census tract could be as high as 22% Asian.

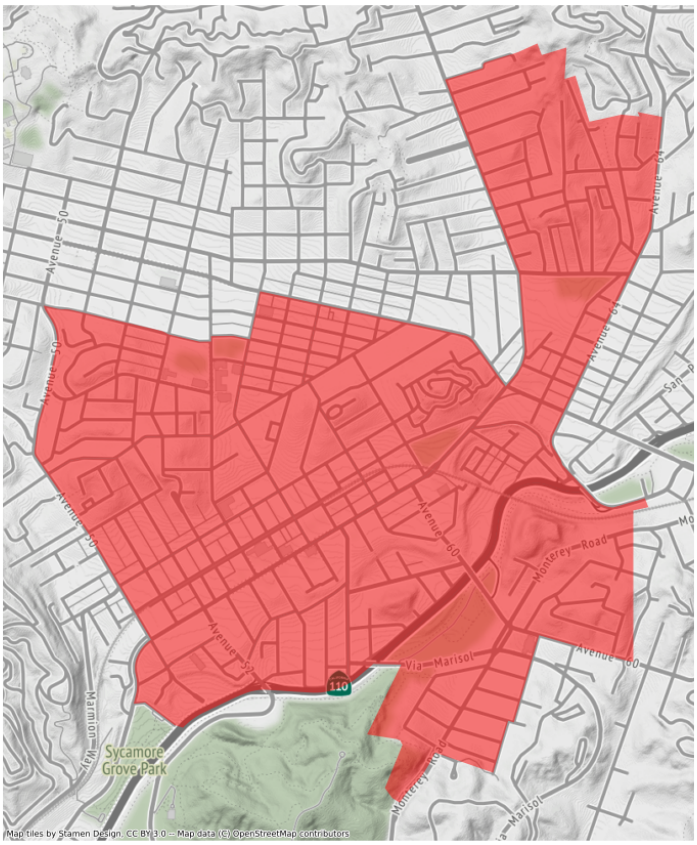
0.1.6 Adding a Basemap to Our Maps

Lastly, let's add a base map to one of these maps for geographical context. To do so, we have to run the following code:

[67]:
```
yoe_web_mercator = yoe.to_crs(epsg=3857)
```

[85]:
```
fig, ax = plt.subplots(figsize=(15, 15))

yoe_web_mercator[yoe_web_mercator['Percent Mexico'] > 40].plot(
                                                    ax=ax,
                                                    alpha=0.5,
                                                    color="red")


ax.axis('off')

ax.set_title('Census Tracts Near Metro L Line with a Foreign Born Population of␣
 ↪More than 40% Mexican',fontsize=24, pad=20)

ctx.add_basemap(ax,source=ctx.providers.Stamen.Terrain)
#how can we add a legend and bins to this?
```

Census Tracts near Metro L Line with a Foreign Born Population of More than 40% Mexican

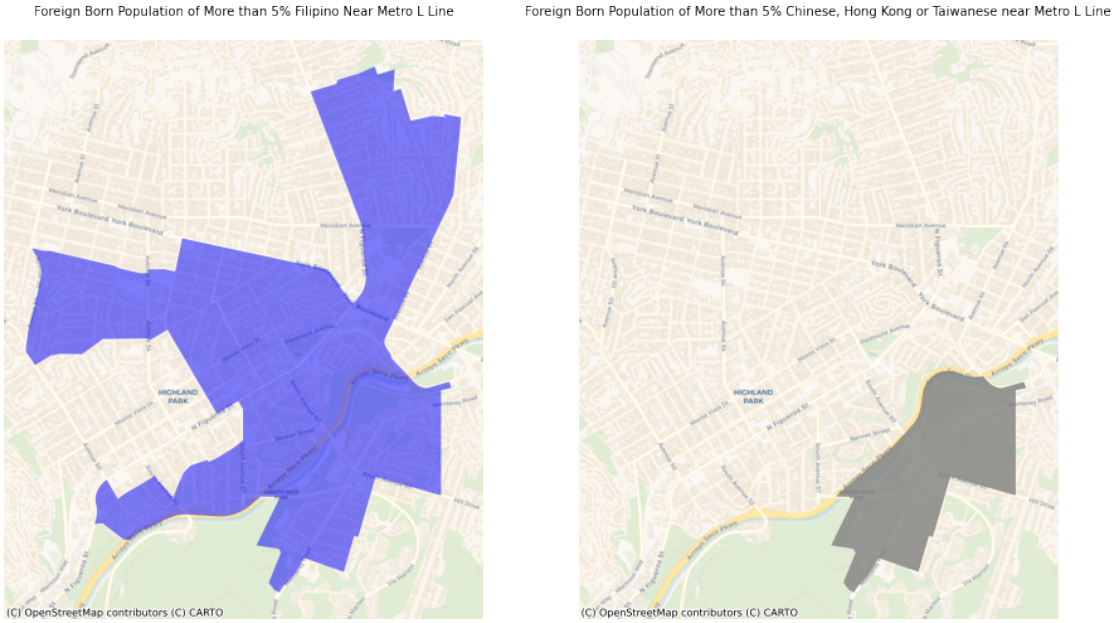


Now with our base map, we can see where the census tracts are in relation to streets and parks.

Before we wrap up, let's do the same for the Asian households we've been analyzing. To get a better sense of where the higher clusters of Asian households are, I'm going to set a minimum percentage of the foreign born population for our census tracts. For example, if the foreign born population of a census tract is less than 7% Filipino, the census tract will not show on our map.

[93]:
```
fig, axs = plt.subplots(1, 2, figsize=(15, 12),sharex=True,sharey=True)

# name each subplot
ax1, ax2 = axs

# add the layer with ax=ax in the argument
yoe_web_mercator[yoe_web_mercator['Percent Philippines'] > 7].plot(
                                                                    ax=ax1,
                                                                    alpha=0.5,
                                                                    ␣
 ↪color="blue")

ax1.axis("off")
```

```
ax1.set_title('Foreign Born Population of More than 7% Filipino Near Metro L␣
 ↪Line',fontsize=10, pad=20)

# add a basemap
ctx.add_basemap(ax1,source=ctx.providers.CartoDB.Voyager) # default zoom

# add the layer with ax=ax in the argument
yoe_web_mercator[yoe_web_mercator['Percent China, H.K., Taiwan'] > 7].
 ↪plot(ax=ax2,

                                                                    ␣
 ↪alpha=0.8,

                                                                    ␣
 ↪color="grey")


ax2.axis("off")
ax2.set_title('Foreign Born Population of More than 7% Chinese, Hong Kong or␣
 ↪Taiwanese near Metro L Line',fontsize=10, pad=20)
# add a basemap
ctx.add_basemap(ax2,source=ctx.providers.CartoDB.Voyager) # zoom override
```



As we had discussed, the shaded area in the southeast quadrant, which we now see is east of the 110 freeway, potentially has a disproportionately high concentration of foreign born Asian households compared to the other tracts near the Highland Park Station. Note the left map and the area around Figueroa that isn't colored in, but is colored in on our map of foreign born Mexicans. That means this area has a foreign born population of less than 7% Filipino.