Mapping_code

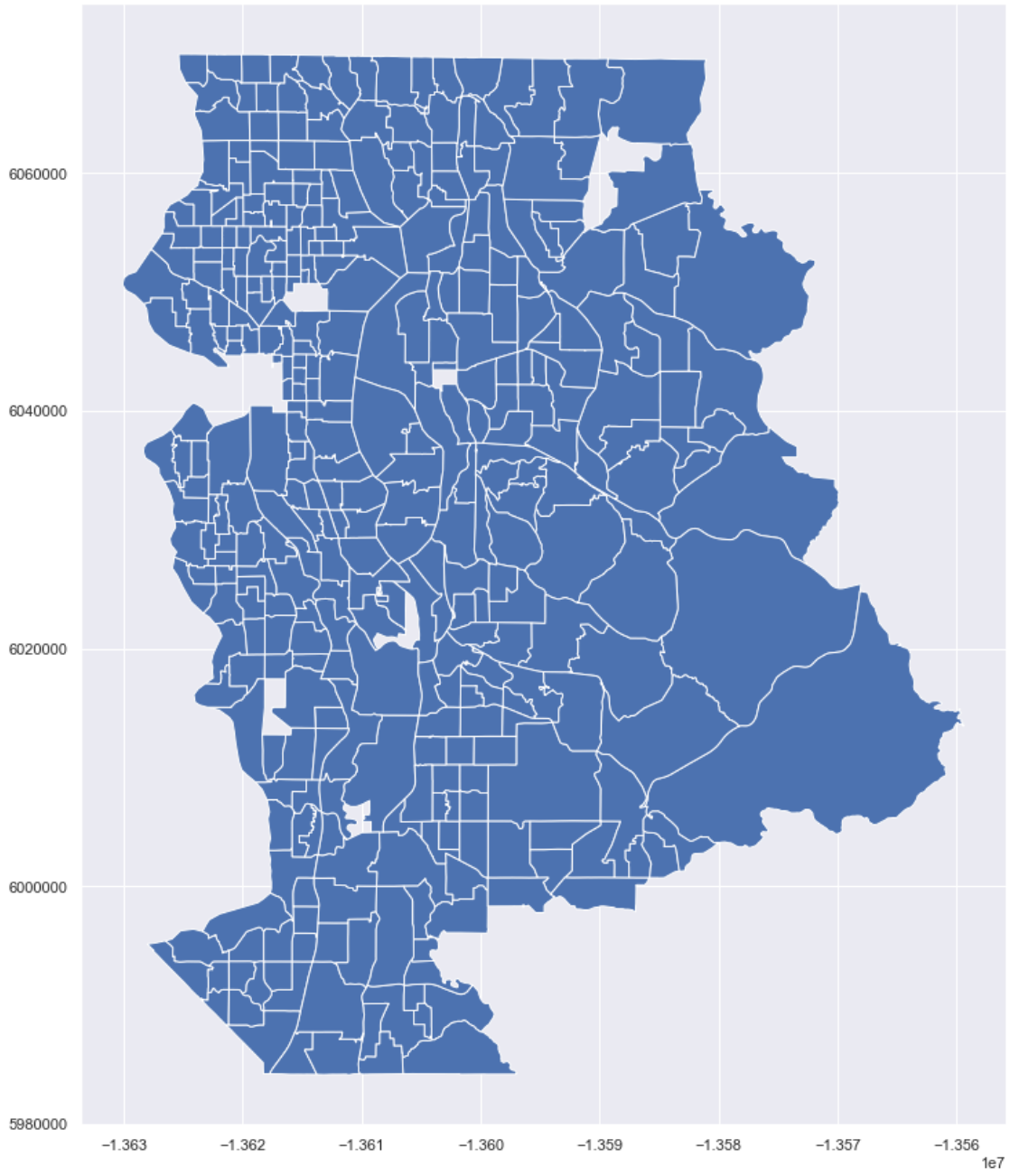
July 19, 2020

In [150]:
```
#@title Python imports
# A bit of imports
import numpy as np
import pandas as pd
import warnings
warnings.filterwarnings('ignore')

import numpy as np
import pandas as pd
import ipywidgets as widgets
from ipywidgets import interact, interact_manual
from matplotlib import pyplot as plt
import seaborn as sns
import warnings
warnings.filterwarnings("ignore")
from scipy import stats
import geopandas as gpd
from shapely.geometry import Point, Polygon
%matplotlib inline
sns.set(color_codes=True)
from sklearn import linear_model
from matplotlib.colors import LinearSegmentedColormap
from matplotlib_scalebar.scalebar import ScaleBar
import statsmodels.api as statm

import libpysal as ps
from mgwr.gwr import GWR
from mgwr.gwr import MGWR
from mgwr.sel_bw import Sel_BW
from spglm.family import Gaussian, Binomial, Poisson
import multiprocessing as mp
pool = mp.Pool()
import io
```

In [151]:
```
census = pd.read_csv("MGWR_session_results.csv")
```

In [152]:
```
census.columns
```

```
Out[152]: Index(['Unnamed: 0', 'Unnamed: 0.1', 'Unnamed: 0.1.1', 'Unnamed: 0.1.1.1',
                 'Unnamed: 0.1.1.1.1', 'ind', 'x_coor', 'y_coor', 'y', 'ols_residual',
                 'mgwr_yhat', 'mgwr_residual', 'localR2', 'beta_Intercept',
                 'beta_avg_age', 'beta_avg_basement', 'beta_avg_sqft',
                 'beta_avg_water_dist', 'beta_avg_unemp', 'beta_avg_tech',
                 'beta_avg_index', 'se_Intercept', 'se_avg_age', 'se_avg_basement',
                 'se_avg_sqft', 'se_avg_water_dist', 'se_avg_unemp', 'se_avg_tech',
                 'se_avg_index', 't_Intercept', 't_avg_age', 't_avg_basement',
                 't_avg_sqft', 't_avg_water_dist', 't_avg_unemp', 't_avg_tech',
                 't_avg_index', 'p_Intercept', 'p_avg_age', 'p_avg_basement',
                 'p_avg_sqft', 'p_avg_water_dist', 'p_avg_unemp', 'p_avg_tech',
                 'p_avg_index', 'sumW_Intercept', 'sumW_avg_age', 'sumW_avg_basement',
                 'sumW_avg_sqft', 'sumW_avg_water_dist', 'sumW_avg_unemp',
                 'sumW_avg_tech', 'sumW_avg_index', 'w_43', 'w_164', 'w_226', 'w_81',
                 'w_354'],
                dtype='object')

In [153]: b_cols = ['beta_Intercept', 'beta_avg_age','beta_avg_water_dist', 'beta_avg_sqft', 'b
          bt_cols = ['bt_constant','bt_age','bt_water_dist','bt_sqft','bt_round_basement','bt_
          t_cols = ['t_Intercept','t_avg_age', 't_avg_water_dist', 't_avg_sqft', 't_avg_baseme
          t_crit = [2.92,2.94,2.67,2.99,3.01,2.14,2.20,2.41]

In [154]: for i in range(8):
              census.loc[census[t_cols[i]] >=t_crit[i], bt_cols[i]] = census[b_cols[i]]
              census.loc[census[t_cols[i]] <=-t_crit[i], bt_cols[i]] = census[b_cols[i]]

In [155]: tr = pd.read_csv("census_tracts/census_tracts.csv")

In [156]: c='census_tracts/census_tracts.shp'
          crs = {'EPSG':'4326'}
          geo = gpd.read_file(c,crs=crs)[['geometry','objectid']]
          fig,ax = plt.subplots(figsize=(20,15))
          geo.plot(ax=ax)

Out[156]: <matplotlib.axes._subplots.AxesSubplot at 0x25763abaeb8>
```



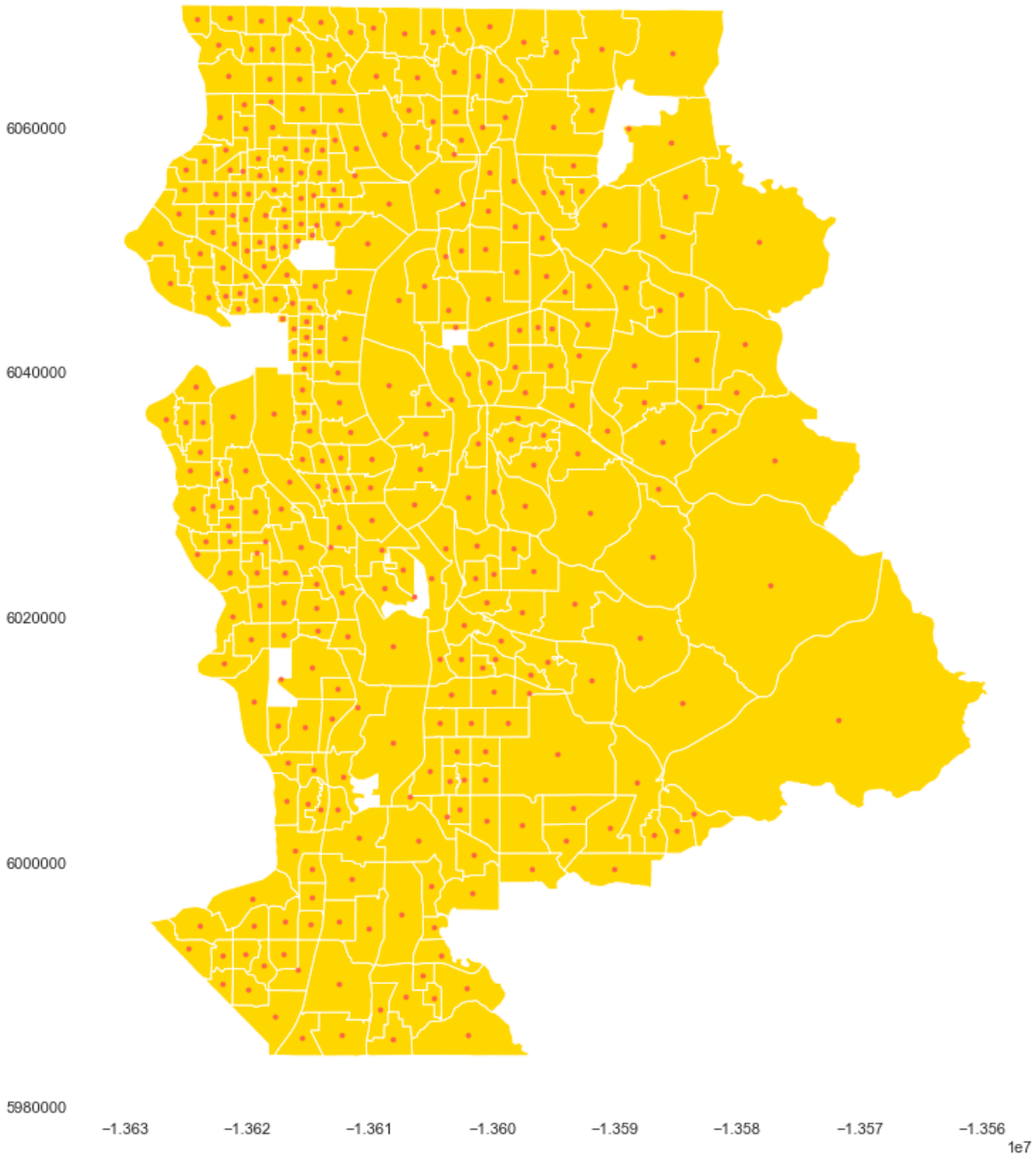

```
In [157]: geo.crs
```

```
Out[157]: {'init': 'epsg:3857'}
```

```
In [158]: coords = np.array(list(zip(census['x_coor'],census['y_coor'])))
          geom_points = [Point(xy) for xy in coords]
          geo_df = gpd.GeoDataFrame(census,crs={'init':'epsg:4326'},geometry=geom_points)
          geo_df = geo_df.rename(columns={'OBJECTID':'index'})
```

```
geo_df = geo_df.to_crs(epsg=3857)
final_geo = gpd.sjoin(geo, geo_df, how='inner',op='contains',lsuffix='left',rsuffix=

fig,ax = plt.subplots(figsize=(20,15))
ax.set_facecolor('white')
final_geo.plot(ax=ax, color='gold')
geo_df.plot(ax=ax, markersize=8,alpha=1,color='tomato',marker="o")
```

Out[158]: <matplotlib.axes._subplots.AxesSubplot at 0x257655d8278>



In [159]:
```
import scipy as sp
import shapefile as shp

import matplotlib as mpl
import matplotlib.pyplot as plt
class MidpointNormalize(mpl.colors.Normalize):
    def __init__(self, vmin, vmax, midpoint=0, clip=False):
        self.midpoint = midpoint
        mpl.colors.Normalize.__init__(self, vmin, vmax, clip)

    def __call__(self, value, clip=None):
        normalized_min = max(0, 1 / 2 * (1 - abs((self.midpoint - self.vmin) / (self
        normalized_max = min(1, 1 / 2 * (1 + abs((self.vmax - self.midpoint) / (self
        normalized_mid = 0.5
        x, y = [self.vmin, self.midpoint, self.vmax], [normalized_min, normalized_mi
        return sp.ma.masked_array(sp.interp(value, x, y))
```

In [160]:
```
label = gpd.read_file("more_labels_new/more_labels_new.shp")
```

In [161]:
```
label=label.to_crs(epsg=3857)
label=label.drop(label.index[3])
label=label.reset_index()
label=label.drop(label.index[5])
label=label.reset_index()
label
```

Out[161]:

	level_0	index	FID_	Field1	latitude	longitude	\
0	0	0	0	0	47.600000	-122.3000	
1	1	1	1	1	47.610100	-122.2015	
2	2	2	2	2	47.674000	-122.1215	
3	3	4	4	4	47.627740	-122.2420	
4	4	5	5	5	47.655548	-122.2950	
5	6	7	7	7	47.488300	-121.9467	
6	7	8	8	8	47.479700	-122.2079	
7	8	9	9	9	47.380900	-122.2348	
8	9	10	10	10	47.322300	-122.3126	
9	10	11	11	11	47.680000	-122.2290	
10	11	12	12	12	47.608500	-122.0878	
11	12	13	13	13	47.450200	-122.3088	
12	13	14	14	14	47.585900	-122.4014	
13	14	15	15	15	47.625300	-122.3222	
14	15	16	16	16	47.679200	-122.3860	
15	16	17	17	17	47.657300	-122.4055	
16	17	18	18	18	47.756000	-122.3457	
17	18	19	19	19	47.758400	-122.2497	
18	19	20	20	20	47.528300	-122.0997	

names	geometry

```
0                       Seattle  POINT (-13614373.72401736 6040565.208625006)
1                     Bellevue  POINT (-13603408.75417422 6042232.762266758)
2                      Redmond  POINT (-13594503.19491076 6052790.400185969)
3            Bill Gates' House  POINT (-13607917.19355135 6045145.975053936)
4     University of Washington  POINT (-13613817.12656339 6049740.411229585)
5   Tiger Mountain State Forest  POINT (-13575044.54792009 6022144.481821851)
6                       Renton   POINT (-13604121.1989153 6020727.859753064)
7                         Kent  POINT (-13607115.69321764 6004469.784188417)
8                   Federal Way  POINT (-13615776.34960135 5994841.227999952)
9               Lake Washington  POINT (-13606470.04017103 6053782.391355693)
10               Lake Sammamish  POINT (-13590751.72807102 6041968.573888839)
11               SeaTac Airport  POINT (-13615353.33553634 6015870.277732232)
12              Alki Beach Park   POINT (-13625661.5203838 6038237.776014488)
13                 Capitol Hill  POINT (-13616845.01671297 6044742.955066294)
14                      Ballard  POINT (-13623947.20022558 6053650.119275319)
15               Discovery Park  POINT (-13626117.93029605 6050029.958486892)
16                    Shoreline  POINT (-13619461.02474661 6066357.500503332)
17                      Kenmore  POINT (-13608774.35363046 6066754.908203133)
18          Cougar Mountain Park  POINT (-13592076.43001146 6028736.472030034)
```

In [176]:
```
def mapp(col,name,color,filename,normal=False):
    vmi=min(col[name])
    vma=max(col[name])
    figsize=(14,10)
    colors = 10
    norm = MidpointNormalize(vmin=vmi, vmax=vma, midpoint=0)
    colors = 6
    fig, ax = plt.subplots(1, figsize=(14, 14))

    if normal==True:
        col.plot(column=name, ax=ax,cmap=color,figsize=figsize,k=colors, linewidth=0
    else:
        col.plot(column=name, ax=ax,cmap=color,figsize=figsize,k=colors, linewidth=0

    ax.axis("off")

    Scalebar = ScaleBar(100000,location='lower left') # 1 pixel = 0.2 meter
    scatter = ax.collections[-1]

    plt.colorbar(scatter, ax=ax, extend='min',orientation='horizontal',fraction=0.046
    col.boundary.plot(ax=ax,color='grey',alpha=0.2)

    texts = []
    for x, y, lab in zip(label.geometry.x, label.geometry.y, label["names"]):
      texts.append(plt.text(x-1500, y-700, lab, fontsize = 8,horizontalalignment='le
    label.plot(ax=ax,alpha=1,color='black',linewidth=0.4)
```

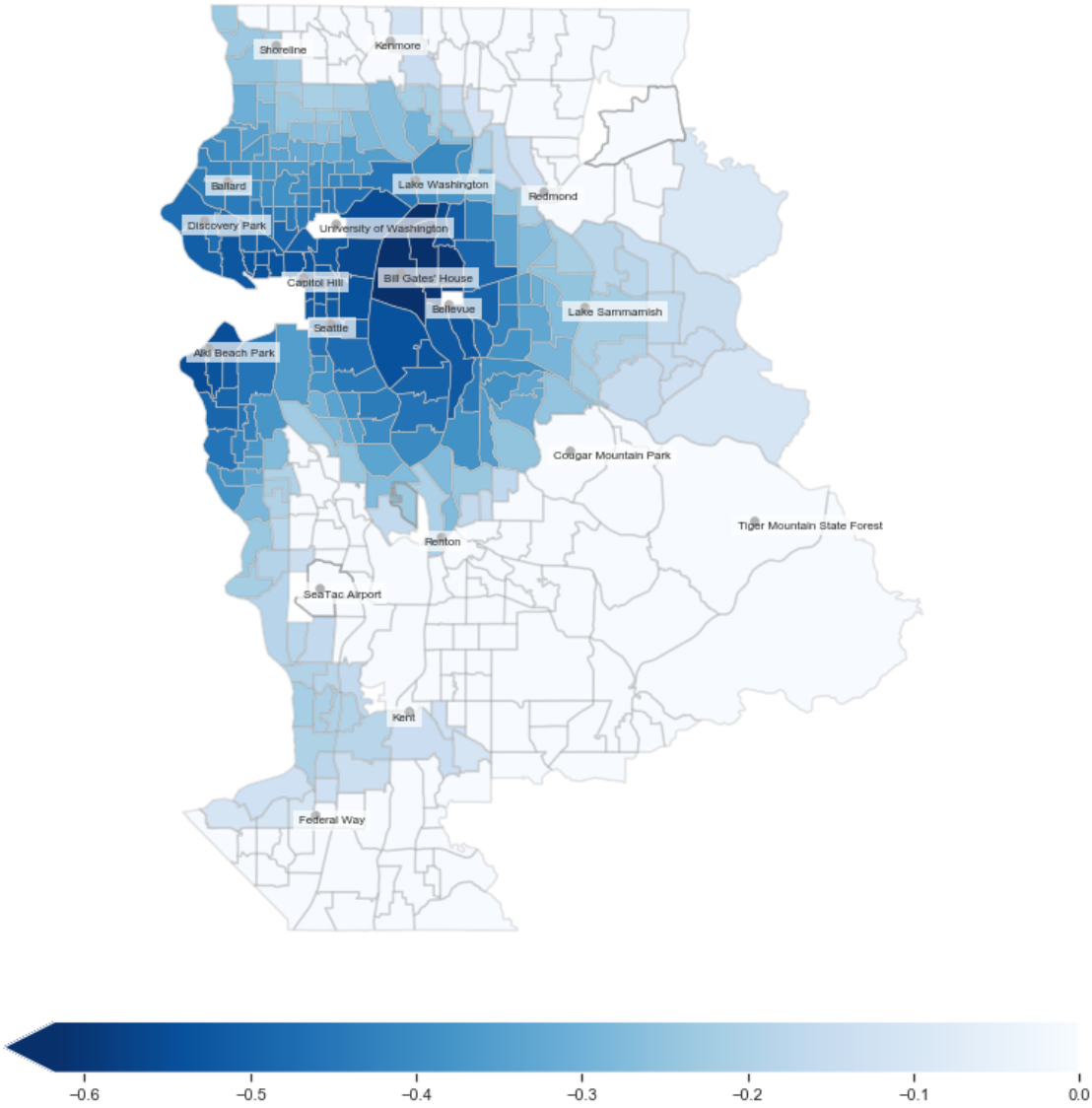
```
            plt.savefig("../images/"+filename)
```

In [169]:
```
final_geo.columns
```

Out[169]:
```
Index(['geometry', 'objectid', 'index_right', 'Unnamed: 0', 'Unnamed: 0.1',
       'Unnamed: 0.1.1', 'Unnamed: 0.1.1.1', 'Unnamed: 0.1.1.1.1', 'ind',
       'x_coor', 'y_coor', 'y', 'ols_residual', 'mgwr_yhat', 'mgwr_residual',
       'localR2', 'beta_Intercept', 'beta_avg_age', 'beta_avg_basement',
       'beta_avg_sqft', 'beta_avg_water_dist', 'beta_avg_unemp',
       'beta_avg_tech', 'beta_avg_index', 'se_Intercept', 'se_avg_age',
       'se_avg_basement', 'se_avg_sqft', 'se_avg_water_dist', 'se_avg_unemp',
       'se_avg_tech', 'se_avg_index', 't_Intercept', 't_avg_age',
       't_avg_basement', 't_avg_sqft', 't_avg_water_dist', 't_avg_unemp',
       't_avg_tech', 't_avg_index', 'p_Intercept', 'p_avg_age',
       'p_avg_basement', 'p_avg_sqft', 'p_avg_water_dist', 'p_avg_unemp',
       'p_avg_tech', 'p_avg_index', 'sumW_Intercept', 'sumW_avg_age',
       'sumW_avg_basement', 'sumW_avg_sqft', 'sumW_avg_water_dist',
       'sumW_avg_unemp', 'sumW_avg_tech', 'sumW_avg_index', 'w_43', 'w_164',
       'w_226', 'w_81', 'w_354', 'bt_constant', 'bt_age', 'bt_water_dist',
       'bt_sqft', 'bt_round_basement', 'bt_index', 'bt_unemp', 'bt_tech'],
      dtype='object')
```

In [188]:
```
final_geo['btn_water']=final_geo['bt_water_dist'].fillna(0.0)
```

In [190]:
```
mapp(col=final_geo,name='btn_water',color='Blues_r',filename="trial",normal=False)
```




```
In [183]: final_geo['bt_age']

Out[183]: 0           NaN
          1           NaN
          2      0.099947
          3           NaN
          4           NaN
                  ...
          352         NaN
          353         NaN
          354         NaN
          355         NaN
```

```
356         NaN
Name: bt_age, Length: 363, dtype: float64
```

In [ ]: