Plotting with GeoJSON

VISUALIZING GEOSPATIAL DATA IN PYTHON

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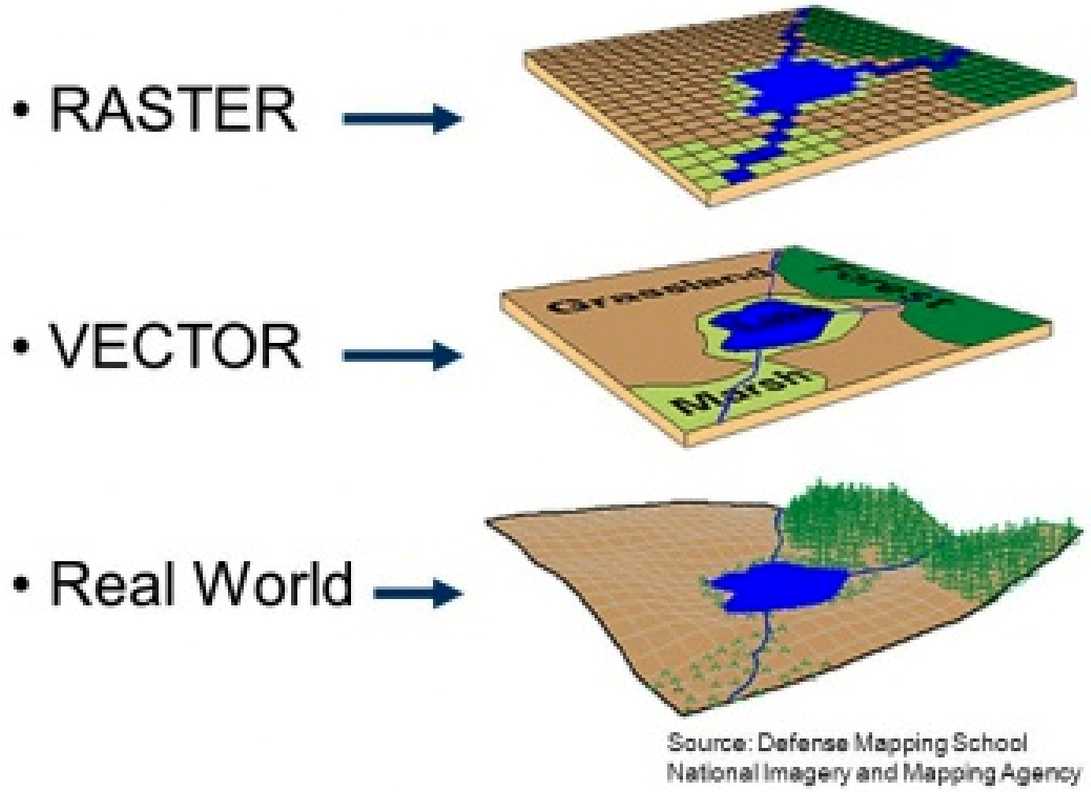
Neighborhoods GeoJSON

```
{ "type": "FeatureCollection",
  "features": [
    { "type":"Feature",
      "properties":{
    "name":"Historic Buena Vista"
    },"geometry":{
        "type":"MultiPolygon","coordinates":[[[[-86.79511056795417,36.17575....
```

```
neighborhoods = gpd.read_file('./data/neighborhood_boundaries.geojson')
neighborhoods.head(1)
```

```
                name                                           geometry
Historic Buena Vista    (POLYGON ((-86.79511056795417 36.17575964963348...)))
```

Geopandas dependencies

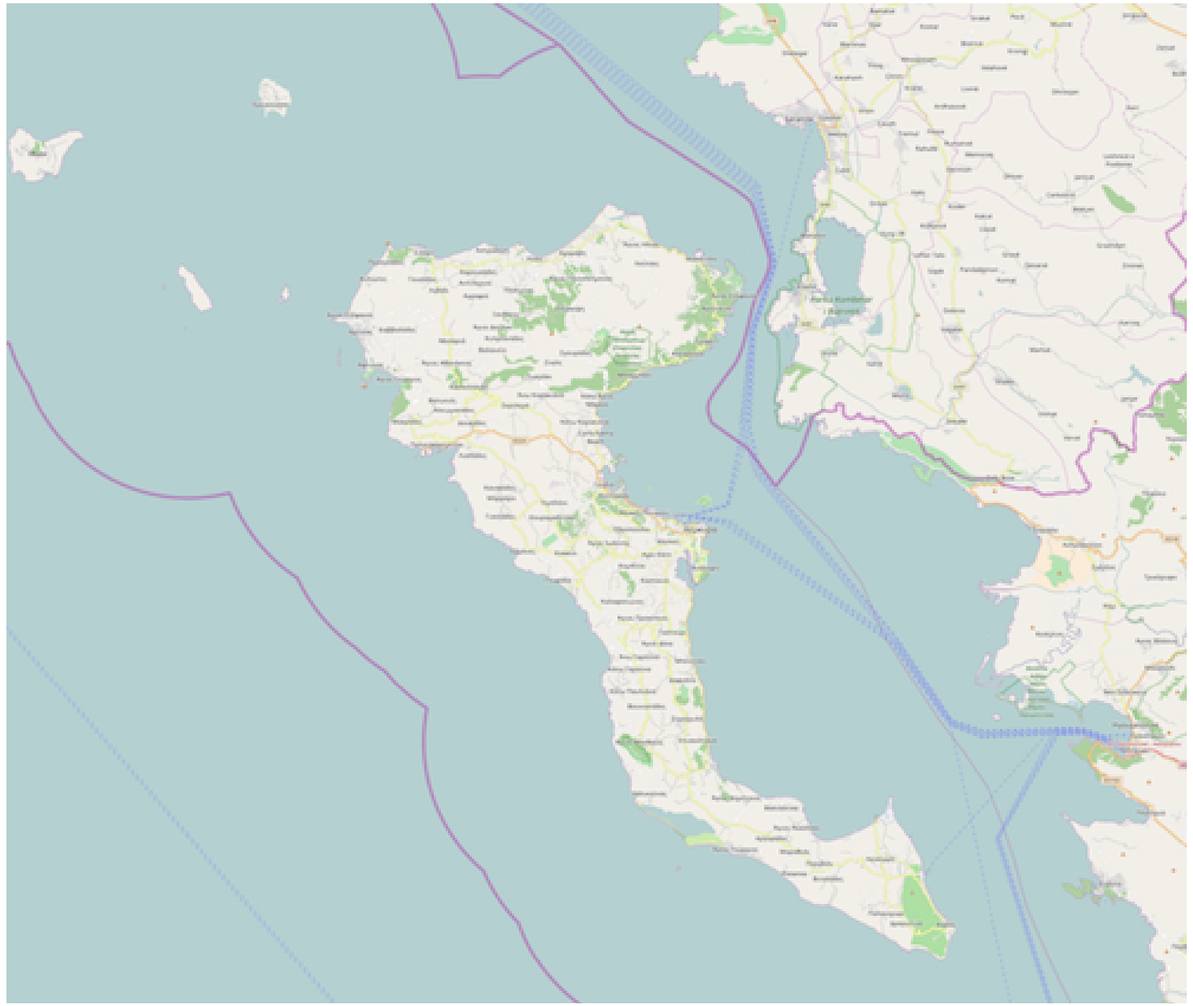


- Fiona
  - provides an python API for OGR
- GDAL/OGR
  - GDAL for translating raster data
  - OGR for translating vector data

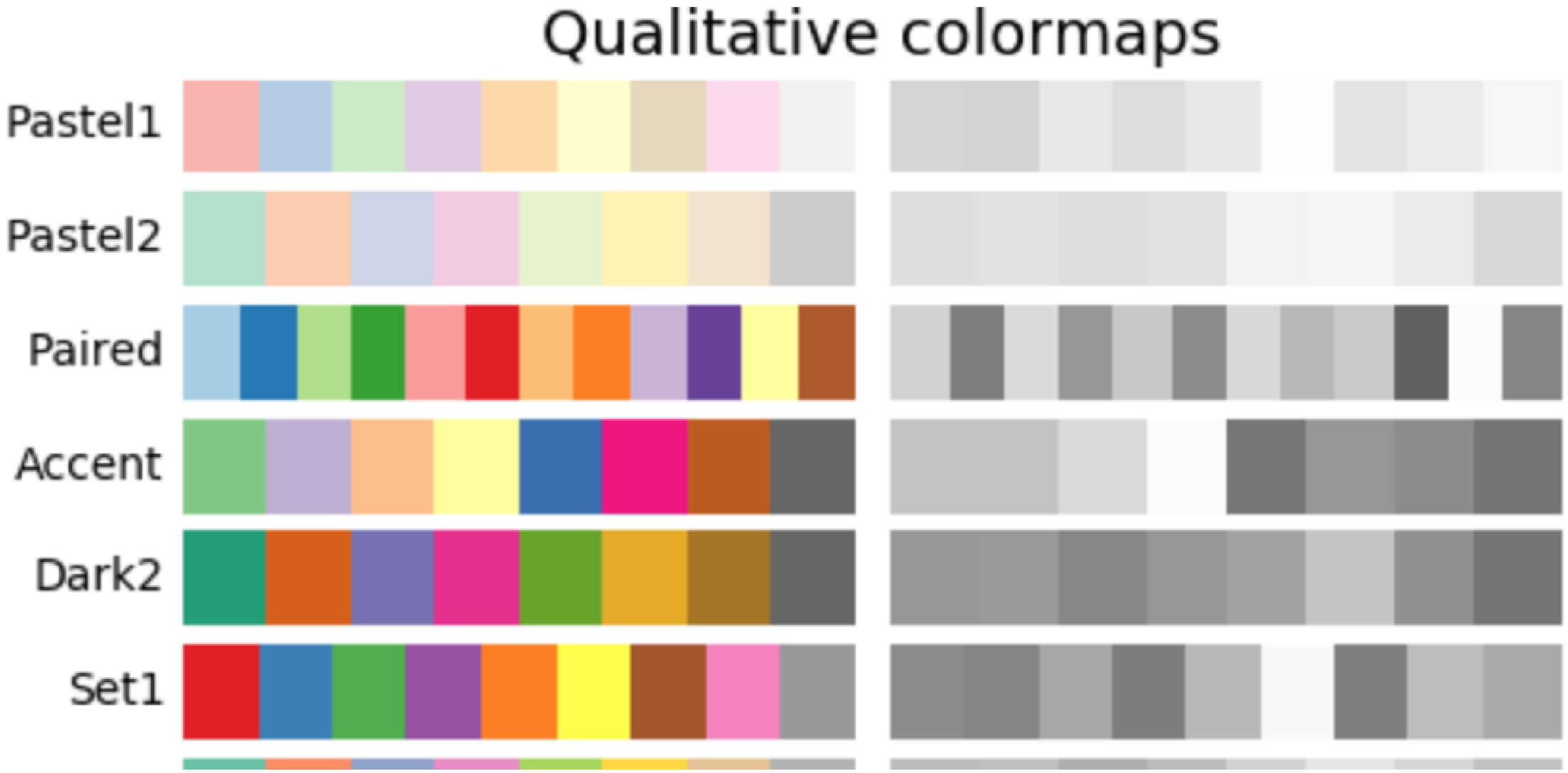
Comparing raster and vector graphics

raster image of Corfu

vector image of Corfu



Colormaps

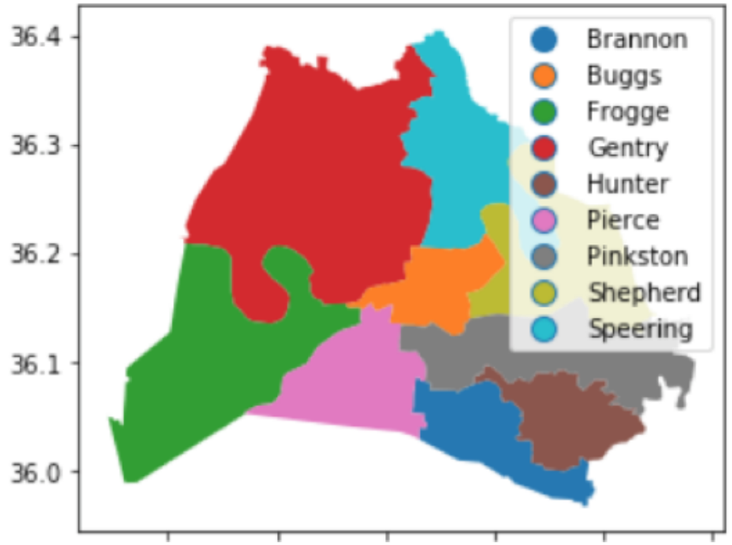

Qualitative colormaps
Pastel1
Pastel2
Paired
Accent
Dark2
Set1

Plotting with color

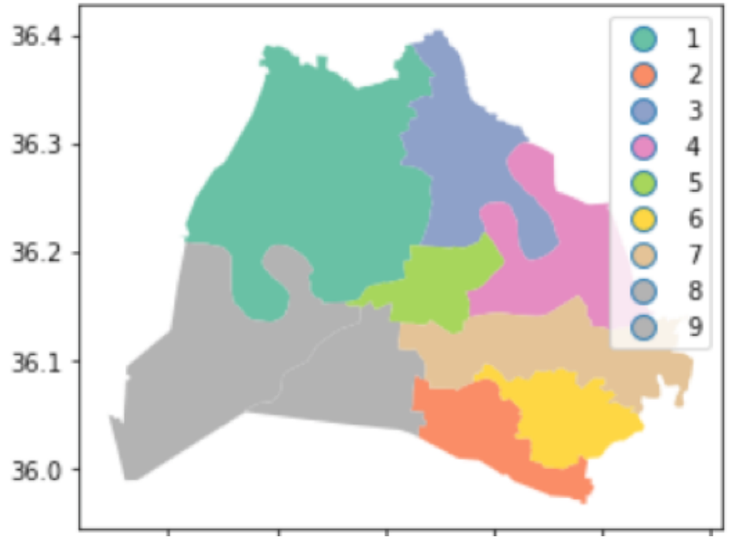
```
school_districts.head(3)
```

```
first_name     last_name     position     district      geometry
Sharon         Gentry        Member        1     (POLYGON ((-86.771 36.383)...))
Jill           Speering      Vice-Chair    3     (POLYGON ((-86.753 36.404)...))
Jo Ann         Brannon       Member        2     (POLYGON ((-86.766 36.083)...))
```

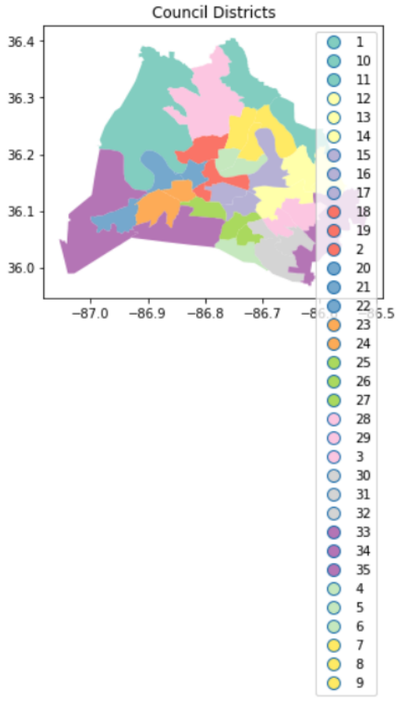
```
schools.plot(column = 'last_name', legend = True);
plt.show();
```



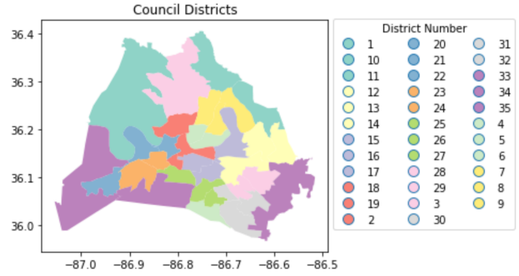

```
schools.plot(column = 'district', cmap = 'Set2', legend = True)
plt.show();
```



```
council_dists.plot(
                    column='district',
                    cmap='Set3',
                    legend=True)
plt.title('Council Districts')
plt.show();
```




```
leg_kwds={'title':'District Number',
          'loc': 'upper left',
          'bbox_to_anchor':(1, 1.03),
          'ncol':3}
council_dists.plot(column='district',
                   cmap='Set3',
                   legend=True,
                legend_kwds=leg_kwds)
plt.title('Council Districts')
plt.show();
```



Let's practice!

VISUALIZING GEOSPATIAL DATA IN PYTHON

Projections and Coordinate Reference Systems

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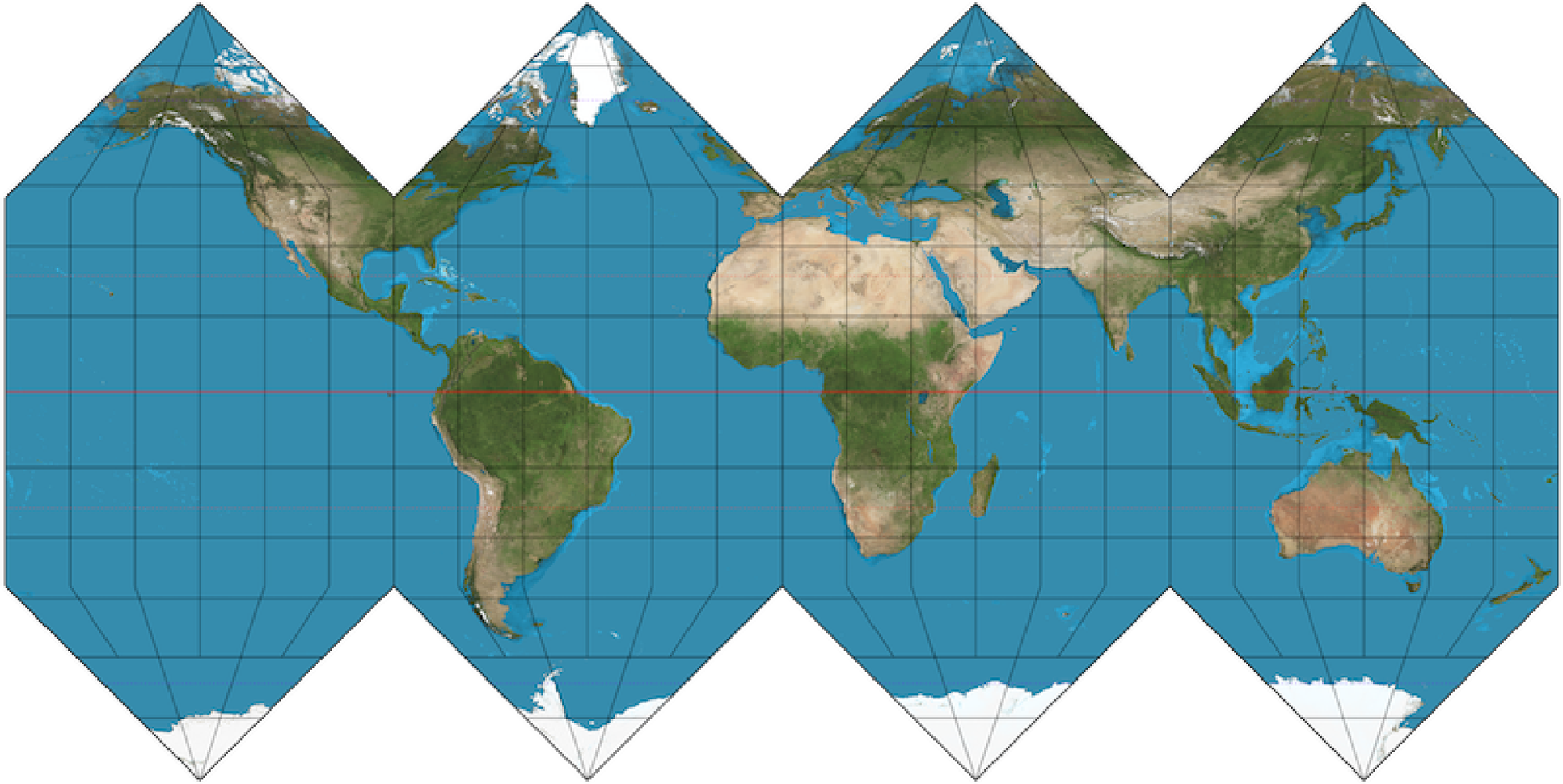
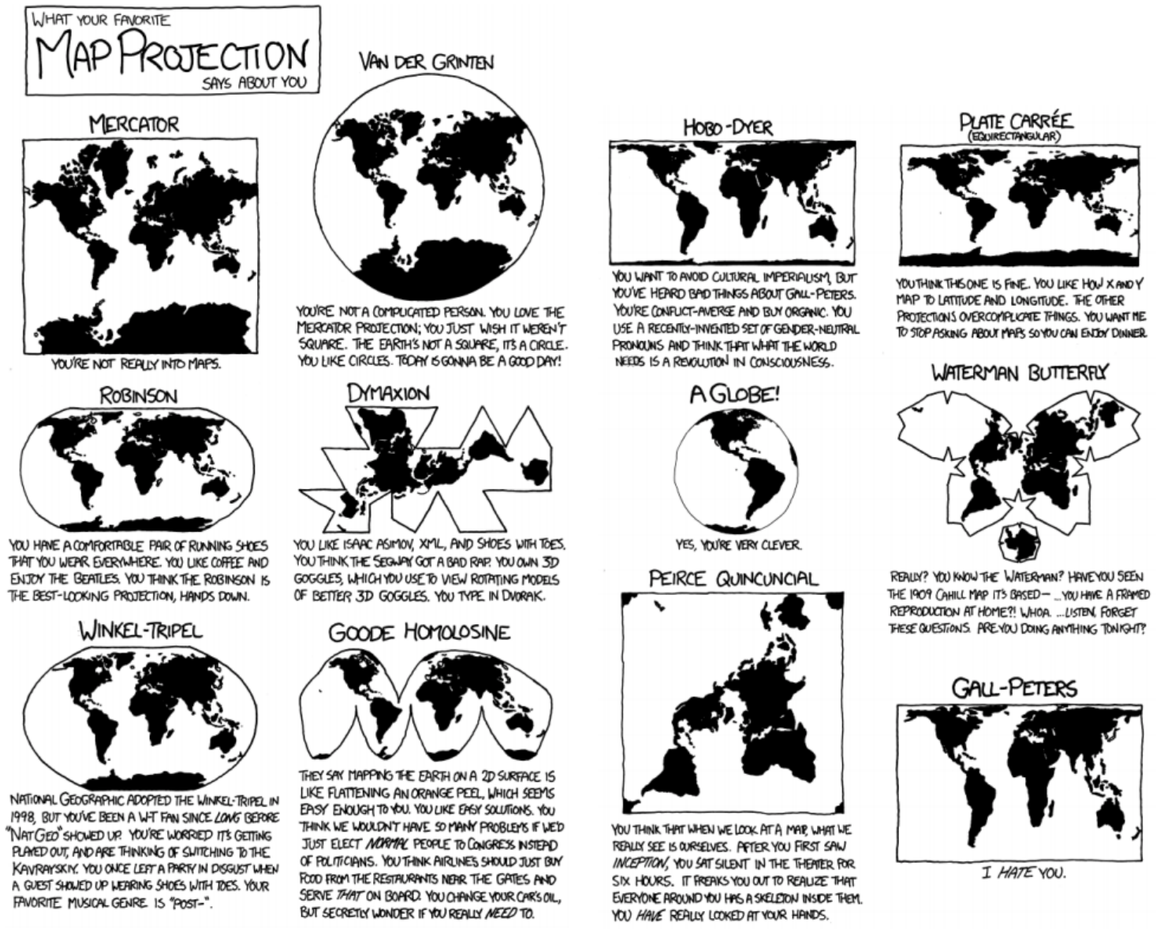
Projections



Many approaches to map projection



*What's that? You think I don't like the Peters map because I'm uncomfortable with having my cultural assumptions challenged? Are you sure you're not... ::puts on sunglasses:: ... **projecting**?* http://xkcd.com/977/ - http://bit.ly/explainxkcd-977

Coordinate Reference Systems

EPSG:4326

- Used by Google Earth
- Units: decimal degrees

EPSG:3857

- Used by Google Maps, Bing Maps, Open Street Maps
- Units: meters

```
School Name               Latitude     Longitude
A. Z. Kelley Elementary    36.021       -86.658
Alex Green Elementary      36.252       -86.832
Amqui Elementary           36.273       -86.703
Andrew Jackson Elementary  36.231       -86.623
```

```
import geopandas as gpd
schools['geometry'] = gpd.points_from_xy(schools.Longitude, schools.Latitude)
schools.head(4)
```

```
School Name               Latitude  Longitude                 geometry
A. Z. Kelley Elementary     36.021    -86.658  POINT (-86.658 36.021)
Alex Green Elementary       36.252    -86.832  POINT (-86.832 36.252)
Amqui Elementary            36.273    -86.703  POINT (-86.703 36.273)
Andrew Jackson Elementary   36.231    -86.623  POINT (-86.623 36.231)
```

Creating a GeoDataFrame from a DataFrame

```
import geopandas as gpd

schools_geo = gpd.GeoDataFrame(schools,
                               crs = 'epsg:4326',
                               geometry = schools.geometry)
```

```
schools_geo.head(4)
```

School Name	Latitude	Longitude	geometry
A. Z. Kelley Elementary	36.021	-86.658	POINT (-86.658 36.021)
Alex Green Elementary	36.252	-86.832	POINT (-86.832 36.252)
Amqui Elementary	36.273	-86.703	POINT (-86.703 36.273)
Andrew Jackson Elementary	36.231	-86.623	POINT (-86.623 36.231)

Changing from one CRS to another

```
schools_geo.head(2)
```

```
School Name              Latitude  Longitude                 geometry
A. Z. Kelley Elementary    36.021    -86.658  POINT (-86.658 36.021)
Alex Green Elementary      36.252    -86.832  POINT (-86.832 36.252)
```

```
schools_geo.geometry = schools_geo.geometry.to_crs(epsg = 3857)
schools_geo.head(2)
```

```
School Name              Latitude  Longitude                       geometry
A. Z. Kelley Elementary    36.021    -86.658  POINT (-9646818.8 4303623.8)
Alex Green Elementary      36.252    -86.832  POINT (-9666119.5 4335484.4)
```

Let's practice!

VISUALIZING GEOSPATIAL DATA IN PYTHON

Spatial joins

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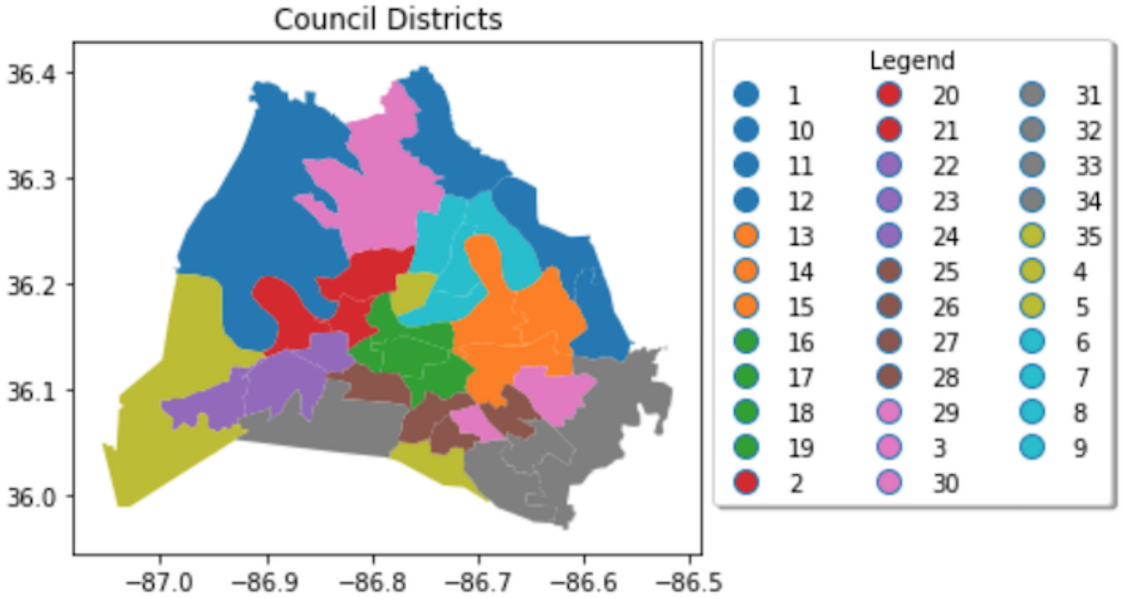
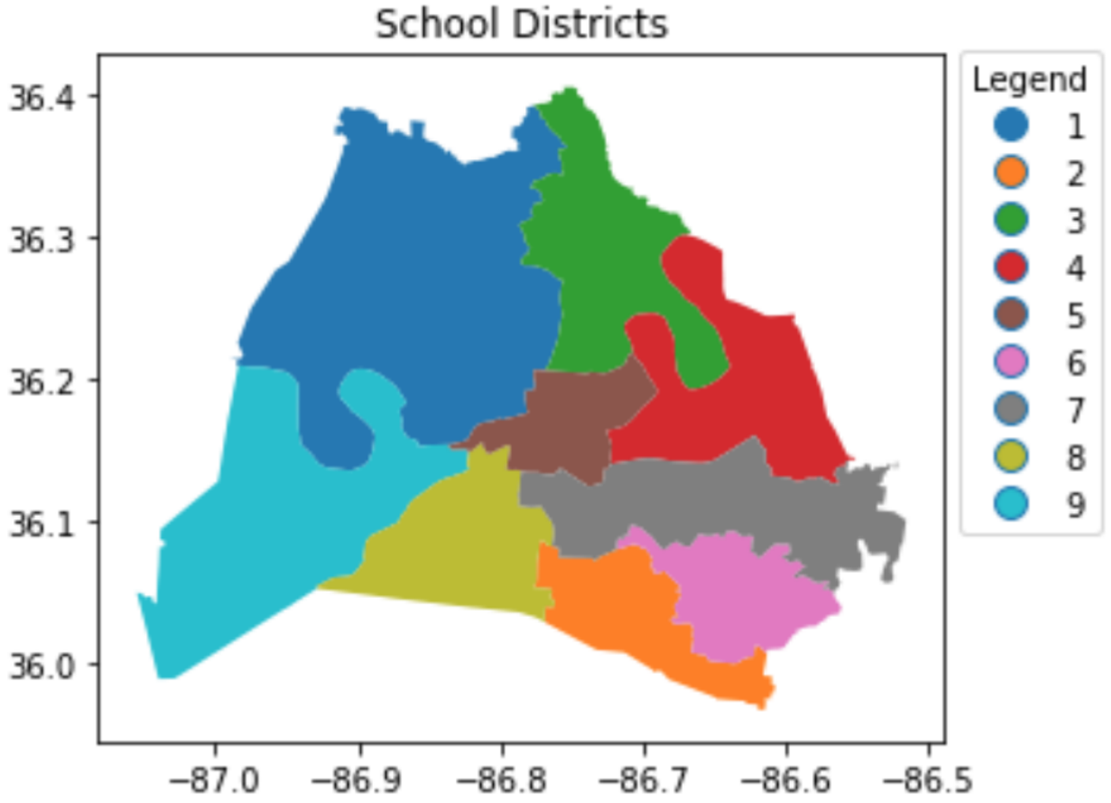
Council districts and school districts





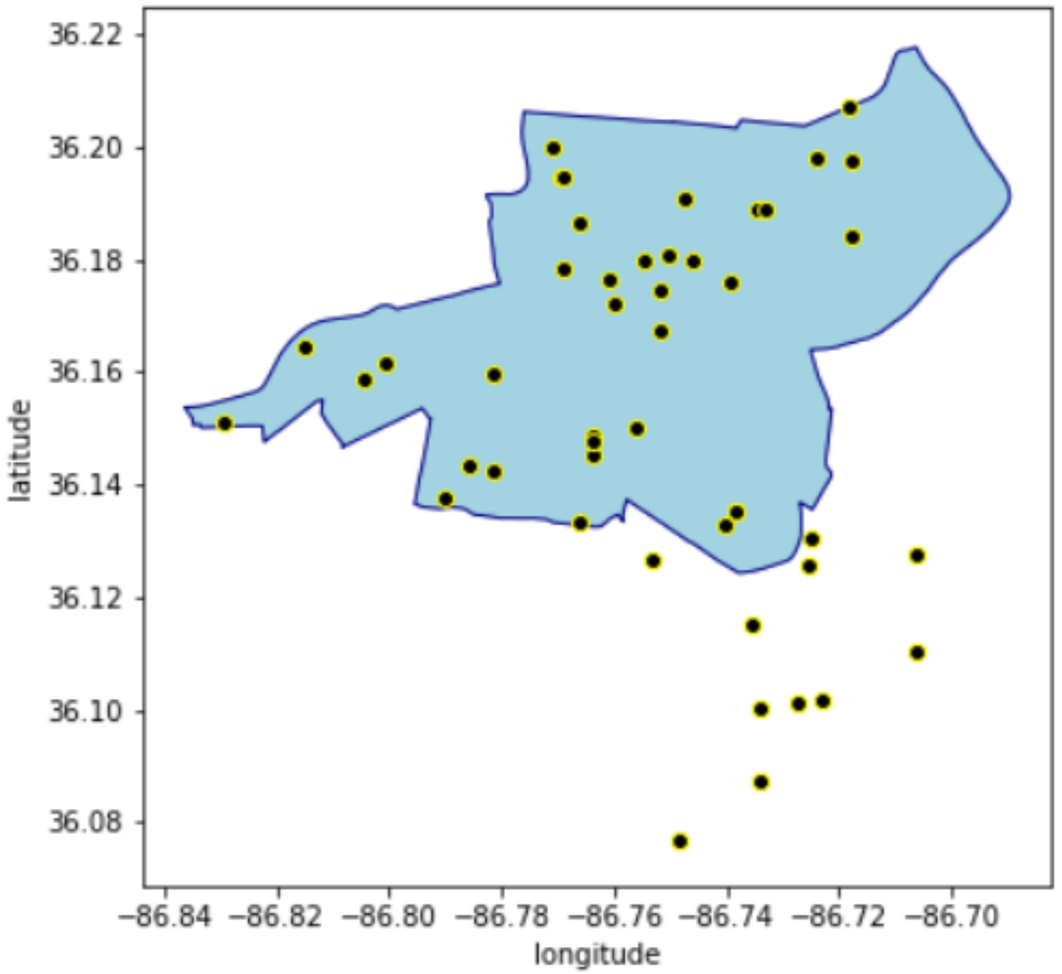
The .sjoin() predicate argument

```
import geopandas as gpd


gpd.sjoin(blue_region_gdf, black_point_gdf, predicate = <how to build>)
```

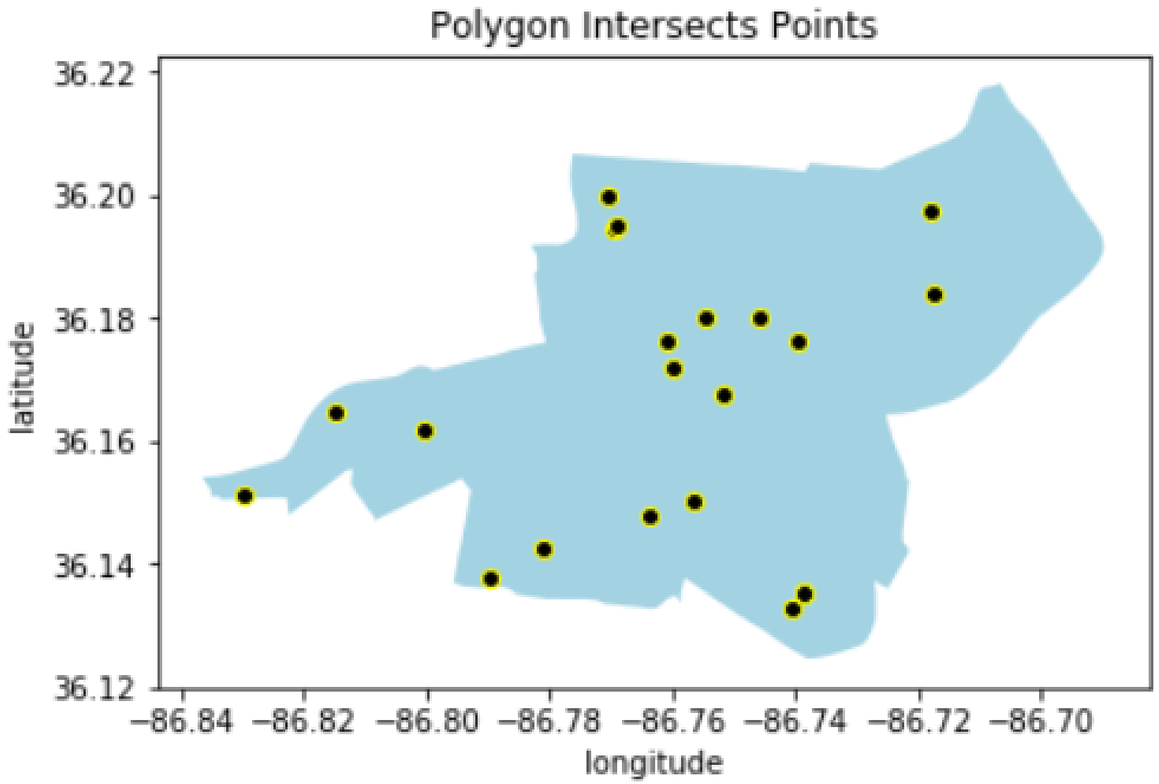
predicate can be ***intersects***, ***contains***, and ***within***

Using .sjoin()


36.22
36.20
36.18
36.16
36.14
36.12
36.10
36.08
latitude
−86.84
−86.82
−86.80
−86.78
−86.76
−86.74
−86.72
−86.70
longitude

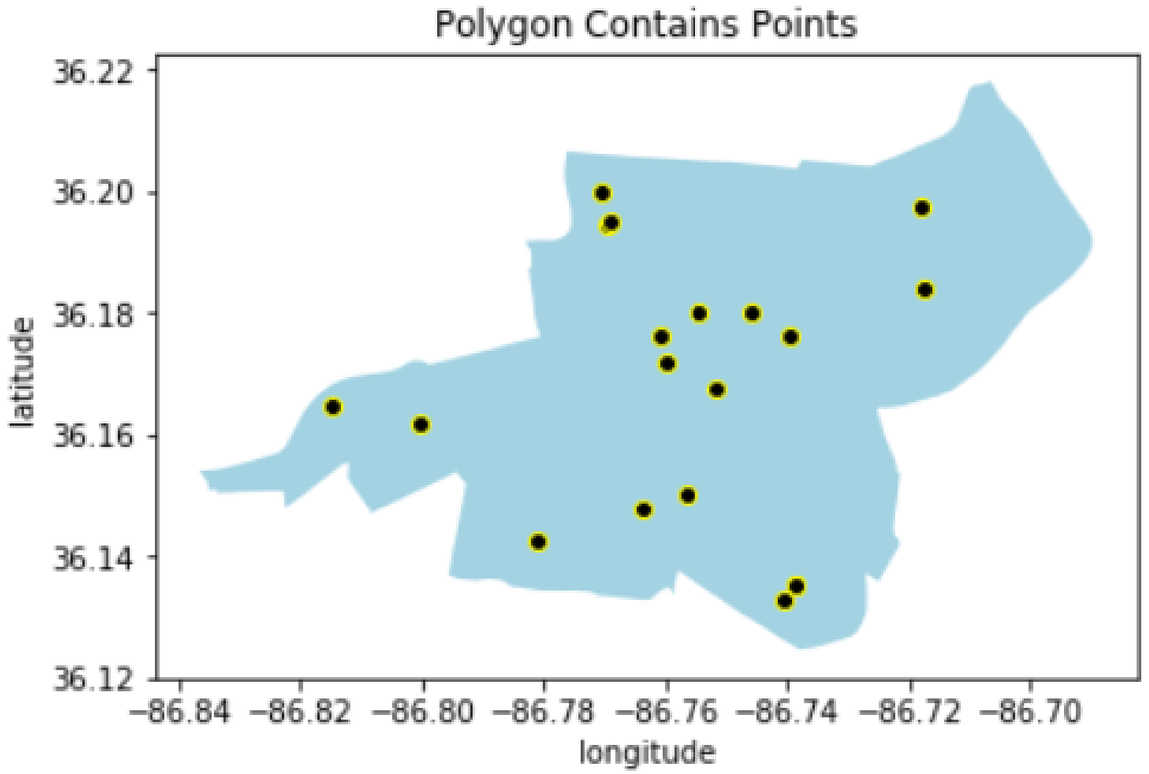
predicate = 'intersects'

```
gpd.sjoin(blue_region_gdf, black_point_gdf, predicate = 'intersects')
```



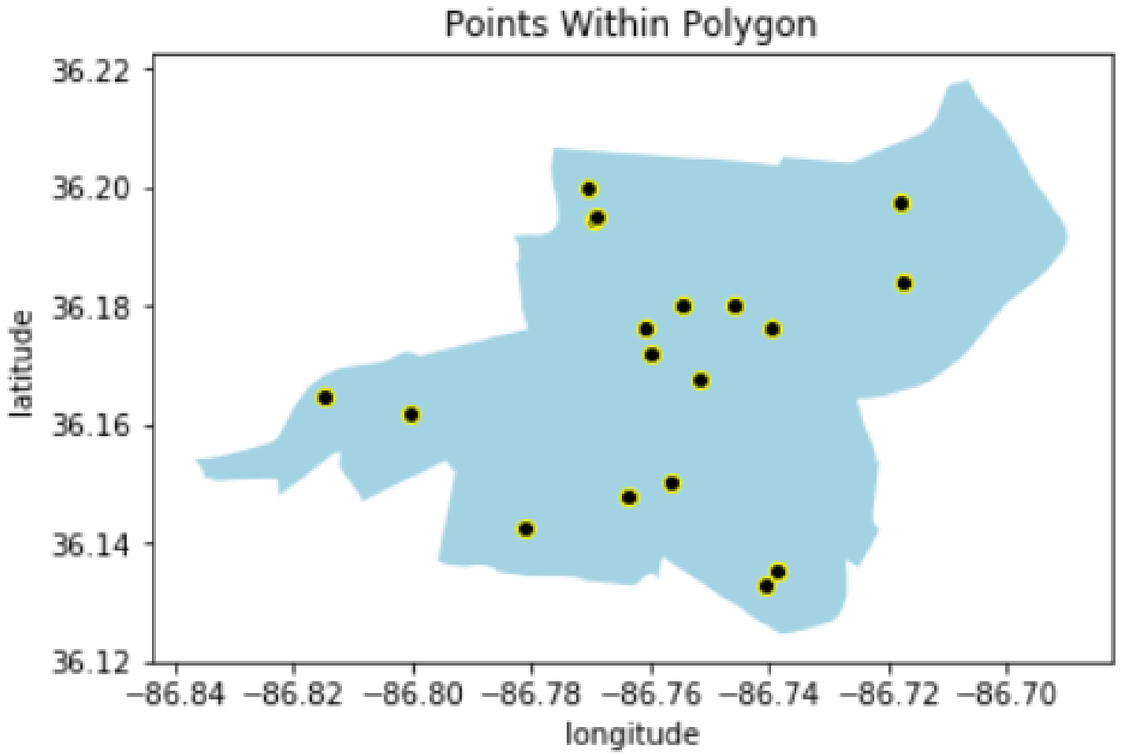
predicate = 'contains'

```
gpd.sjoin(blue_region_gdf, black_point_gdf, predicate = 'contains')
```



predicate = 'within'

```
gpd.sjoin(black_point_gdf, blue_region_gdf, predicate = 'within')
```



The .sjoin() predicate argument - within

```
# find council districts within school districts

within_gdf = gpd.sjoin(council_districts, school_districts, predicate = 'within')
print('council districts within school districts: ', within_gdf.shape[0])
```

```
council districts within school districts:  11
```

The .sjoin() predicate argument - contains

```
# find school districts that contain council districts

contains_gdf = pd.sjoin(school_districts, council_districts, predicate = 'contains')
print('school districts contain council districts: ', contains_gdf.shape[0])
```

```
school districts contain council districts:  11
```

The .sjoin() predicate argument - intersects

```
# find council districts that intersect with school districts

intersect_gdf = gpd.sjoin(council_districts, school_districts, predicate = 'intersects')
print('council districts intersect school districts: ', intersect.shape[0])
```

```
council districts intersect school districts:  100
```

Columns in a spatially joined GeoDataFrame

```
within_gdf = gpd.sjoin(council_districts, school_districts, predicate = 'within')
within_gdf.head()
```

	first_name_left	last_name_left	district_left	index_right
0	Nick	Leonardo	1	0
1	DeCosta	Hastings	2	0
2	Nancy	VanReece	8	1
3	Bill	Pridemore	9	1
9	Doug	Pardue	10	1

```
# Aggregate council districts by school district - rename district_left and district_right
within_gdf.district_left = council_district
within_gdf.district_right = school_district
within_gdf[['council_district', 'school_district']
          ].groupby('school_district'
                    ).agg('count'
                         ).sort_values('council_district', ascending = False)
```

```
                 council_district
school_district
       3                        3
       1                        2
       9                        2
       2                        1
       5                        1
       6                        1
       8                        1
```

Let's Practice!

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