Plotting with GeoJSON

VISUALIZING GEOSPATIAL DATA IN PYTHON



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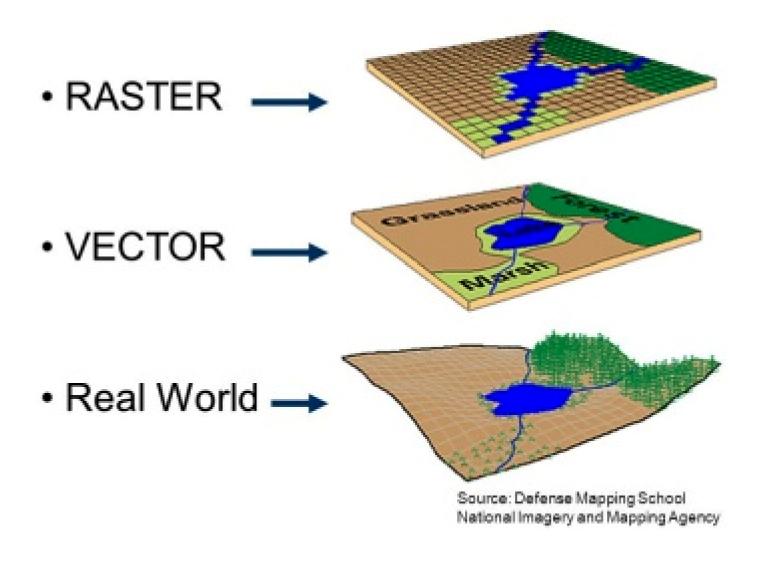


Neighborhoods GeoJSON

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

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

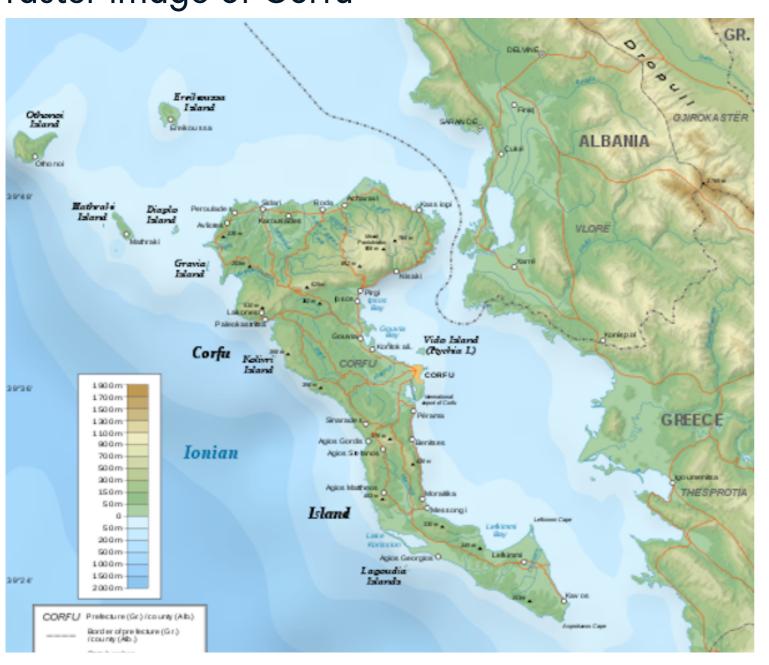
Geopandas dependencies



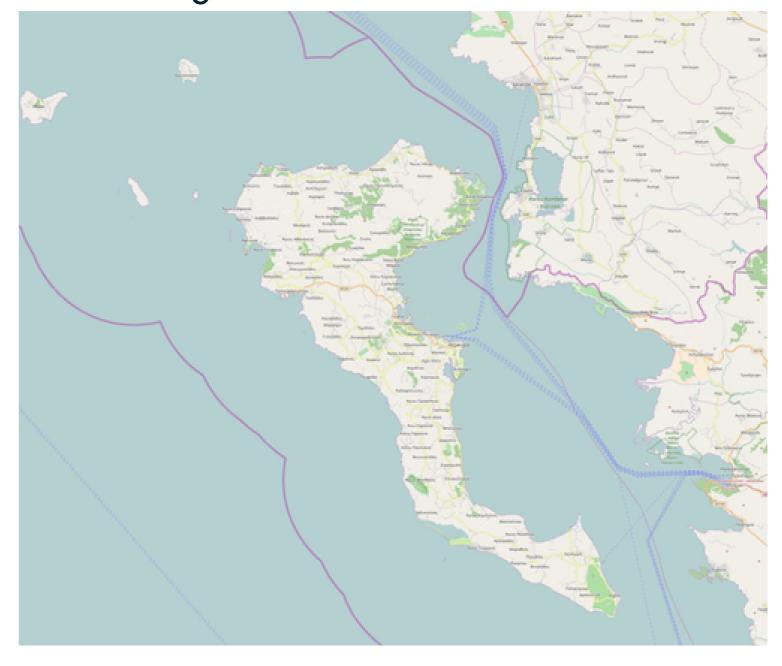
- Fiona
 - provides an python API for OGR
- GDAL/OGR
 - GDAL for translating raster data
 - OGR for translating vector data

Comparing raster and vector graphics

raster image of Corfu



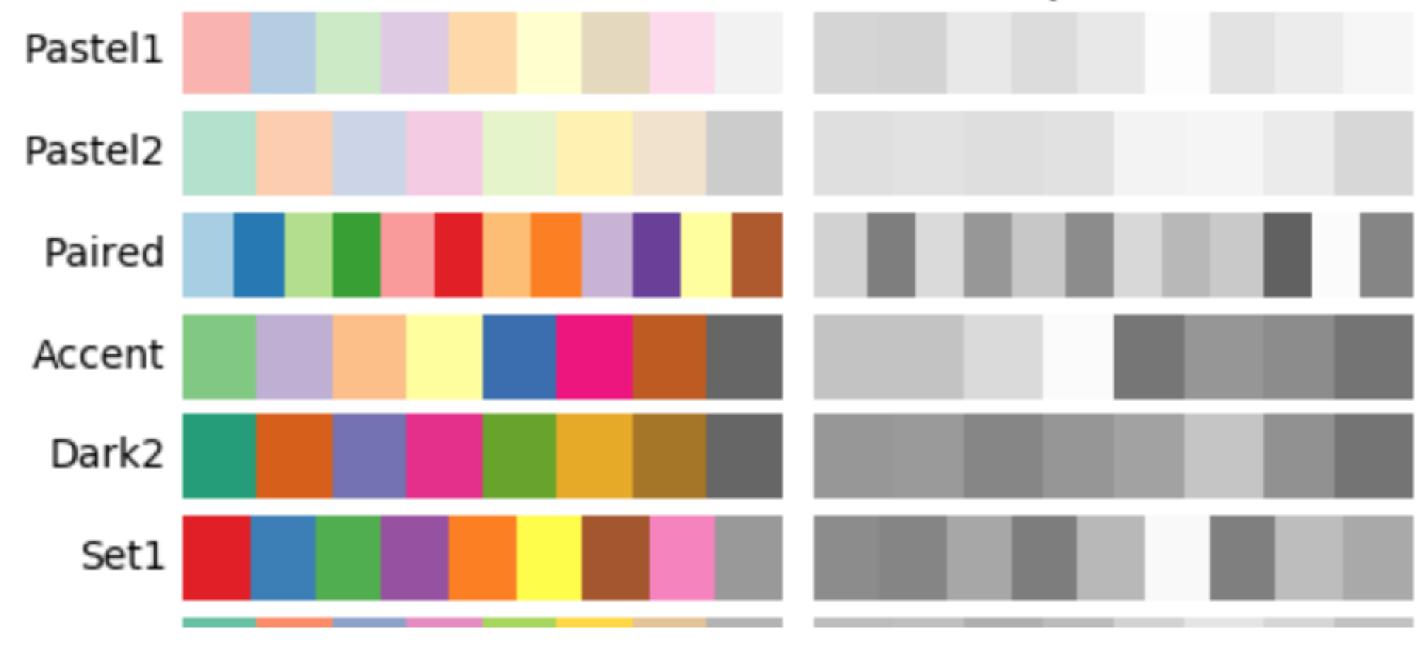
vector image of Corfu





Colormaps

Qualitative colormaps



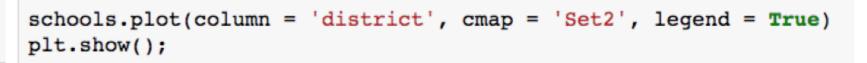


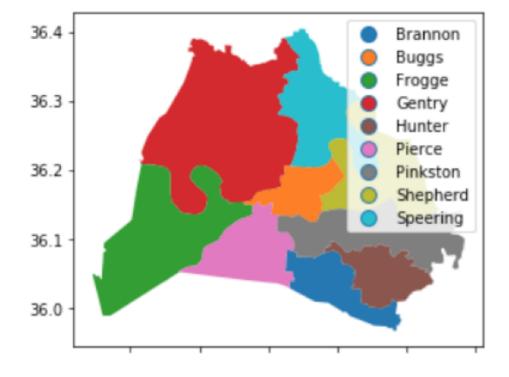
Plotting with color

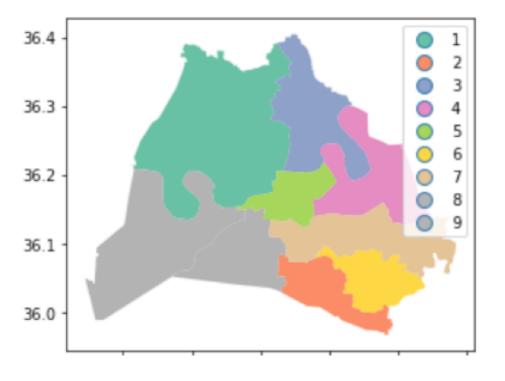
```
school_districts.head(3)
```

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

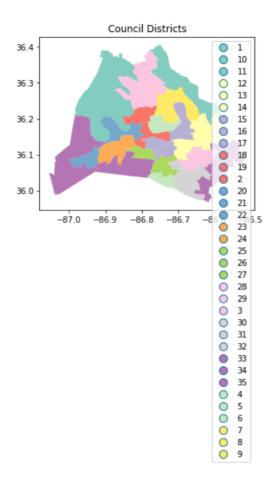
```
schools.plot(column = 'last_name', legend = True);
plt.show();
```

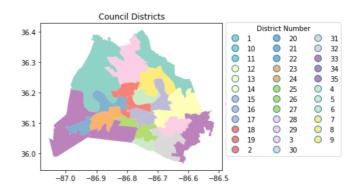












Let's practice!

VISUALIZING GEOSPATIAL DATA IN PYTHON



Projections and Coordinate Reference Systems

VISUALIZING GEOSPATIAL DATA IN PYTHON

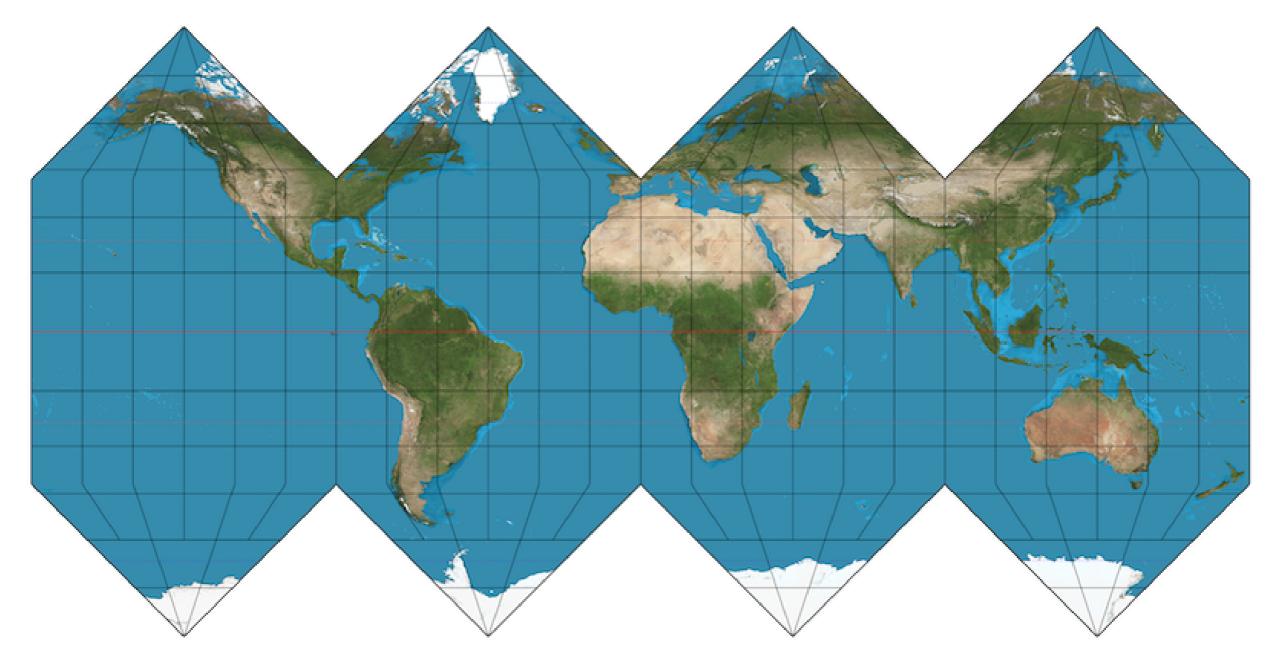
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Projections



Many approaches to map projection







YOU HAVE A COMFORTABLE PAIR OF RUNNING SHOES THAT YOU WEAR EVERYWHERE. YOU LIKE COFFEE AND ENJOY THE BEATLES. YOU THINK THE ROBINSON IS THE BEST-LOOKING PROJECTION, HANDS DOWN.

WINKEL-TRIPEL



NATIONAL GEOGRAPHIC ADOPTED THE WINKEL-TRIPEL IN 1998, BUT YOU'VE BEEN A WIT FAN SINCE LOWG BEFORE "NAT GEO" SHOWED UP. YOU'RE WORRIED IT'S GETTING PLAYED OUT, AND ARE THINKING OF SLITCHING TO THE KAVRAYSKIY. YOU ONCE LEFT A PARTY IN DISGUST WHEN A GUEST SHOWED UP WEARING SHOES WITH TOES. YOUR FAVORITE MUSICAL GENRE IS "POST-".

VAN DER GRINTEN



YOU'RE NOT A COMPUCATED PERSON. YOU LOVE THE MERCATOR PROJECTION; YOU JUST WISH IT WEREN'T SQUARE. THE EARTH'S NOT A SQUARE, IT'S A CIRCLE. YOU LIKE CIRCLES. TODAY IS GONNA BE A GOOD DAY!



YOU LIKE ISAAC ASMOV, XML, AND SHOES WITH TOES. YOU THINK THE SEGMAY GOT A BAD RAP. YOU OWN 3D GOGGLES, WHICH YOU USE TO VIEW ROTATING MODELS OF BETTER 3D GOGGLES. YOU TYPE IN DVORAK.

GOODE HOMOLOSINE



THEY SAY MAPPING THE EARTH ON A 2D SURFACE IS LIKE FLATTENING AN ORANGE PEEL, WHICH SEEMS EASY ENOUGH TO YOU. YOU LIKE EASY SOLUTIONS, YOU THINK WE WOULDN'T HAVE SO MANY PROBLEMS IF WE'D JUST ELECT NORMAL PEOPLE TO CONGRESS INSTEAD OF POLITICIANS. YOU THINK AIRLINES SHOULD JUST BUY FOOD FROM THE RESTAURANTS NEAR THE GATES AND SERVE THAT ON BOARD. YOU CHANGE YOUR CAR'S OIL, BUT SECRETLY WONDER IF YOU REALLY NEED TO.

HOBO-DYER



YOU WANT TO AVOID CULTURAL IMPERIALISM, BUT YOU'VE HEARD BAID THINGS ABOUT GALL-PETERS. YOU'RE CONFLICT-AVERSE AND BUY ORGANIC. YOU USE A RECENTLY-INVENTED SET OF GENDER-NEUTRAL PRONOUNS AND THINK THAT WHAT THE WORLD NEEDS IS A REVOLUTION IN CONSCIOUSNESS.

A GLOBE!



YES, YOU'RE VERY CLEVER

PEIRCE QUINCUNCIAL



YOU THINK THAT WHEN WE LOOK AT A MAR, WHAT WE REALLY SEE IS OURSELVES. AFTER YOU FIRST SAW INCEPTION, YOU SAT SILENT IN THE THEATER FOR SIX HOURS, IT FREAKS YOU OUT TO REALIZE THAT EVERYONE AROUND YOU HAS A SKELLDON INSIDE THEM. YOU HAVE REALLY LOOKED AT YOUR HANDS.

PLATE CARRÉE



YOUTHINK THIS ONE IS FINE. YOU LIKE HOW X AND Y MAP TO LATITUDE AND LONGITUDE. THE OTHER PROTECTIONS OVERCOMPLICATE THINGS. YOU WANT HE TO STOP ASKING ABOUT MAPS SOYOU CAN ENDBY DINNER.

WATERMAN BUTTERFLY



REALLY? YOU KNOW THE WATERMAN? HAVEYOU SEEN THE 1909 CAHILL MAP IT'S BASED - ... YOU HAVE A FRAMED REPRODUCTION AT HOME?! WHOA. ... LISTEN, FORGET THESE QUESTIONS. AREYOU DOING ANYTHING TONIGHT?

GALL-PETERS



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

```
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

VISUALIZING GEOSPATIAL DATA IN PYTHON

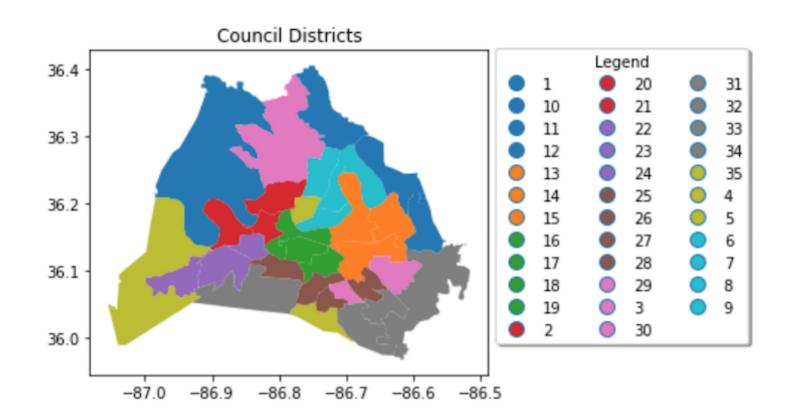


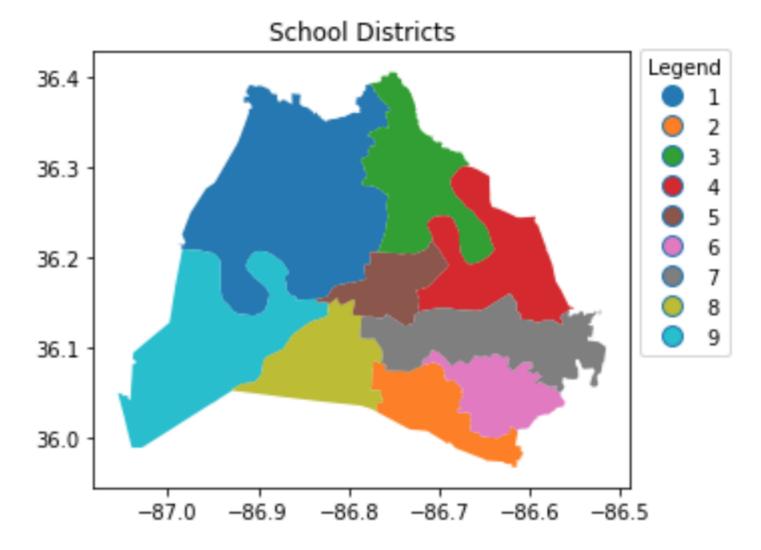
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Council districts and school districts





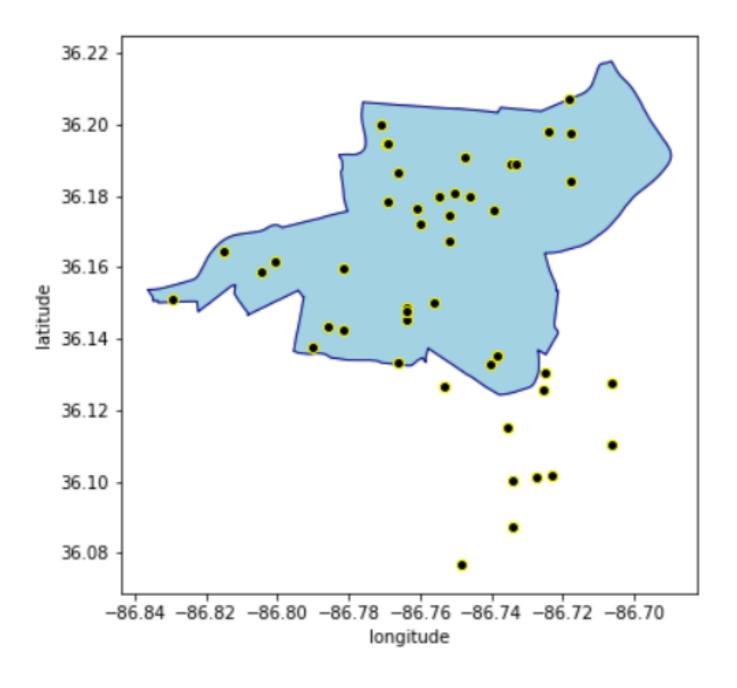
The .sjoin() predicate argument

```
import geopandas as gpd

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

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

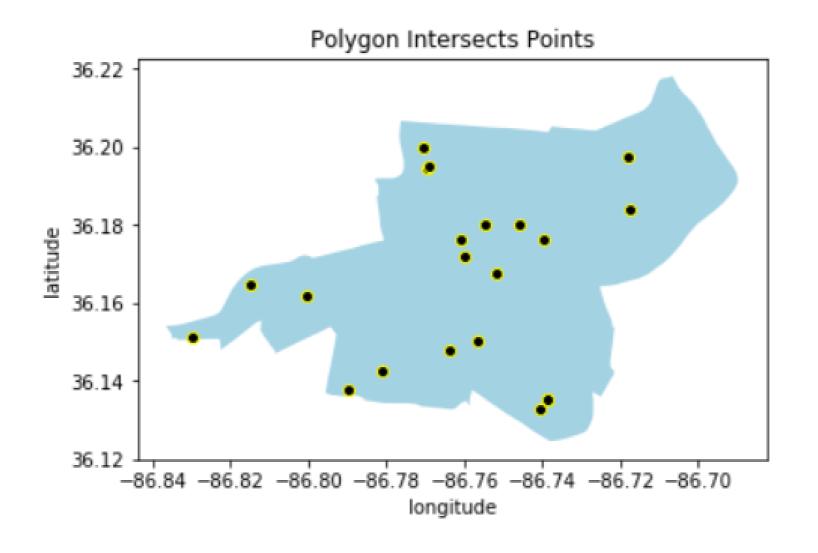
Using .sjoin()





predicate = 'intersects'

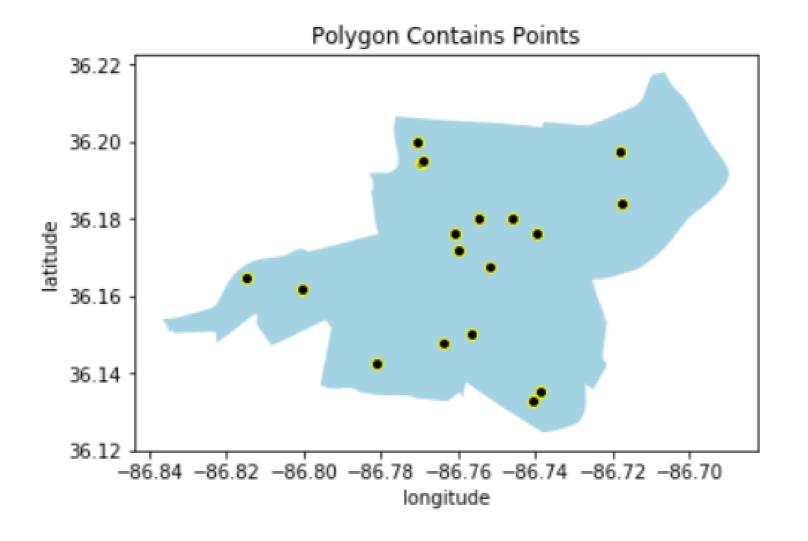
```
gpd.sjoin(blue_region_gdf, black_point_gdf, predicate = 'intersects')
```





predicate = 'contains'

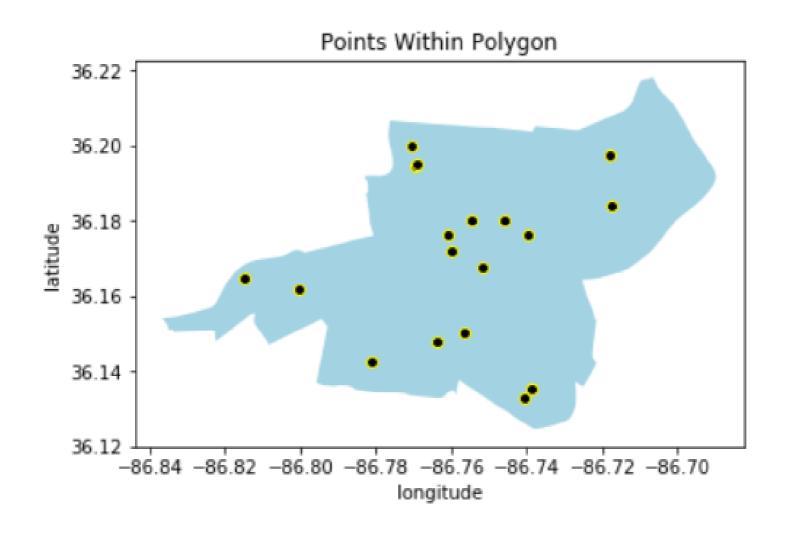
gpd.sjoin(blue_region_gdf, black_point_gdf, predicate = 'contains')





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
```

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