```
# importacao de bibliotecas necessarias
import pandas as pd
import geopandas as gpd
import matplotlib.pyplot as plt
```

```
distritos = '/content/distritos.geojson'
```

```
gdf = gpd.read_file(distritos)
print("GeoJSON carregado com sucesso!")
```

```
GeoJSON carregado com sucesso!
```

```
gdf
```

	Shape_Leng	Shape_Area	ADM2_PT	ADM2_PCODE	ADM2_REF	ADM2ALT1PT	ADM2ALT2PT	ADM1_PT	ADM1_PCODE	ADM0_EN	ADM0_
0	4.858224	0.534384	Alto Molocue	MZ1101	None	None	None	Zambezia	MZ11	Mozambique	Moçambiq
1	3.762392	0.410000	Ancuabe	MZ0101	None	None	None	Cabo Delgado	MZ01	Mozambique	Moçambiq
2	4.739196	0.254969	Angoche	MZ0701	None	None	None	Nampula	MZ07	Mozambique	Moçambiq
3	3.167173	0.273576	Angonia	MZ1001	None	None	None	Tete	MZ10	Mozambique	Moçambiq
4	4.065989	0.458926	Balama	MZ0102	None	None	None	Cabo Delgado	MZ01	Mozambique	Moçambiq
...	...	...	...	...	...	...	...	...	...	...	
154	3.053094	0.307910	Tsangano	MZ1014	None	None	None	Tete	MZ10	Mozambique	Moçambiq
155	3.005266	0.270869	Vanduzi	MZ0412	None	None	None	Manica	MZ04	Mozambique	Moçambiq
156	4.783225	0.513009	Vilankulo	MZ0313	None	None	None	Inhambane	MZ03	Mozambique	Moçambiq
157	2.294808	0.179351	Zavala	MZ0314	None	None	None	Inhambane	MZ03	Mozambique	Moçambiq
158	4.762527	1.009072	Zumbu	MZ1015	None	None	None	Tete	MZ10	Mozambique	Moçambiq

159 rows × 16 columns

```
# verificar as primeiras 5 linhas da geodataFrame
gdf.head(3)
```

	Shape_Leng	Shape_Area	ADM2_PT	ADM2_PCODE	ADM2_REF	ADM2ALT1PT	ADM2ALT2PT	ADM1_PT	ADM1_PCODE	ADM0_EN	ADM0_PT
0	4.858224	0.534384	Alto Molocue	MZ1101	None	None	None	Zambezia	MZ11	Mozambique	Moçambique
1	3.762392	0.410000	Ancuabe	MZ0101	None	None	None	Cabo Delgado	MZ01	Mozambique	Moçambique
2	4.739196	0.254969	Angoche	MZ0701	None	None	None	Nampula	MZ07	Mozambique	Moçambique

```
gdf.info()
```

```
<class 'geopandas.geodataframe.GeoDataFrame'>
RangeIndex: 159 entries, 0 to 158
Data columns (total 16 columns):
 #   Column      Non-Null Count  Dtype
---  ------      --------------  -----
 0   Shape_Leng  159 non-null    float64
 1   Shape_Area  159 non-null    float64
 2   ADM2_PT     159 non-null    object
 3   ADM2_PCODE  159 non-null    object
 4   ADM2_REF    3 non-null      object
 5   ADM2ALT1PT  0 non-null      object
 6   ADM2ALT2PT  0 non-null      object
 7   ADM1_PT     159 non-null    object
 8   ADM1_PCODE  159 non-null    object
 9   ADM0_EN     159 non-null    object
 10  ADM0_PT     159 non-null    object
 11  ADM0_PCODE  159 non-null    object
 12  date        159 non-null    datetime64[ms]
 13  validOn     159 non-null    datetime64[ms]
 14  validTo     0 non-null      object
 15  geometry    159 non-null    geometry
dtypes: datetime64[ms](2), float64(2), geometry(1), object(11)
memory usage: 20.0+ KB
```

```
gdf.describe()
```

	Shape_Leng	Shape_Area	date	validOn
count	159.000000	159.000000	159	159
mean	3.637014	0.421633	2019-04-02 00:00:00	2019-06-07 00:00:00
min	0.114016	0.000697	2019-04-02 00:00:00	2019-06-07 00:00:00
25%	2.708239	0.205342	2019-04-02 00:00:00	2019-06-07 00:00:00
50%	3.753251	0.372215	2019-04-02 00:00:00	2019-06-07 00:00:00
75%	4.737337	0.584103	2019-04-02 00:00:00	2019-06-07 00:00:00
max	7.797211	1.495228	2019-04-02 00:00:00	2019-06-07 00:00:00
std	1.554027	0.319528	NaN	NaN

```
gdf.tail(2)
```

	Shape_Leng	Shape_Area	ADM2_PT	ADM2_PCODE	ADM2_REF	ADM2ALT1PT	ADM2ALT2PT	ADM1_PT	ADM1_PCODE	ADM0_EN	ADM0_P
157	2.294808	0.179351	Zavala	MZ0314	None	None	None	Inhambane	MZ03	Mozambique	Moçambiqu
158	4.762527	1.009072	Zumbu	MZ1015	None	None	None	Tete	MZ10	Mozambique	Moçambiqu

```
display(gdf.head())
```

	Shape_Leng	Shape_Area	ADM2_PT	ADM2_PCODE	ADM2_REF	ADM2ALT1PT	ADM2ALT2PT	ADM1_PT	ADM1_PCODE	ADM0_EN	ADM0_PT
0	4.858224	0.534384	Alto Molocue	MZ1101	None	None	None	Zambezia	MZ11	Mozambique	Moçambique
1	3.762392	0.410000	Ancuabe	MZ0101	None	None	None	Cabo Delgado	MZ01	Mozambique	Moçambique
2	4.739196	0.254969	Angoche	MZ0701	None	None	None	Nampula	MZ07	Mozambique	Moçambique
3	3.167173	0.273576	Angonia	MZ1001	None	None	None	Tete	MZ10	Mozambique	Moçambique
4	4.065989	0.458926	Balama	MZ0102	None	None	None	Cabo Delgado	MZ01	Mozambique	Moçambique

```
print("Número de feições:", len(gdf))
```

```
Número de feições: 159
```

```
print("Colunas disponíveis:", gdf.columns.tolist())
```

```
Colunas disponíveis: ['Shape_Leng', 'Shape_Area', 'ADM2_PT', 'ADM2_PCODE', 'ADM2_REF', 'ADM2ALT1PT', 'ADM2ALT2PT', 'ADM1_PT', 'A
```

```
print("CRS atual:", gdf.crs)
```

```
CRS atual: EPSG:4326
```

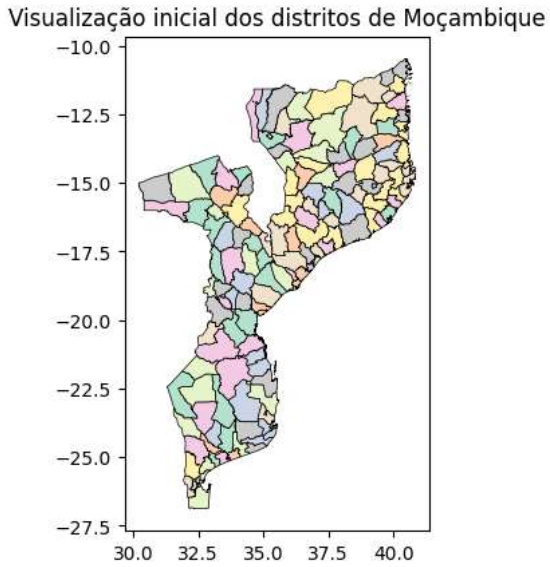
```
print("Tipo da coluna geometry:", type(gdf.geometry))
```

```
Tipo da coluna geometry: <class 'geopandas.geoseries.GeoSeries'>
```

```
print("Algumas geometrias inválidas?", not gdf.is_valid.all())
```

```
Algumas geometrias inválidas? False
```

```
gdf.plot(edgecolor='black', linewidth=0.5, cmap='Pastel2')
plt.title('Visualização inicial dos distritos de Moçambique')
plt.axis('on')
plt.show()
```




```
# filtro de um distrito
distrito_escolhido = 'Vanduzi'
```

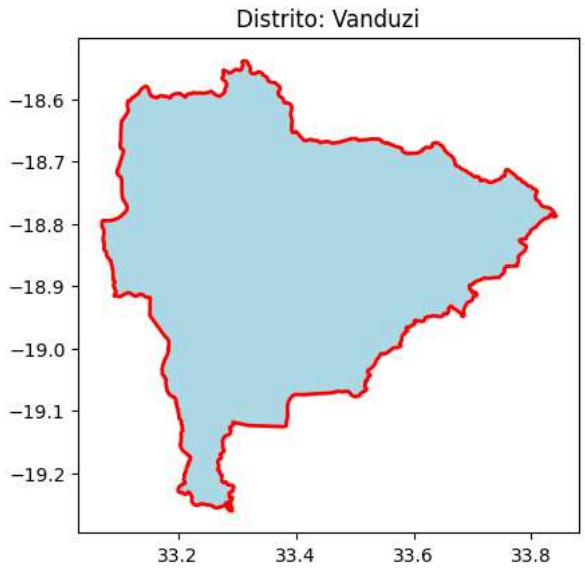
```
gdf_filtro = gdf[gdf['ADM2_PT'] == distrito_escolhido]
```

```
print(f"Número de feições no distrito {distrito_escolhido}: {len(gdf_filtro)}")
display(gdf_filtro)
```

```
Número de feições no distrito Vanduzi: 1
```

	Shape_Leng	Shape_Area	ADM2_PT	ADM2_PCODE	ADM2_REF	ADM2ALT1PT	ADM2ALT2PT	ADM1_PT	ADM1_PCODE	ADM0_EN	ADM0_PT
155	3.005266	0.270869	Vanduzi	MZ0412	None	None	None	Manica	MZ04	Mozambique	Moçambique

```
gdf_filtro.plot(edgecolor='red', facecolor='lightblue', linewidth=2)
plt.title(f'Distrito: {distrito_escolhido}')
plt.axis('on')
plt.show()
```



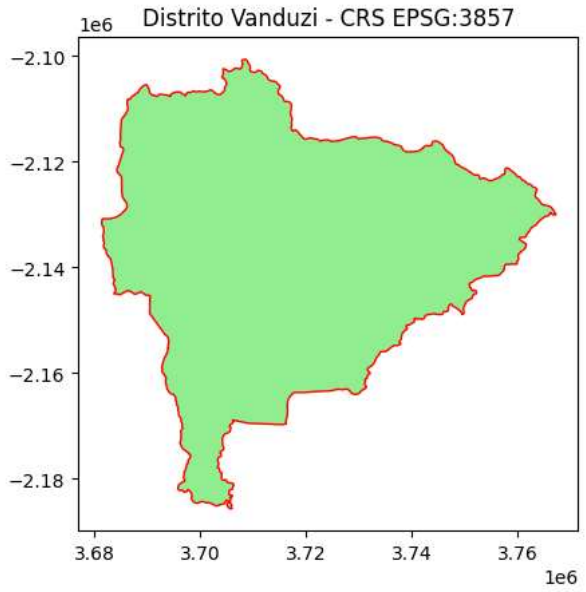
```
output_shp = f"distrito_{distrito_escolhido}.shp"
gdf_filtro.to_file(output_shp)
print(f"Distrito {distrito_escolhido} exportado com sucesso como {output_shp}!")
```

```
Distrito Vanduzi exportado com sucesso como distrito_Vanduzi.shp!
/usr/local/lib/python3.12/dist-packages/pyogrio/raw.py:723: RuntimeWarning: Field date create as date field, though DateTime req
  ogr_write(
/usr/local/lib/python3.12/dist-packages/pyogrio/raw.py:723: RuntimeWarning: Field validOn create as date field, though DateTime
  ogr_write(
```

```
gdf_filtro_3857 = gdf_filtro.to_crs(epsg=3857)
print("Novo CRS:", gdf_filtro_3857.crs)
```

```
Novo CRS: EPSG:3857
```

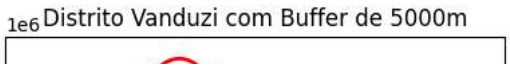
```
gdf_filtro_3857.plot(edgecolor='red', facecolor='lightgreen', linewidth=1)
plt.title(f'Distrito {distrito_escolhido} - CRS EPSG:3857')
plt.axis('on')
plt.show()
```




```
# buffer
buffer_distancia = 5000 # 5 km
```

```
# Criando buffer usando Shapely via GeoPandas
gdf_buffer = gdf_filtro_3857.copy()
gdf_buffer['geometry'] = gdf_buffer.geometry.buffer(buffer_distancia)
```

```
# visualizar o buffer
base = gdf_filtro_3857.plot(edgecolor='blue', facecolor='lightblue', linewidth=1, alpha=0.5)
gdf_buffer.plot(ax=base, edgecolor='red', facecolor='none', linewidth=2)
plt.title(f'Distrito {distrito_escolhido} com Buffer de {buffer_distancia}m')
plt.axis('on')
plt.show()
```


1e6
Distrito Vanduzi com Buffer de 5000m