In [1]:
```python
import os
os.environ['USE_PYGEOS'] = '0'
import geopandas as gpd

cities = gpd.read_file('lab2/data/oregon_fires.shp')
cities.head()
```

Out[1]:

	year	name	geometry
0	2020	JENNY 2-3	POLYGON ((-122.38670 42.00859, -122.38672 42.0...
1	2000	ORE ASSIST #7	POLYGON ((-122.27244 42.01294, -122.27212 42.0...
2	2018	HIDDEN	POLYGON ((-121.91930 42.00275, -121.91930 42.0...
3	2018	KLAMATHON	MULTIPOLYGON (((-122.61918 41.91839, -122.6190...
4	2021	ORTUR-FY21-WF-Onion Flat	POLYGON ((-122.81903 45.37620, -122.81903 45.3...

In [2]:
```python
cities.shape
```

Out[2]: (8702, 3)

In [3]:
```python
cities[cities['year'] == '2021']
```

Out[3]:

year	name	geometry

In [4]:
```python
import os
os.environ['USE_PYGEOS'] = '0'
import geopandas as gpd

cities = gpd.read_file('lab2/data/oregon_fires.shp')
cities.head()
```

Out[4]:

	year	name	geometry
0	2020	JENNY 2-3	POLYGON ((-122.38670 42.00859, -122.38672 42.0...
1	2000	ORE ASSIST #7	POLYGON ((-122.27244 42.01294, -122.27212 42.0...
2	2018	HIDDEN	POLYGON ((-121.91930 42.00275, -121.91930 42.0...
3	2018	KLAMATHON	MULTIPOLYGON (((-122.61918 41.91839, -122.6190...
4	2021	ORTUR-FY21-WF-Onion Flat	POLYGON ((-122.81903 45.37620, -122.81903 45.3...

In [5]:
```python
cities[cities['year'] == 2021].shape[0]
```

Out[5]: 271

In [6]:
```python
cities.crs
```

Out[6]:
```
<Geographic 2D CRS: EPSG:4326>
Name: WGS 84
Axis Info [ellipsoidal]:
- Lat[north]: Geodetic latitude (degree)
- Lon[east]: Geodetic longitude (degree)
Area of Use:
- name: World.
- bounds: (-180.0, -90.0, 180.0, 90.0)
Datum: World Geodetic System 1984 ensemble
- Ellipsoid: WGS 84
- Prime Meridian: Greenwich
```

In [7]:
```python
cities_reproject = cities.to_crs('EPSG:32610')
cities_reproject.crs
```

Out[7]:
```
<Derived Projected CRS: EPSG:32610>
Name: WGS 84 / UTM zone 10N
Axis Info [cartesian]:
- E[east]: Easting (metre)
- N[north]: Northing (metre)
Area of Use:
- name: Between 126°W and 120°W, northern hemisphere between equator and 84°N, onshore and offshore. Canada - British
Columbia (BC); Northwest Territories (NWT); Nunavut; Yukon. United States (USA) - Alaska (AK).
- bounds: (-126.0, 0.0, -120.0, 84.0)
Coordinate Operation:
- name: UTM zone 10N
- method: Transverse Mercator
Datum: World Geodetic System 1984 ensemble
- Ellipsoid: WGS 84
- Prime Meridian: Greenwich
```

In [8]:
```python
cities_reproject['area'] = cities_reproject['geometry'].area
cities_reproject.head()
```

Out[8]:

	year	name	geometry	area
0	2020	JENNY 2-3	POLYGON ((550784.928 4650911.797, 550783.594 4...	5.919054e+04
1	2000	ORE ASSIST #7	POLYGON ((560242.809 4651469.298, 560269.634 4...	5.624302e+05
2	2018	HIDDEN	POLYGON ((589497.299 4650646.601, 589497.501 4...	5.014556e+04
3	2018	KLAMATHON	MULTIPOLYGON (((531578.908 4640784.805, 531591...	1.536989e+08
4	2021	ORTUR-FY21-WF-Onion Flat	POLYGON ((514169.618 5024759.062, 514169.415 5...	1.728530e+04

In [9]:
```python
cities_reproject.nlargest(n=5, columns='area')
```

Out[9]:

	year	name	geometry	area
6204	2012	Long Draw	POLYGON ((941973.412 4689496.078, 941969.912 4...	2.267397e+09
5771	2002	Biscuit	MULTIPOLYGON (((431847.040 4719759.526, 431865...	2.023472e+09
1258	2012	Holloway	POLYGON ((891362.675 4682114.905, 891513.023 4...	1.871568e+09
7276	2021	Bootleg	MULTIPOLYGON (((644470.778 4751332.348, 644455...	1.673948e+09
5452	2014	Saddle Draw	POLYGON ((894790.231 4829334.974, 894928.493 4...	1.137893e+09

In [10]:
```python
cities_area = cities_reproject[cities_reproject['year'] == 2021]
```

In [11]:
```python
cities_area
```

Out[11]:

	year	name	geometry	area
4	2021	ORTUR-FY21-WF-Onion Flat	POLYGON ((514169.618 5024759.062, 514169.415 5...	17285.297733
5	2021	ORTUR-FY21-WF-Onion Flat	POLYGON ((514169.618 5024759.062, 514072.116 5...	8755.419266
6	2021	Cedar Trail	POLYGON ((589643.805 4659518.087, 589648.387 4...	6068.859081
7	2021	Krumbo	POLYGON ((837238.117 4764552.507, 837233.259 4...	361332.351920
9	2021	ORTUR-FY21-WF-ONION FLAT 2	POLYGON ((514257.952 5024799.308, 514285.880 5...	11289.028649
...	...	...	...	...
8697	2021	Highway 38 Milepost 24	MULTIPOLYGON (((441464.562 4834775.883, 441464...	103002.862408
8698	2021	Slide Creek	POLYGON ((425722.164 4761458.163, 425723.958 4...	12578.333431
8699	2021	McClellan	POLYGON ((803247.456 4921436.641, 803247.870 4...	28477.790614
8700	2021	Crump	POLYGON ((759752.612 4680324.219, 759752.790 4...	215508.443698
8701	2021	Shirttail Creek	MULTIPOLYGON (((817574.830 4891336.587, 817571...	129250.150237

271 rows × 4 columns

In [12]:
```python
total_area = cities_area['area'].sum()
```

In [13]:
```python
total_area
```

Out[13]: 4273346142.798037

In [14]:
```python
total_area / 1000000
```

Out[14]: 4273.346142798037

In [15]:
```python
import os
os.environ['USE_PYGEOS'] = '0'
import geopandas as gpd

owls = gpd.read_file('lab2/data/spotted_owls.shp')
owls.head()
```

Out[15]:

	males	females	geometry
0	1.0	1.0	POINT (-123.36946 43.84928)
1	1.0	0.0	POINT (-123.38553 45.35914)
2	1.0	0.0	POINT (-123.38924 45.36038)
3	1.0	1.0	POINT (-122.29425 42.05855)
4	1.0	1.0	POINT (-123.40914 43.83023)

In [16]:
```python
owls.shape
```

Out[16]: (1821, 3)

In [17]:
```python
owls['males'].min()
```

Out[17]: 0.0

In [18]:
```python
owls['males'].max()
```

Out[18]: 1.0

In [19]:
```python
owls['females'].min()
```

Out[19]: 0.0

In [20]:
```python
owls['females'].max()
```

Out[20]: 1.0

In [21]:
```python
owl = owls[owls['females'] == 1.0].shape[0]
```

In [22]:
```python
(owl / owls.shape[0]) * 100
```

Out[22]: 82.8665568369028

In [23]:
```python
owls['geometry'].x.max()
```

Out[23]: -121.98568051428559

In [24]:
```python
owls.crs
```

Out[24]:
```
<Geographic 2D CRS: EPSG:4326>
Name: WGS 84
Axis Info [ellipsoidal]:
- Lat[north]: Geodetic latitude (degree)
- Lon[east]: Geodetic longitude (degree)
Area of Use:
- name: World.
- bounds: (-180.0, -90.0, 180.0, 90.0)
Datum: World Geodetic System 1984 ensemble
- Ellipsoid: WGS 84
- Prime Meridian: Greenwich
```

In [25]:
```python
owls_reproject = owls.to_crs('EPSG:32610')
owls_reproject.crs
```

Out[25]:
```
<Derived Projected CRS: EPSG:32610>
Name: WGS 84 / UTM zone 10N
Axis Info [cartesian]:
- E[east]: Easting (metre)
- N[north]: Northing (metre)
Area of Use:
- name: Between 126°W and 120°W, northern hemisphere between equator and 84°N, onshore and offshore. Canada - British
Columbia (BC); Northwest Territories (NWT); Nunavut; Yukon. United States (USA) - Alaska (AK).
- bounds: (-126.0, 0.0, -120.0, 84.0)
Coordinate Operation:
- name: UTM zone 10N
- method: Transverse Mercator
Datum: World Geodetic System 1984 ensemble
- Ellipsoid: WGS 84
- Prime Meridian: Greenwich
```

In [26]:
```python
owls_reproject['pairs'] = ((owls_reproject['males'] == 1) & (owls_reproject['females'] == 1)) * 1
owls_reproject
```

Out[26]:

	males	females	geometry	pairs
0	1.0	1.0	POINT (470303.870 4855199.056)	1
1	1.0	0.0	POINT (469805.124 5022919.501)	0
2	1.0	0.0	POINT (469515.128 5023059.499)	0
3	1.0	1.0	POINT (558395.071 4656517.664)	1
4	1.0	1.0	POINT (467103.826 4853099.018)	1
...	...	...	...	...
1816	1.0	1.0	POINT (456668.244 4901979.778)	1
1817	1.0	1.0	POINT (489540.427 4829445.475)	1
1818	1.0	1.0	POINT (480109.937 4846579.835)	1
1819	1.0	1.0	POINT (453394.406 4726797.099)	1
1820	1.0	1.0	POINT (423960.816 4754649.512)	1

1821 rows × 4 columns

In [ ]:

In [27]:
```python
df = owls_reproject.sjoin(cities_reproject, how="left")
```

In [28]:
```python
df
```

Out[28]:

	males	females	geometry	pairs	index_right	year	name	area
0	1.0	1.0	POINT (470303.870 4855199.056)	1	NaN	NaN	NaN	NaN
1	1.0	0.0	POINT (469805.124 5022919.501)	0	NaN	NaN	NaN	NaN
2	1.0	0.0	POINT (469515.128 5023059.499)	0	NaN	NaN	NaN	NaN
3	1.0	1.0	POINT (558395.071 4656517.664)	1	5518.0	2014.0	Oregon Gulch	1.419897e+08
4	1.0	1.0	POINT (467103.826 4853099.018)	1	NaN	NaN	NaN	NaN
...	...	...	...	...	...	...	...	...
1817	1.0	1.0	POINT (489540.427 4829445.475)	1	NaN	NaN	NaN	NaN
1818	1.0	1.0	POINT (480109.937 4846579.835)	1	NaN	NaN	NaN	NaN
1819	1.0	1.0	POINT (453394.406 4726797.099)	1	3720.0	1936.0	Unknown	1.907409e+06
1819	1.0	1.0	POINT (453394.406 4726797.099)	1	5506.0	2013.0	Dads Creek	9.890021e+07
1820	1.0	1.0	POINT (423960.816 4754649.512)	1	NaN	NaN	NaN	NaN

1908 rows × 8 columns

In [29]:
```python
join = df.dropna()
```

In [30]:
```python
join
```

Out[30]:

	males	females	geometry	pairs	index_right	year	name	area
3	1.0	1.0	POINT (558395.071 4656517.664)	1	5518.0	2014.0	Oregon Gulch	1.419897e+08
20	1.0	1.0	POINT (491894.663 4673886.857)	1	7680.0	1926.0	UNNAMED	2.760407e+06
23	1.0	1.0	POINT (455504.343 4705876.760)	1	7102.0	2018.0	Taylor Creek	2.140691e+08
24	1.0	1.0	POINT (521794.943 4733527.381)	1	7835.0	2002.0	TIMBERED ROCK	1.097454e+08
24	1.0	1.0	POINT (521794.943 4733527.381)	1	6231.0	2018.0	Miles	1.476432e+08
...	...	...	...	...	...	...	...	...
1797	1.0	0.0	POINT (542047.702 4887805.965)	0	7191.0	2020.0	Holiday Farm	7.011687e+08
1808	1.0	1.0	POINT (448944.345 4734097.209)	1	6368.0	2013.0	Rabbit Mtn2	9.704631e+07
1812	1.0	0.0	POINT (438184.122 4733637.191)	0	3668.0	1936.0	Unknown	3.265512e+06
1819	1.0	1.0	POINT (453394.406 4726797.099)	1	3720.0	1936.0	Unknown	1.907409e+06
1819	1.0	1.0	POINT (453394.406 4726797.099)	1	5506.0	2013.0	Dads Creek	9.890021e+07

377 rows × 8 columns
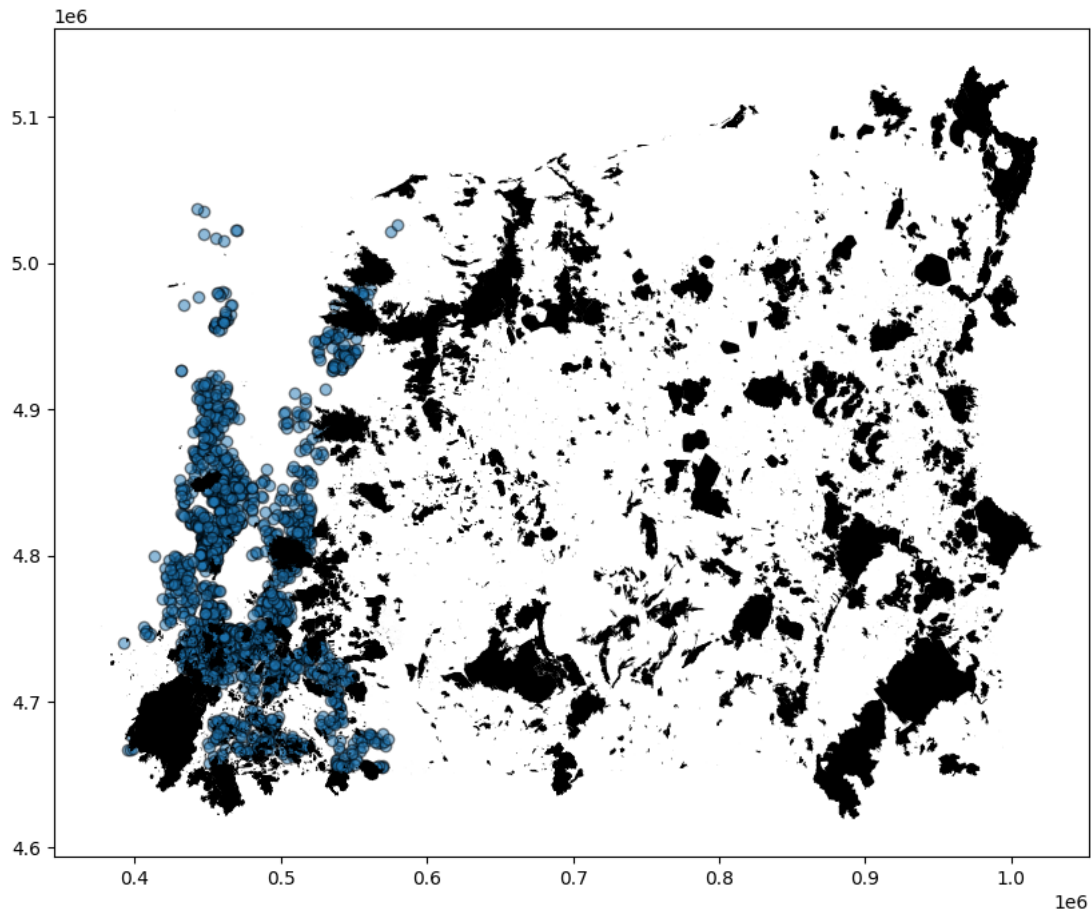
In [31]: `join['pairs'].sum()`

Out[31]: 324

In [32]: `join.groupby('year')['pairs'].sum().reset_index()`

Out[32]:

	year	pairs
0	1910.0	8
1	1914.0	22
2	1926.0	2
3	1936.0	31
4	1945.0	1
5	1951.0	5
6	1966.0	0
7	1987.0	17
8	1994.0	5
9	2001.0	2
10	2002.0	22
11	2005.0	4
12	2008.0	1
13	2009.0	2
14	2013.0	47
15	2014.0	3
16	2015.0	22
17	2016.0	1
18	2017.0	18
19	2018.0	36
20	2019.0	9
21	2020.0	58
22	2021.0	8

In [33]:
```
ax = owls_reproject.plot(figsize=(10, 10), alpha=0.5, edgecolor='k')
cities_reproject.plot(ax=ax, color='black', markersize=5)
```

Out[33]: <AxesSubplot: >

In [34]: `ax`

Out[34]: <AxesSubplot: >

In [ ]: