Removing points that are so inaccurate they land in the ocean, and assigning an island to each point

- Island is often assigned to occurrence points (although sometimes not), but are variable in how they are entered (east Maui versus west, diacriticals, etc). This step will standardized how those are entered.

In [1]:

```
import os
# changing directory
os.chdir("C:/Users/Kelsey/Documents/rwork/hapi")
```

In [2]:

```
import geopandas as gpd
import matplotlib.pyplot as plt
import pandas as pd
```

In [3]:

```
#Reading in a shapefile of the Main Islands of Hawaii
MainIslands = gpd.read_file("mainisl_100m_3.shp")
```

In [4]:

```
# importing a csv file of plant occurrence records
import pandas as pd
HAPI_OCC = pd.read_csv("HAPI_DISTRIBUTION_OCCURRENCES.1.csv")
```

```
C:\Users\Kelsey\Anaconda3\lib\site-packages\IPython\core\interactiveshell.py:3020: DtypeWarning: C
olumns (3,6,7,9,10,11,14,15,16,17,21,22) have mixed types. Specify dtype option on import or set l
ow_memory=False.
  interactivity=interactivity, compiler=compiler, result=result)
```

In [5]:

```
HAPI_OCC.head(3)
```

Out[5]:

	scientificName	publisher	basisOfRecord	recordNumber	recordedBy	individualCount	lifeStage	reproductiveCondition	de
0	Lepisorus thunbergianus	Natural History Museum (London) Collection Spe...	PRESERVED_SPECIMEN	1886	Thomas A. (Tom) Ranker, P G. Trapp, C G. Hanson	NaN	NaN	NaN	
1	Gahnia gahniiformis	Natural History Museum (London) Collection Spe...	PRESERVED_SPECIMEN	1250	Urbain Jean Faurie	NaN	NaN	NaN	
2	Euphorbia olowaluana	Natural History Museum (London) Collection Spe...	PRESERVED_SPECIMEN	19824	Otto Degener, Toshio Murashige, Greenwell	NaN	NaN	NaN	

3 rows × 24 columns

In [6]:

```
MainIslands.crs
```

Out[6]:

```
{'init': 'epsg:4326'}
```

In [7]:

```
#MainIslands = MainIslands.to_crs({'init': 'epsg:32604'})
```

In [8]:

```
MainIslands.head(3)
# it worked!
```

Out[8]:

	isle	geometry
0	Kauai	POLYGON ((-159.3461118057677 21.93637350851169...
1	Niihau	POLYGON ((-160.0730039167078 21.89508810939679...
2	Oahu	POLYGON ((-157.6505686740289 21.29807812207038...

In [9]:

```
from shapely.geometry import Point

# combine lat and lon column to a shapely Point() object
HAPI_OCC['geometry'] = HAPI_OCC.apply(lambda x: Point((float(x.decimalLongitude), float(x.decimalLa
titude))), axis=1)
#converting it into a geodataframe shape file
geo_HAPI_OCC = gpd.GeoDataFrame(HAPI_OCC, geometry= HAPI_OCC['geometry'])
```

In [10]:

```
geo_HAPI_OCC.head(3)
# it worked! geometry column added
```

Out[10]:

	scientificName	publisher	basisOfRecord	recordNumber	recordedBy	individualCount	lifeStage	reproductiveCondition	de
0	Lepisorus thunbergianus	Natural History Museum (London) Collection Spe...	PRESERVED_SPECIMEN	1886	Thomas A. (Tom) Ranker, P G. Trapp, C G. Hanson	NaN	NaN	NaN	
1	Gahnia gahniiformis	Natural History Museum (London) Collection Spe...	PRESERVED_SPECIMEN	1250	Urbain Jean Faurie	NaN	NaN	NaN	
2	Euphorbia olowaluana	Natural History Museum (London) Collection Spe...	PRESERVED_SPECIMEN	19824	Otto Degener, Toshio Murashige, Greenwell	NaN	NaN	NaN	

3 rows × 25 columns

In [11]:

```
# converting this to the same coordinate system ID as the shapefile
geo_HAPI_OCC.crs = ({'init': 'epsg:4326'})
```

In [12]:

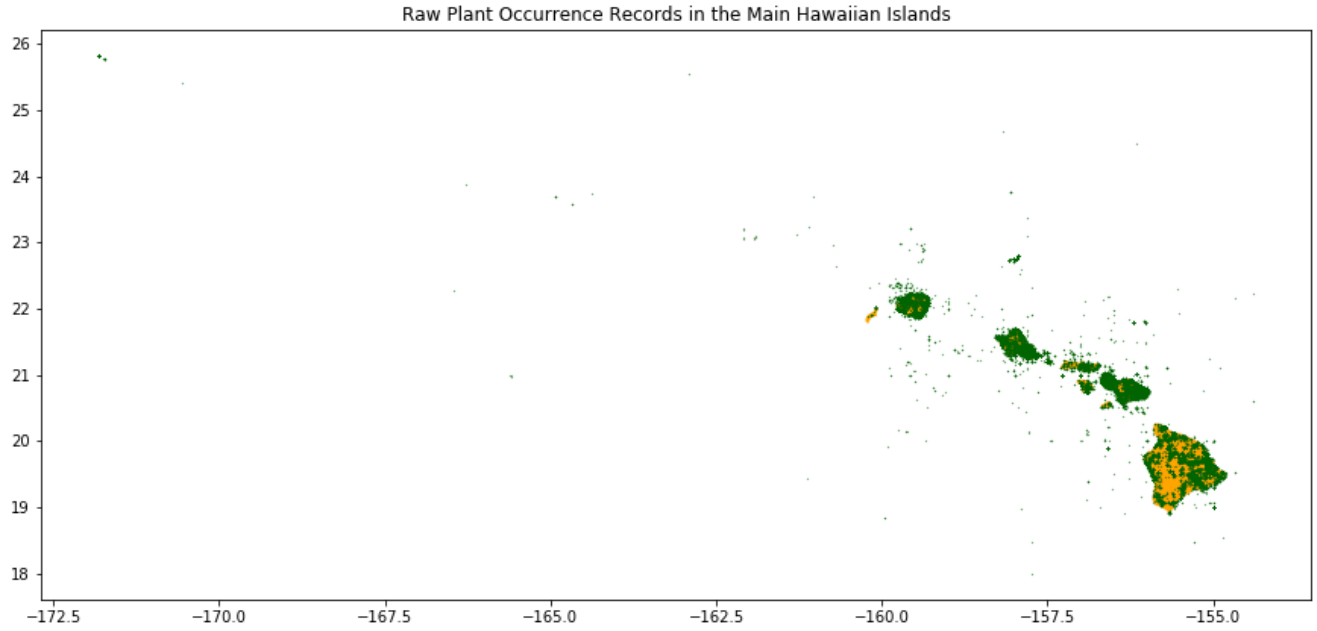
```
geo_HAPI_OCC.crs
```

Out[12]:

```
{'init': 'epsg:4326'}
```

In [13]:

```
%matplotlib inline
f, ax1 = plt.subplots(1, figsize=(15, 11))

fig1 = plt.gcf()

MainIslands.plot(color = "orange", ax=ax1)
geo_HAPI_OCC.plot( markersize = 0.05, color = "darkgreen", ax = ax1)
fig1.set_facecolor('white')


plt.title('Raw Plant Occurrence Records in the Main Hawaiian Islands')

plt.show()
```



Here we see that there are a lot of points that land outside of the islands, even though the island polygons have been buffered + 100m to account for point inaccuracy

In [14]:

```
geo_HAPI_OCC.shape
```

Out[14]:

```
(154950, 25)
```

In [22]:

```
# spatialling joining the lava risk with and airbnb data using geopandas
geo_HAPI_OCC_onland = gpd.sjoin(geo_HAPI_OCC, MainIslands, how = 'right', op = 'intersects')
```

In [23]:

```
geo_HAPI_OCC_onland.shape
```

Out[23]:

```
(151349, 27)
```

In [32]:

```
geo_HAPI_OCC_onland.head(2)
```

Out[32]:

index_right	index_left	scientificName	publisher	basisOfRecord	recordNumber	recordedBy	individualCount	lifeStage	repr
4	0	Lepisorus thunbergianus	Natural History Museum (London) Collection Spe...	PRESERVED_SPECIMEN	1886	Thomas A. (Tom) Ranker, P G. Trapp, C G. Hanson	NaN	NaN	
4	11	Solanum haleakalaense	Natural History Museum (London) Collection Spe...	PRESERVED_SPECIMEN	s.n.	Wilhelm B. Hillebrand	NaN	NaN	

2 rows × 27 columns

In [26]:

```
geo_HAPI_OCC_onland2 = geo_HAPI_OCC_onland.drop(['geometry'], axis=1)
```

In [27]:

```
# combine lat and lon column to a shapely Point() object
geo_HAPI_OCC_onland2['geometry'] = geo_HAPI_OCC_onland2.apply(lambda x: Point((float(x.decimalLongi
tude), float(x.decimalLatitude))), axis=1)
#converting it into a geodataframe shape file
geo_HAPI_OCC_onland2 = gpd.GeoDataFrame(geo_HAPI_OCC_onland2, geometry=
geo_HAPI_OCC_onland2['geometry'])
```

In [17]:

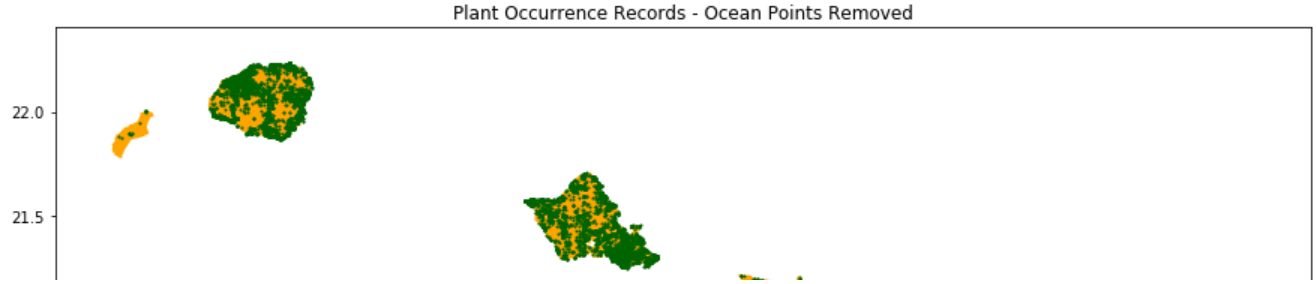
```
geo_HAPI_OCC_onland['isle'].unique()
```

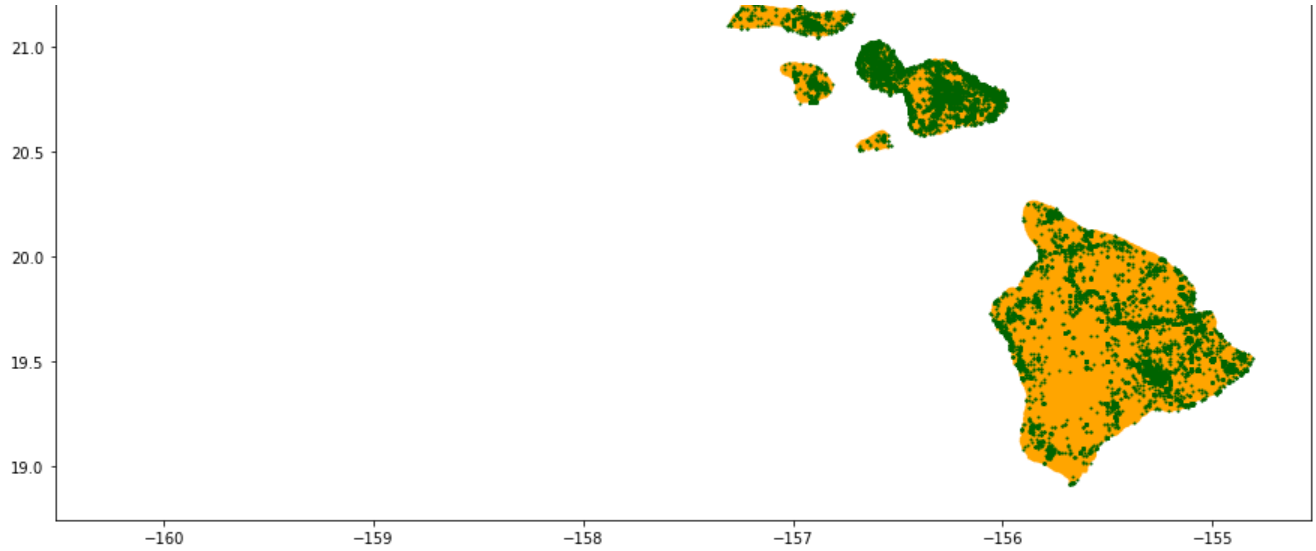
Out[17]:

```
array(['Maui', 'Oahu', 'Kauai', 'Lanai', 'Hawaii', 'Molokai', 'Niihau',
       'Kahoolawe'], dtype=object)
```

In [29]:

```
%matplotlib inline
f, ax1 = plt.subplots(1, figsize=(15, 11))

fig1 = plt.gcf()

MainIslands.plot(color = "orange", ax=ax1)
geo_HAPI_OCC_onland2.plot( markersize = 1, color = "darkgreen", ax = ax1)
fig1.set_facecolor('white')


plt.title('Plant Occurrence Records - Ocean Points Removed')

plt.show()
```





Only terrestrial points should remain

In [30]:

```
# of points in the ocean
len(geo_HAPI_OCC)-len(geo_HAPI_OCC_onland2)
```

Out[30]:

3601

In [33]:

```
export = geo_HAPI_OCC_onland.drop(['geometry'], axis=1)
```

In [34]:

```
export.to_csv('de-oceanized_HAPI_OCCURRENCE.csv', index = False)
```

Exporting as csv to open in R, so we can take advantage of the scrubR package.