In [38]:

```python
import matplotlib.pyplot as plt
%matplotlib inline
import re
import pandas as pd
import numpy as np
import warnings
warnings.filterwarnings('ignore')
import requests
import seaborn as sns
```

In [39]:

```python
# import geopandas as gpd
```

In [102…

```python
heatIslands = pd.read_excel('data/holc_heat.xls')
heatIslands
```

Out[102…

	holcNum_JSONToFeatures.OBJECTID	holcNum_JSONToFeatures.name	holcNum_JSONToFeatures.holc_id	holcNu
0	1	Miami Shores	A1	
1	2	Brickell Ave. District	A10	
2	3	Natoma Manors	A11	
3	4	New Shenandoah	A12	
4	5	Old Shenandoah	A13	
...	...	...	...	
69	70	NaN	D5	
70	71	Northwest Miami	D6	
71	72	Downtown Northwest	D7	
72	73	NaN	D8	
73	74	Coconut Grove	D9	

74 rows × 23 columns

In [103…

```python
#Rename columns so they are standardized and more readable
heatIslands.rename(columns={'ZonalSt_FLMiami1.MEDIAN':'MedianTemp'}, inplace=True)
heatIslands.rename(columns={'holcNum_JSONToFeatures.holc_grade':'GradeScore'}, inplace=Tru
heatIslands.rename(columns={'ZonalSt_FLMiami1.MEAN':'Mean'}, inplace=True)
heatIslands.rename(columns={'ZonalSt_FLMiami1.MAX':'Max'}, inplace=True)
heatIslands.rename(columns={'holcNum_JSONToFeatures.holc_id':'holc_id'}, inplace=True)
```

In [104…

```python
## Note the HOLC categorized neighhbordhoods'A' = Best ... 'D'=Hazard
# Letter grades are also represented as scores 4-1
heatIslands1 = heatIslands[['MedianTemp','GradeScore','Mean','Max','holc_id']]
heatIslands1
```

Out[104…

	MedianTemp	GradeScore	Mean	Max	holc_id
0	110	4	110.418899	130	A1
1	111	4	109.518188	121	A10
2	106	4	106.661290	112	A11
		4	115.227826	122	A12

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	MedianTemp	GradeScore	Mean	Max	holc_id
4	117	4	117.134130	121	A13
...	...	...	...	...	...
69	118	1	118.605091	140	D5
70	122	1	122.168563	137	D6
71	118	1	118.607754	144	D7
72	123	1	122.622881	125	D8
73	115	1	115.722195	137	D9

74 rows × 5 columns

In [99]:

```
heatIslands2  = heatIslands1.rename(columns={"GradeScore": "holc_grade"})
```

In [100…

```
heatIslands2
```

Out[100…

	MedianTemp	holc_grade	Mean	Max	holc_id
0	110	4	110.418899	130	A1
1	111	4	109.518188	121	A10
2	106	4	106.661290	112	A11
3	115	4	115.227826	122	A12
4	117	4	117.134130	121	A13
...	...	...	...	...	...
69	118	1	118.605091	140	D5
70	122	1	122.168563	137	D6
71	118	1	118.607754	144	D7
72	123	1	122.622881	125	D8
73	115	1	115.722195	137	D9

74 rows × 5 columns

In [93]:

```
heatIslands2 = heatIslands2.groupby('holc_grade')['MedianTemp'].mean()
heatIslands2 =heatIslands2.to_frame()
heatIslands2= heatIslands2.reset_index()
```

In [47]:

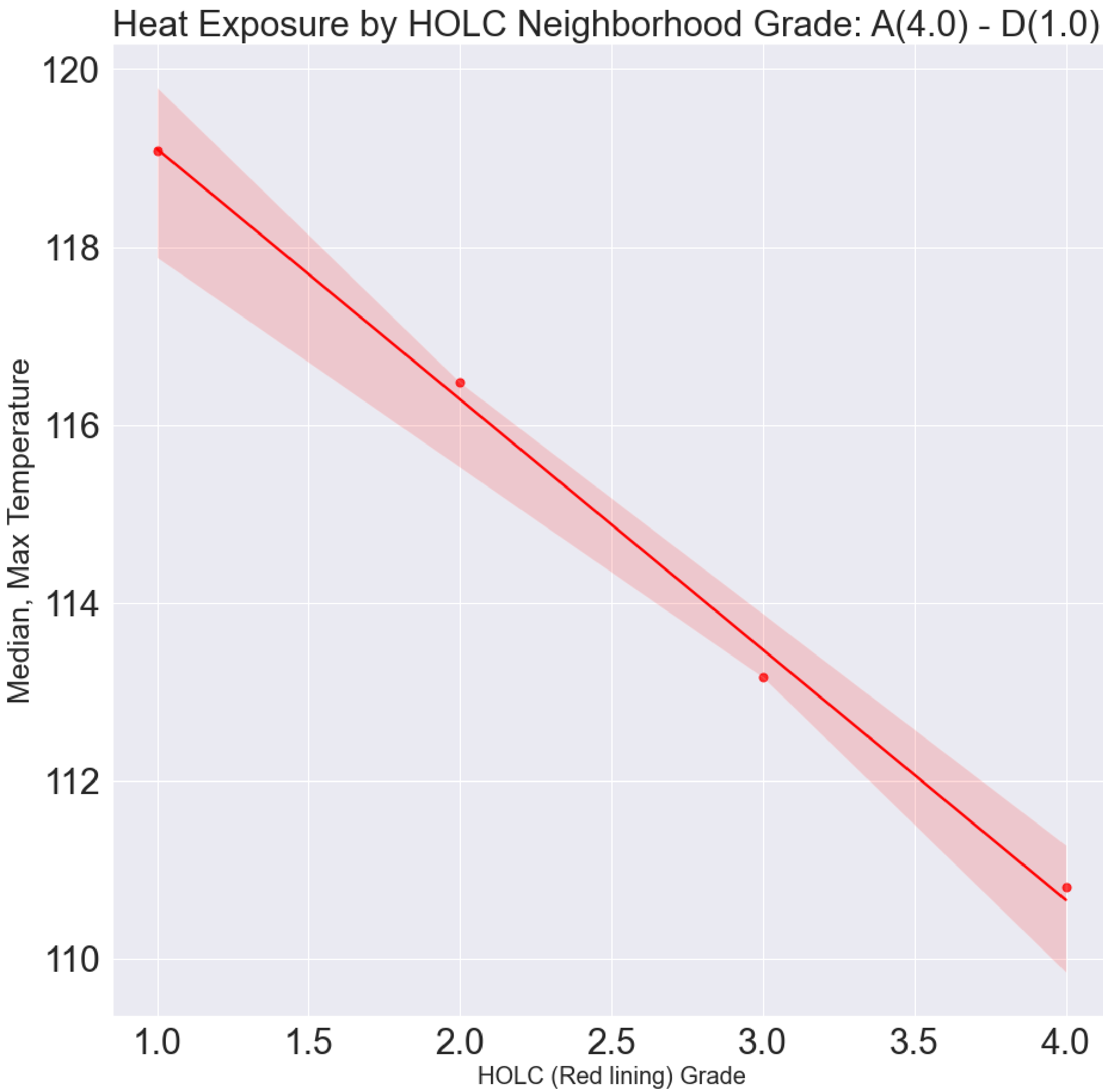
```
sns.set(rc = {'figure.figsize':(15,15)})


p1 = sns.regplot(data= heatIslands2,  x="holc_grade", y="MedianTemp", fit_reg=True,  colo
p1.set_xlabel("HOLC (Red lining) Grade: A(4.0) - D(1.0) ", fontsize = 20)

p1.set_xlabel("HOLC (Red lining) Grade", fontsize = 20)
p1.set_ylabel("Median, Max Temperature", fontsize = 25)
p1.set_title("Heat Exposure by HOLC Neighborhood Grade: A(4.0) - D(1.0) ", fontsize = 30)

p1.tick_params(labelsize=30)
```

```
plt.savefig('holcGraphs/holcHeat.png')
```



In [48]:
```
# corrMatrix = heatIslands1.corr()
# sns.heatmap(corrMatrix, annot=True)
# plt.show()
```

ELEVATION

In [49]:
```
dfElevation = pd.read_csv('data/holc_elev.csv')
dfElevation['holc_id'].merge(heatIslands1, on='hold_id', how='left')
```

Out[49]:

	OBJECTID	holc_id	ZONE_CODE	COUNT	AREA	MIN	MAX	MEAN
0	1	A1	1	1041718	26042950	-0.327994	14.942991	8.320908
1	2	A10	2	492238	12305950	-0.280000	49.035973	14.222938
2	3	A11	3	96555	2413875	3.316000	22.129992	15.606367

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	OBJECTID	holc_id	ZONE_CODE	COUNT	AREA	MIN	MAX	MEAN
3	4	A12	4	540360	13509000	5.510053	15.218997	10.063169
4	5	A13	5	236099	5902475	4.144005	15.406997	9.750800
...	...	...	...	...	...	...	...	...
69	70	D5	70	2438932	60973300	0.034001	30.542999	9.076029
70	71	D6	71	1757136	43928400	-5.584886	38.699993	9.449970
71	72	D7	72	819665	20491625	0.280000	43.693001	12.113272
72	73	D8	73	73446	1836150	4.635003	14.414996	8.796817
73	74	D9	74	639037	15975925	4.839016	27.835993	10.027507

74 rows × 8 columns

In [51]:

```
dfHolcGrades = pd.read_csv('data/holc_grades.csv')
dfHolcGrades
```

Out[51]:

	name	holc_id	holc_grade	area_description_data	geometry
0	Miami Shores	A1	A	{'5': 'Peak sales prices occured in July of 19...	MULTIPOLYGON (((-80.177291 25.865415, -80.1772...
1	Brickell Ave. District	A10	A	{'5': '', '6': 'Brickell Ave. District, Miami ...	MULTIPOLYGON (((-80.190797 25.756686, -80.1914...
2	Natoma Manors	A11	A	{'5': '', '6': 'Natoma Manors, Miami, Florida ...	MULTIPOLYGON (((-80.21830199999999 25.741955, ...
3	New Shenandoah	A12	A	{'5': 'This is the most rapidly developing sec...	MULTIPOLYGON (((-80.206262 25.753058, -80.2100...
4	Old Shenandoah	A13	A	{'5': 'There is a small percentage of these ho...	MULTIPOLYGON (((-80.221593 25.753164, -80.2214...
...	...	...	...	...	...
69	NaN	D5	D	{'5': 'This is a sparsely settled outlying are...	MULTIPOLYGON (((-80.24406399999999 25.804895, ...
70	Northwest Miami	D6	D	{'5': '', '6': 'Majority in Northwest portion ...	MULTIPOLYGON (((-80.207596 25.784049, -80.2073...
71	Downtown Northwest	D7	D	{'5': 'This is a downtown Negro area, practica...	MULTIPOLYGON (((-80.206227 25.797257, -80.2000...
72	NaN	D8	D	{'5': 'This is a small Southwest downtown Negr...	MULTIPOLYGON (((-80.20236 25.763833, -80.20321...
73	Coconut Grove	D9	D	{'5': 'This is the Coconut Grove Negro section...	MULTIPOLYGON (((-80.245073 25.725573, -80.2495...

74 rows × 5 columns

In [52]:

```
dfHolcGrades1 = dfHolcGrades[['name','holc_id','holc_grade']]
dfHolcGrades1
```

Out[52]:

	name	holc_id	holc_grade
0	Miami Shores	A1	A
1	Brickell Ave. District	A10	A
2	Natoma Manors	A11	A

	name	holc_id	holc_grade
3	New Shenandoah	A12	A
4	Old Shenandoah	A13	A
...	...	...	...
69	NaN	D5	D
70	Northwest Miami	D6	D
71	Downtown Northwest	D7	D
72	NaN	D8	D
73	Coconut Grove	D9	D

74 rows × 3 columns

In [53]:

```
elev1 =  dfHE[['ZONE_CODE', 'MEAN','holc_id']]
elev1
```

Out[53]:

	ZONE_CODE	MEAN	holc_id
0	1	8.320908	A1
1	2	14.222938	A10
2	3	15.606367	A11
3	4	10.063169	A12
4	5	9.750800	A13
...	...	...	...
69	70	9.076029	D5
70	71	9.449970	D6
71	72	12.113272	D7
72	73	8.796817	D8
73	74	10.027507	D9

74 rows × 3 columns

In [54]:

```
dfHE2= elev1.merge(dfHolcGrades1, on='holc_id', how='left')
```

In [55]:

```
dfHE2 = dfHE2.rename(columns={"MEAN": "Mean_Neighborhood_Elevation"})
```

In [56]:

```
dfHE3Mean= dfHE2.groupby(dfHE2['holc_grade'])["Mean_Neighborhood_Elevation"].mean()
dfHE3Mean =dfHE3Mean.to_frame()
dfHE3Mean.sort_values(by = "holc_grade", ascending=True)
dfHE3Mean = dfHE3Mean.reset_index()
```

In [57]:

```
dfHE3Mean.sort_values(by="holc_grade", ascending=False, inplace=True)
dfHE3Mean
```

Out[57]:

	holc_grade	Mean_Neighborhood_Elevation
		9.532565

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	holc_grade	Mean_Neighborhood_Elevation
2	C	8.668769
1	B	8.451025
0	A	7.555483

In [77]:

```
grade_dict = {'A':1,'B':2,'C':3,'D':4}
```

In [79]:

```
dfHE3Mean['holc_grade'] = dfHE3Mean['holc_grade'].replace(grade_dict)
dfHE3Mean
```

Out[79]:

	holc_grade	Mean_Neighborhood_Elevation
3	4	9.532565
2	3	8.668769
1	2	8.451025
0	1	7.555483

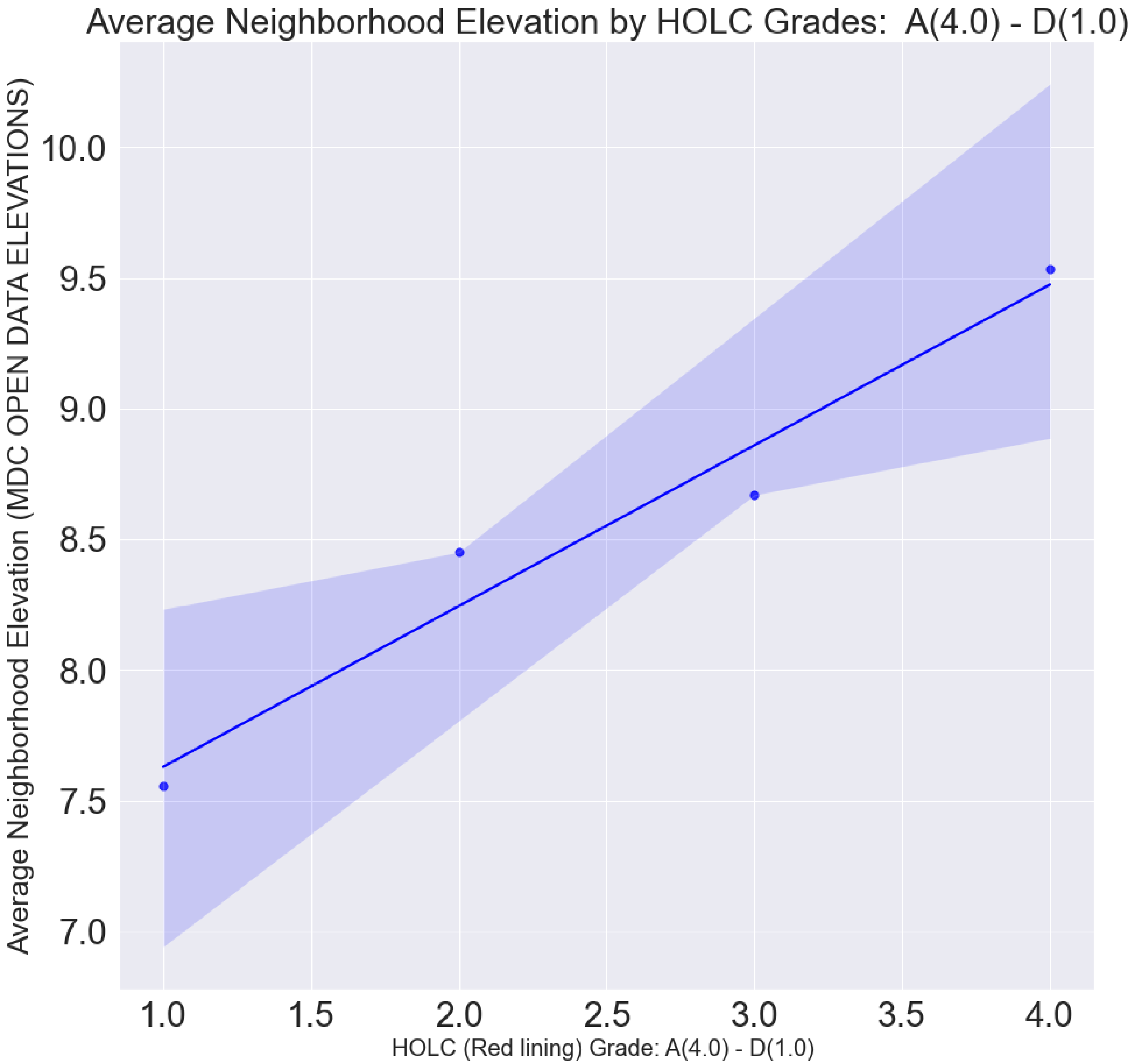
In [80]:

```
sns.set(rc = {'figure.figsize':(15,15)})

p1 = sns.regplot(data=dfHE3Mean,  x=dfHE3Mean["holc_grade"], y="Mean_Neighborhood_Elevati
p1.set_xlabel("HOLC (Red lining) Grade: A(4.0) - D(1.0) ", fontsize = 20)
p1.set_ylabel("Average Neighborhood Elevation (MDC OPEN DATA ELEVATIONS)", fontsize = 25)
p1.set_title("Average Neighborhood Elevation by HOLC Grades:  A(4.0) - D(1.0)", fontsize =


#tick size
p1.tick_params(labelsize=30)

plt.savefig('holcGraphs/Average Neighborhood Elevation by HOLC Grades.png')
```



TREE CANOPY COVERAGE

In [115…

```
treeC = pd.read_excel('data/holc_tree.xls')
treeC
```

Out[115…

	OBJECTID	holc_id	ZONE_CODE	COUNT	AREA	MEAN
0	1	A1	1	20	0.000218	7.505753
1	2	A10	2	11	0.000120	9.083878
2	3	A11	3	1	0.000011	19.964495
3	4	A12	4	10	0.000109	4.974944
4	5	A13	5	5	0.000054	3.049167
...	...	...	...	...	...	...
67	68	D4	68	27	0.000294	4.272904
68	69	D5	69	47	0.000512	3.094395
69	70	D6	70	39	0.000425	1.410581

	OBJECTID	holc_id	ZONE_CODE	COUNT	AREA	MEAN
70	71	D7	71	19	0.000207	1.958738
71	72	D9	72	11	0.000120	8.561389

72 rows × 6 columns

In [116…
```
treeC = treeC[['holc_id', 'MEAN']]
```

In [117…
```
treeC = treeC.rename(columns={"MEAN": "Mean Tree Canopy Coverage"})
```

In [118…
```
treeC
```

Out[118…

	holc_id	Mean Tree Canopy Coverage
0	A1	7.505753
1	A10	9.083878
2	A11	19.964495
3	A12	4.974944
4	A13	3.049167
...	...	...
67	D4	4.272904
68	D5	3.094395
69	D6	1.410581
70	D7	1.958738
71	D9	8.561389

72 rows × 2 columns

In [119…
```
treeC = treeC.merge(heatIslands1, on="holc_id", how="left")
treeC= treeC.groupby(treeC['GradeScore'])["Mean Tree Canopy Coverage"].mean()
treeC =treeC.to_frame()
treeC.sort_values(by = "GradeScore", ascending=True)
treeC = treeC.reset_index()
```

In [120…
```
treeC
```

Out[120…

	GradeScore	Mean Tree Canopy Coverage
0	1	3.207434
1	2	4.846830
2	3	5.724602
3	4	6.969792

In [122…
```
sns.set(rc = {'figure.figsize':(15,15)})

# p1 = sns.regplot(data=dfHE2,  x=dfHE2.index, y="Mean_Neighborhood_Elevation", fit_reg=Tr
```

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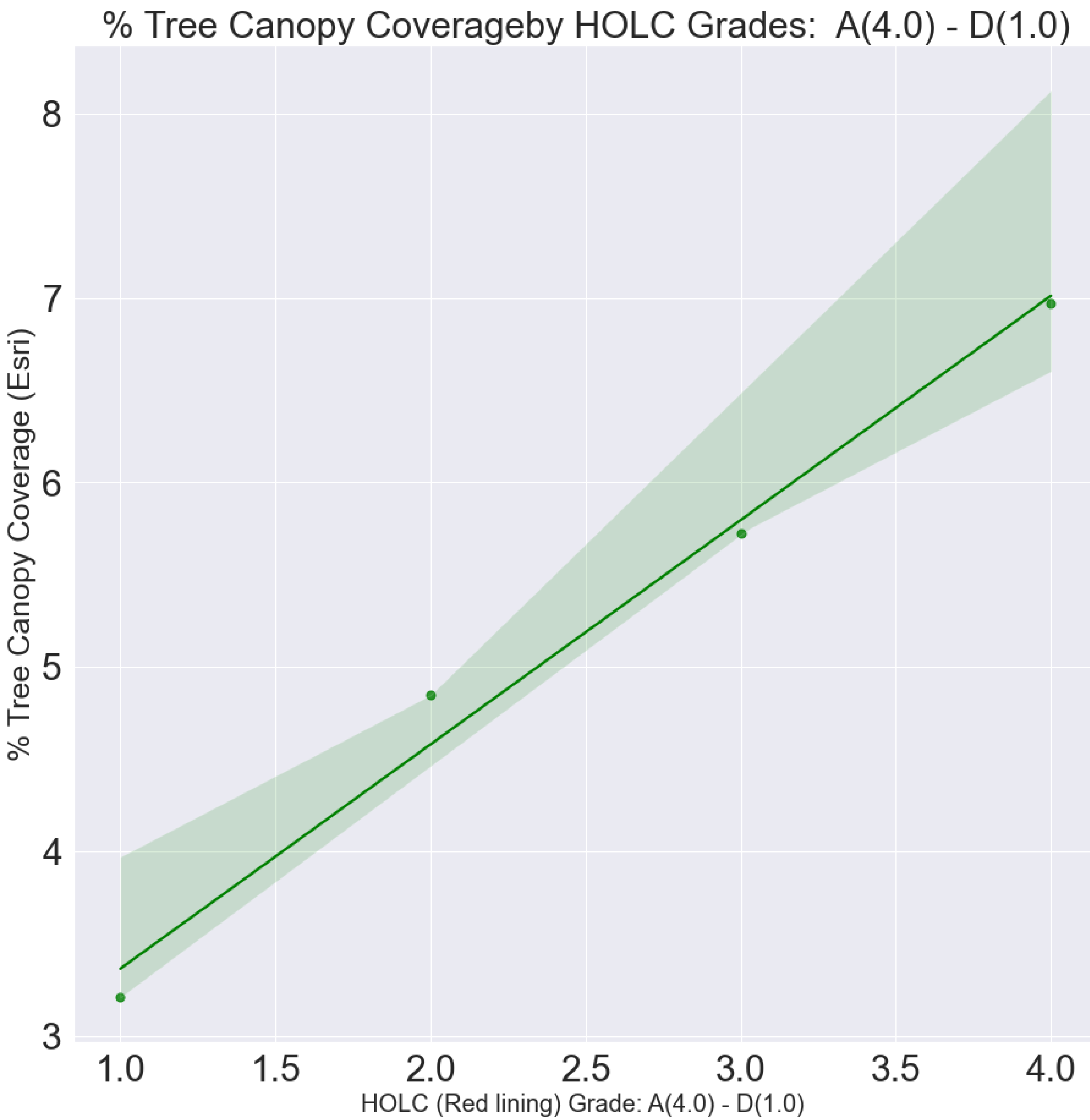
```
p1 = sns.regplot(data=treeC,  x=treeC["GradeScore"], y="Mean Tree Canopy Coverage", fit_re
p1.set_xlabel("HOLC (Red lining) Grade: A(4.0) - D(1.0) ", fontsize = 20)
p1.set_ylabel("% Tree Canopy Coverage (Esri)", fontsize = 25)
p1.set_title("% Tree Canopy Coverageby HOLC Grades:  A(4.0) - D(1.0)", fontsize = 30)


#tick size
p1.tick_params(labelsize=30)

plt.savefig('holcGraphs/treeCanopyCoverageHolc.png')
```



RENT INCREASE

In [123…

```
rent = pd.read_excel('data/rentIncreasePer.xls')
rent
```

Out[123…

	OBJECTID	holcNum_JSONToFeatures_holc_id	ZONE_CODE	COUNT	AREA	MEAN	PERCENTAGE
0	1	A1	1	47	2937500	0.428900	42.890000
1	2	A11	3	6	375000	0.467400	46.740000
2	3	A12	4	10	625000	0.418000	41.800000
3	4	A13	5	8	500000	0.418000	41.800000
4	5	A14	6	8	500000	0.451300	45.130000
...	...	...	...	...	...	...	...
61	62	D4	69	41	2562500	0.281046	28.104634
62	63	D6	71	35	2187500	0.167900	16.790000
63	64	D7	72	3	187500	0.167900	16.790000
64	65	D8	73	2	125000	0.666700	66.670000
65	66	D9	74	29	1812500	0.467400	46.740000

66 rows × 7 columns

In [139…

```
rent = rent.rename(columns={"holcNum_JSONToFeatures_holc_id": "holc_id"})
```

In [141…

```
rent
```

Out[141…

	OBJECTID	ZONE_CODE	COUNT	AREA	MEAN	PERCENTAGE	MedianTemp	Mean
holc_grade								
1	61.5	68.400000	19.700000	1.231250e+06	0.338523	33.852279	119.500000	119.611445
2	47.5	50.444444	22.166667	1.385417e+06	0.424488	42.448762	116.166667	116.242176
3	26.5	28.291667	16.000000	1.000000e+06	0.442932	44.293151	113.041667	112.997165
4	7.5	8.428571	20.000000	1.250000e+06	0.418219	41.821944	110.785714	110.835649

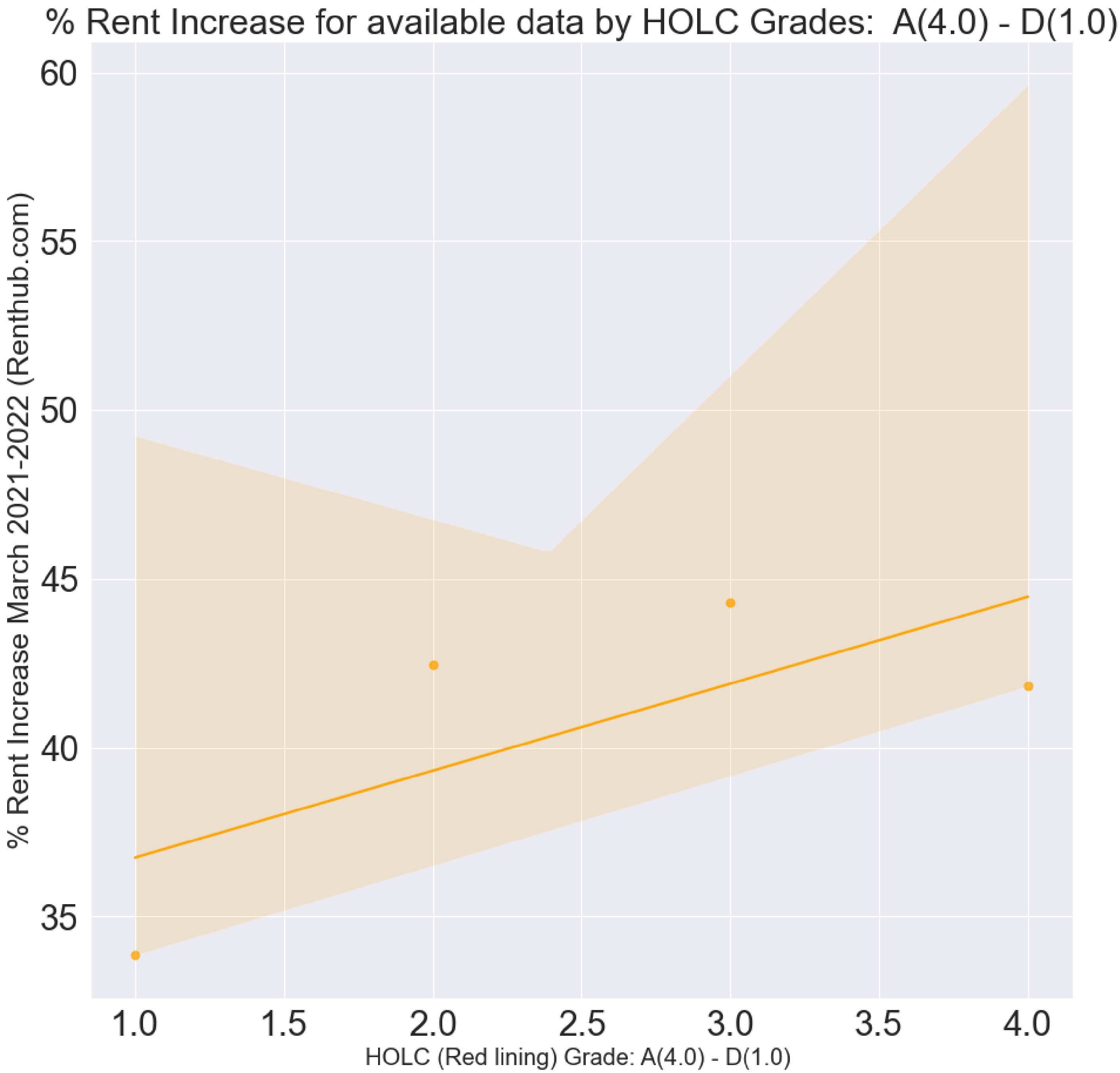
In [142…

```
sns.set(rc = {'figure.figsize':(15,15)})

# p1 = sns.regplot(data=dfHE2,  x=dfHE2.index, y="Mean_Neighborhood_Elevation", fit_reg=Tr
p1 = sns.regplot(data=rent,  x=rent.index, y="PERCENTAGE", fit_reg=True,  color= 'orange',
p1.set_xlabel("HOLC (Red lining) Grade: A(4.0) - D(1.0) ", fontsize = 20)
p1.set_ylabel("% Rent Increase March 2021-2022 (Renthub.com)", fontsize = 25)
p1.set_title("% Rent Increase for available data by HOLC Grades:  A(4.0) - D(1.0)", fonts:


#tick size
p1.tick_params(labelsize=30)

plt.savefig('holcGraphs/rentIncrease.png')
```



% Rent Increase for available data by HOLC Grades: A(4.0) - D(1.0)
60
55
50
45
40
35
% Rent Increase March 2021-2022 (Renthub.com)
1.0
1.5
2.0
2.5
3.0
3.5
4.0
HOLC (Red lining) Grade: A(4.0) - D(1.0)

In [ ]:

In [ ]:

In [ ]: