Trees, Air Quality, and Wealth Distribution in New York City

Annie Bishai | April 18, 2022

The Question

Can metrics of air quality and trees (health, density) be used to accurately predict household income in census tracts of NYC?

Income

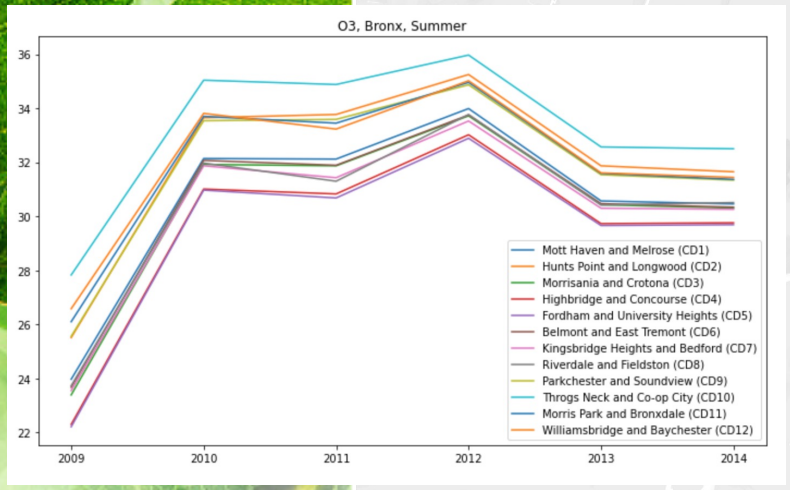
Manhattan
Bronx
Brooklyn
Queens
Staten Island

Map based on Longitude (generated) and Latitude (generated). Color shows sum of Median Household Income (2017). Details are shown for Census Tract and Community District.

Air Quality: Ozone

Ozone

Summer Levels

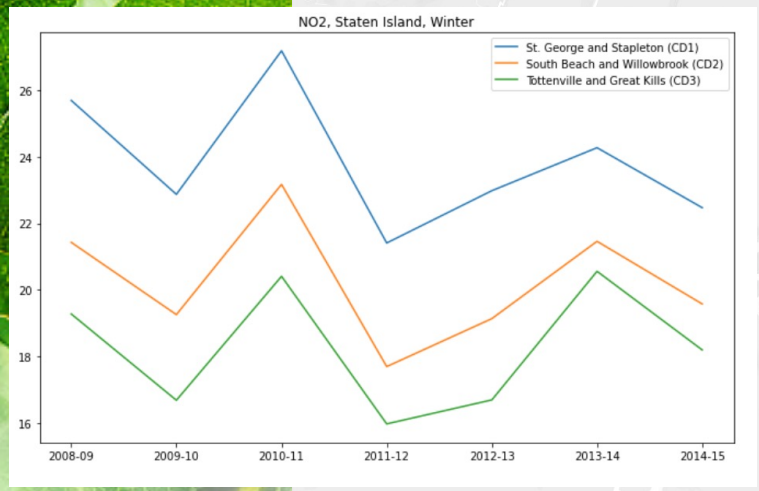


Map based on Longitude (generated) and Latitude (generated). Color shows SUM([Ozone (ppb), Summer 2009]+[10S O3]+[11S O3]+[12S O3]+[13.... Details are shown for CD Name.

Sum of summer averag..

195.4 336.7

Air Quality Trends: NO2



Nitrogen Dioxide

Percent Change, 2009-2017

2006-15

Map based on Longitude (generated) and Latitude (generated). Color shows sum of Winter NO2 Pct Change (2006-15). Details are shown for CD Name.

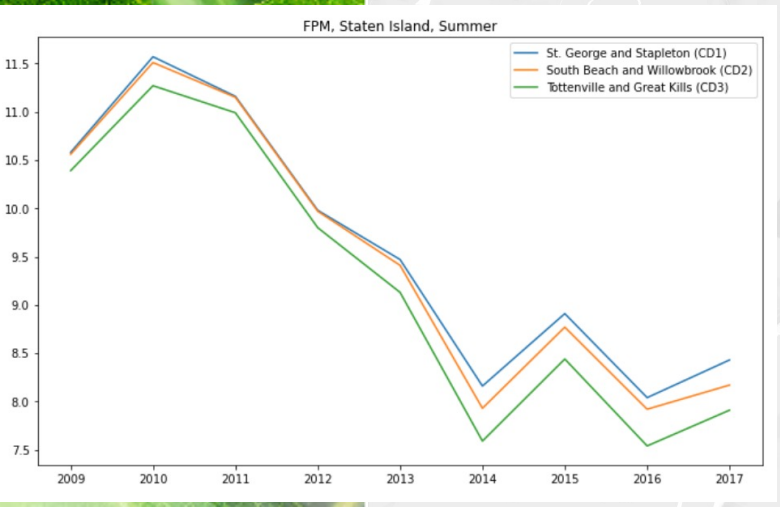
Percent change, winter ..

-0.2818 0.0024

Air Quality Trends: PM 2.5

Fine Particulate Matter

Percent Change, 2009-2017



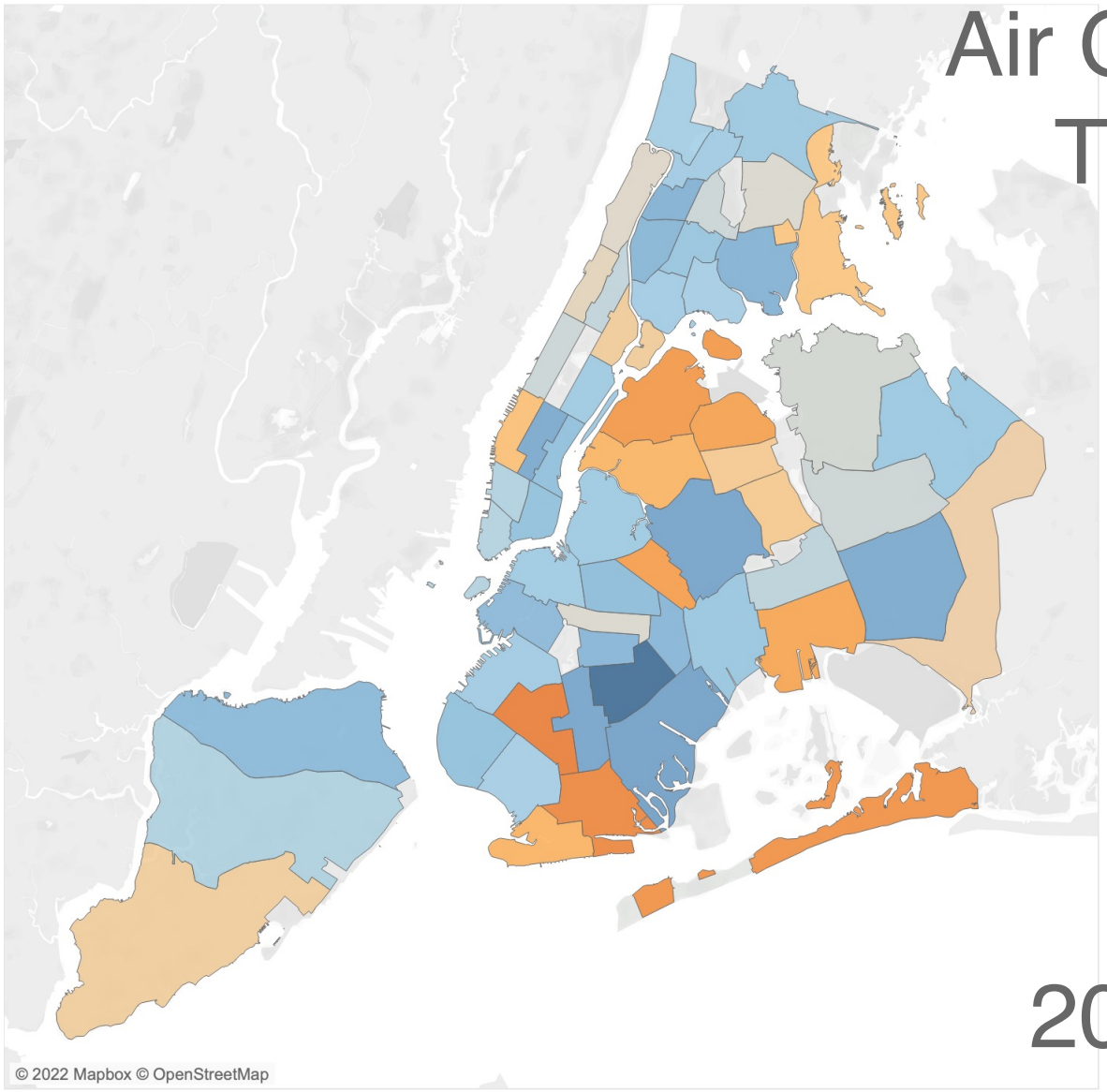
Map based on Longitude (generated) and Latitude (generated). Color shows sum of Summer PM 2.5 Pct Change (2009-17). Details are shown for CD Name.

Percent change, summ..

-0.2551 -0.0896

2009-17

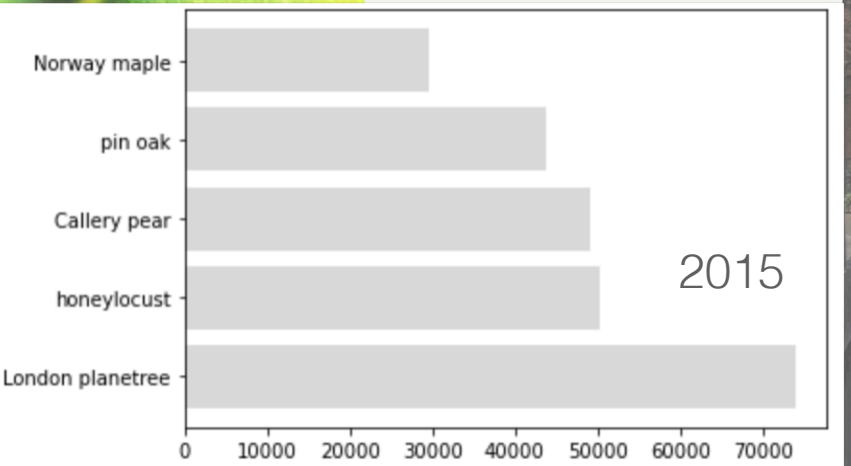
Air Quality Trends: Traffic

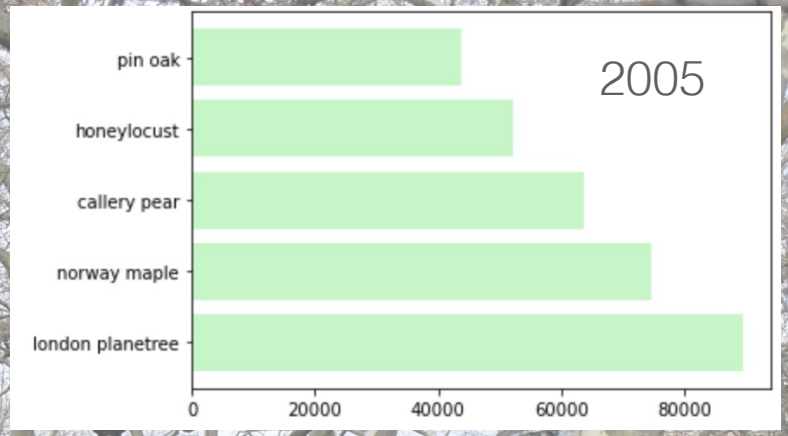


2006-15

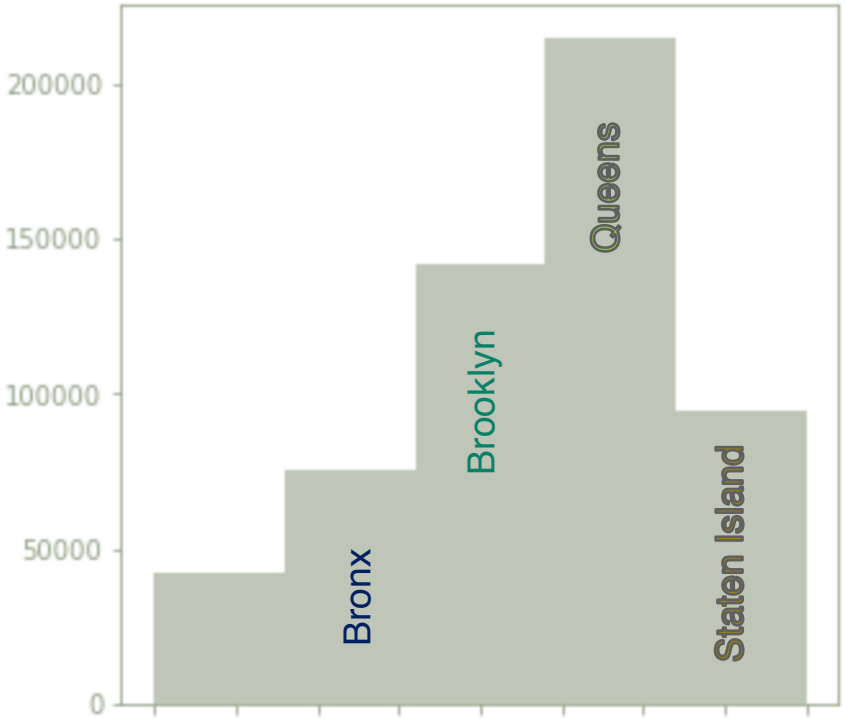
Tree Census

- Alive?
- Subjective health
- Species
- Diameter
- Sidewalk damage
- Location

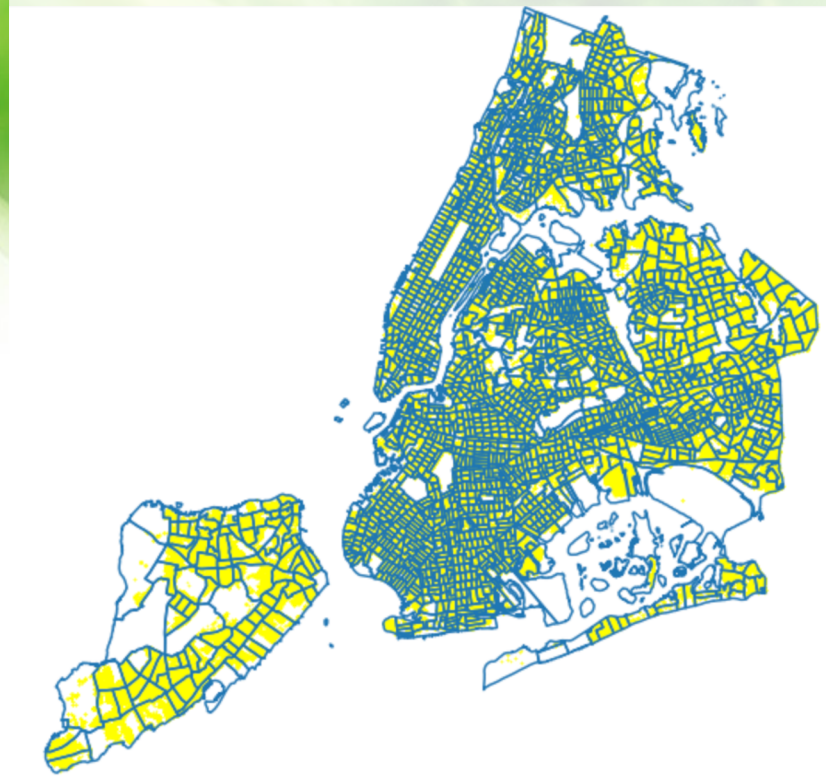


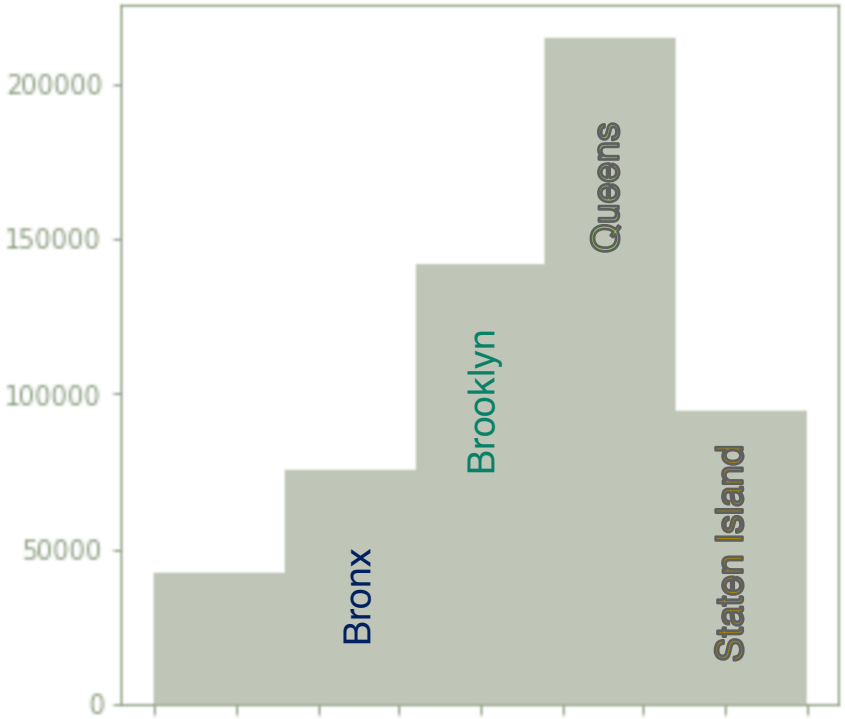


Tree Census cont'd

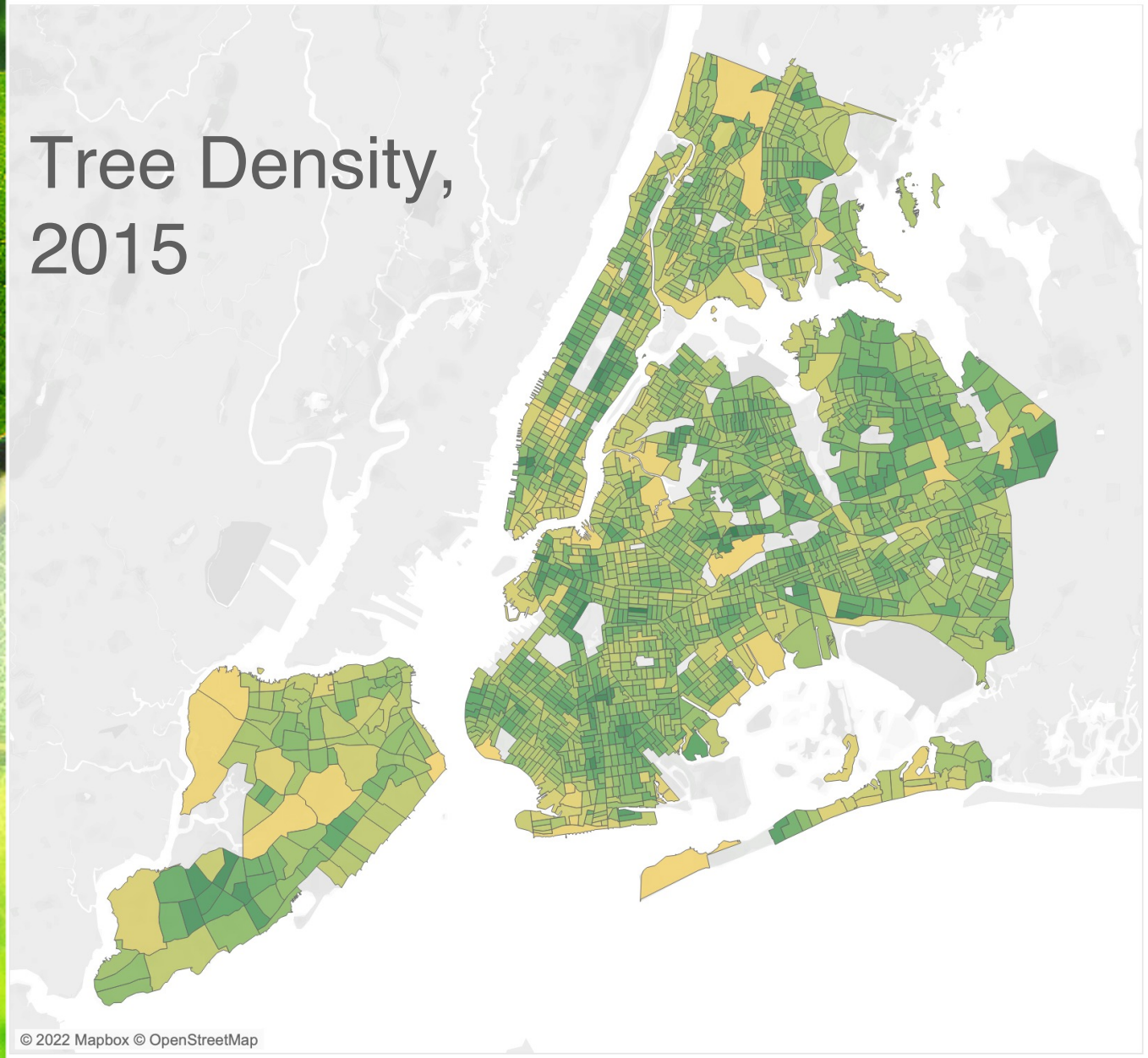


Tree Census cont'd





Tree Density, 2015



Map based on Longitude (generated) and Latitude (generated). Color shows SUM([Tree Density (2015)]+[Tree Density (2005)]). Details are shown for Census Tract and Community District.

SUM([Tree Density (20..

0.4 486.6

Modeling

- Bagging
- **Random Forest**
- ExtraTrees
- Gradient Boosting
- Adaboost

Baseline

RMSE: $31,613.13

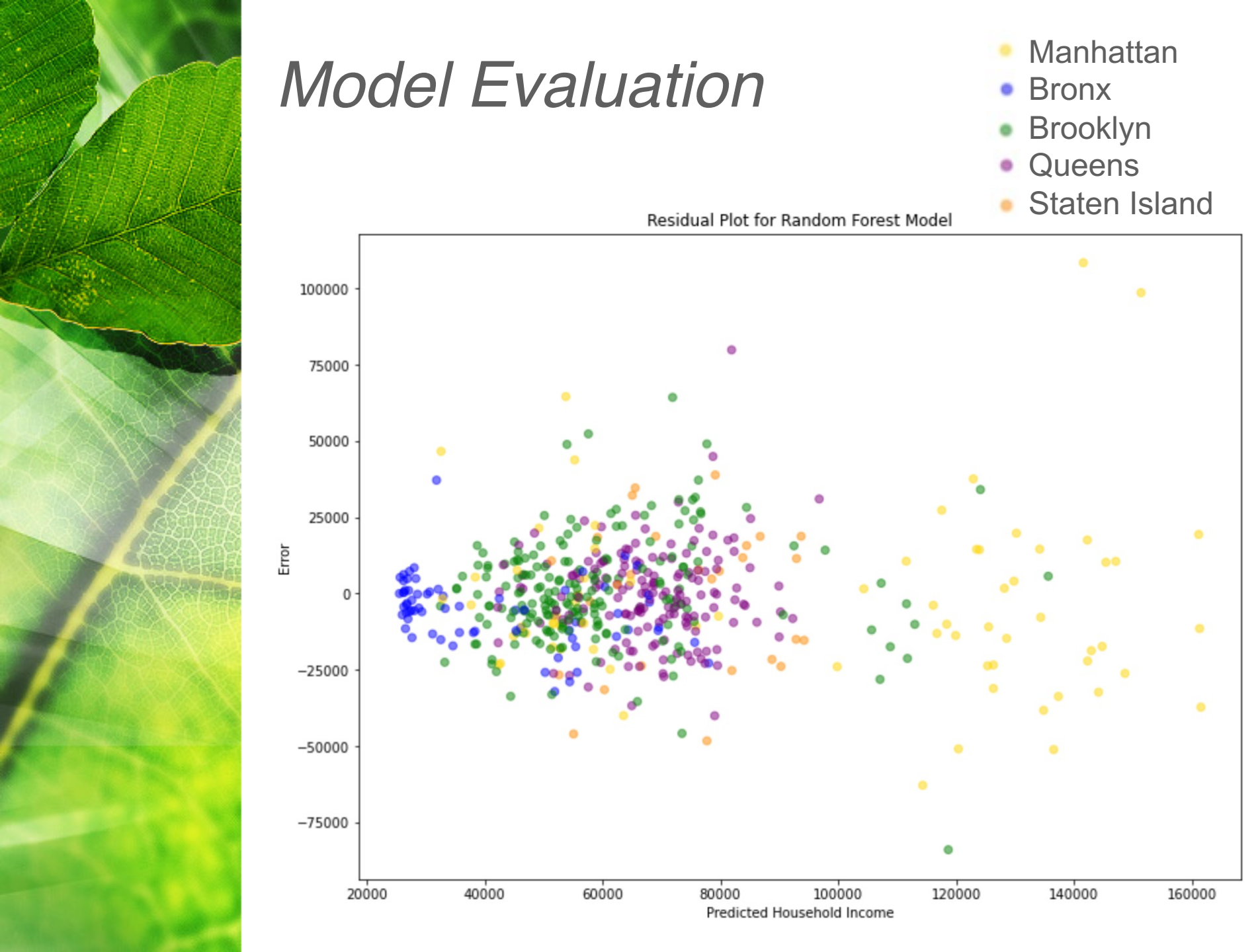
Random Forest Model:

RMSE: $18,661.84

R2 score: 0.651

- Based on MSE, model is a 65.15% improvement from null
- Based on RMSE, model is a 40.97% improvement from null

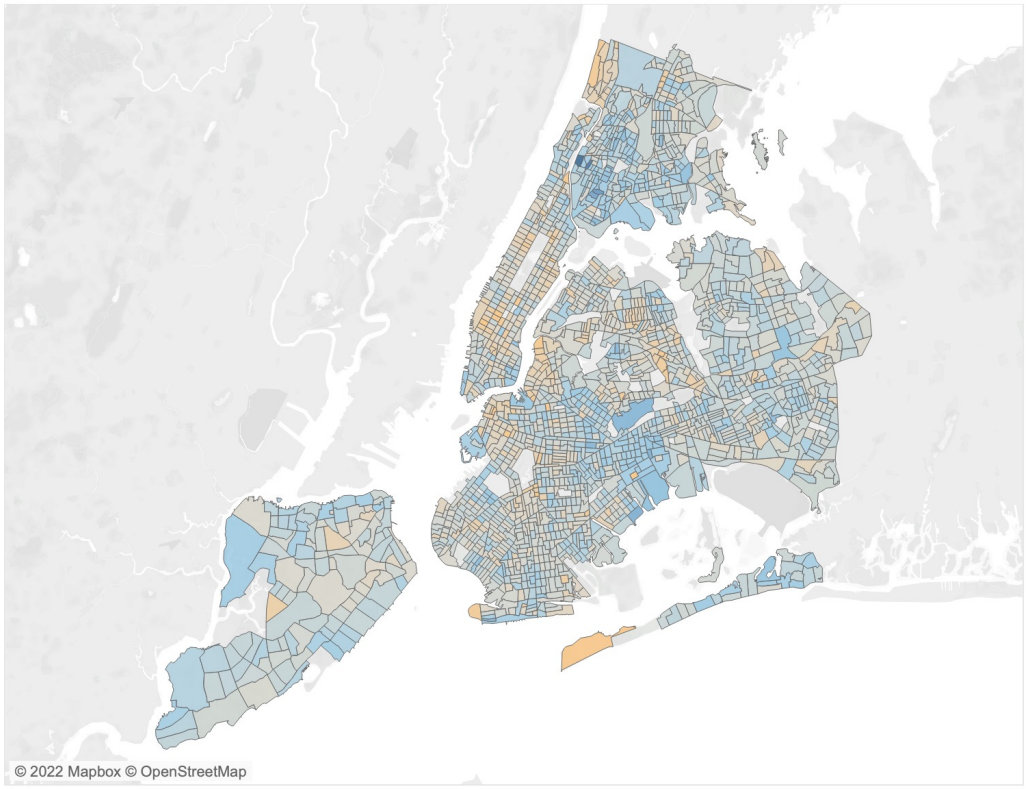
Model Evaluation



Feature Importance

1. Winter NO2 2012-13
2. Winter NO2 change
3. Summer NO2 2017
4. Tree count 2005
5. Number of species 2005
6. Summer ozone 2010
7. Summer ozone 2013
8. Tree density change
9. Tree count change
10. SO2 change
11. Tract area
12. Near park %
13. Mean Tree Diameter
14. Number of species 2015
15. Summer 2017 PM 2.5

Change in number of trees (‘05-’15)



Map based on Longitude (generated) and Latitude (generated). Color shows sum of Number of Tree Species Change (2005-15). Details are shown for Census Tract and Community District.

Number of Tree Species..

-0.90 11.00

So what?

- Predicting potential impact of tree-planting, pollution-reduction efforts on geographic income stratification
- Identifying areas of high risk for adverse health effects of climate change/pollution

What next?

- Make this model better: more feature engineering
- Bring in more info on relevant policy/budget changes
- Fit to specific geographies (boroughs)
- Different y-variable?
- Read the lit!

Thank you!

This presentation has been designed using resources from PoweredTemplate.com

London Planetree image: https://matthewwills.com/2012/01/14/not-as-plain-as-all-that/