



# Food Wastage in New York City

## Trends, Borough Comparisons, and Potential Solutions



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# Introduction:

**New York City generates about 3 million tons of food waste annually. Despite active city-wide initiatives, including composting programs and food redistribution efforts, food waste continues to be high.**

**This project focuses on understanding the dynamics of food waste by analyzing annual trends, identifying differences among boroughs, and examining critical socioeconomic drivers of waste generation.**

**Food waste impacts NYC's climate goals, economy, and infrastructure. Addressing borough-level disparities can make reduction efforts more efficient and equitable.**

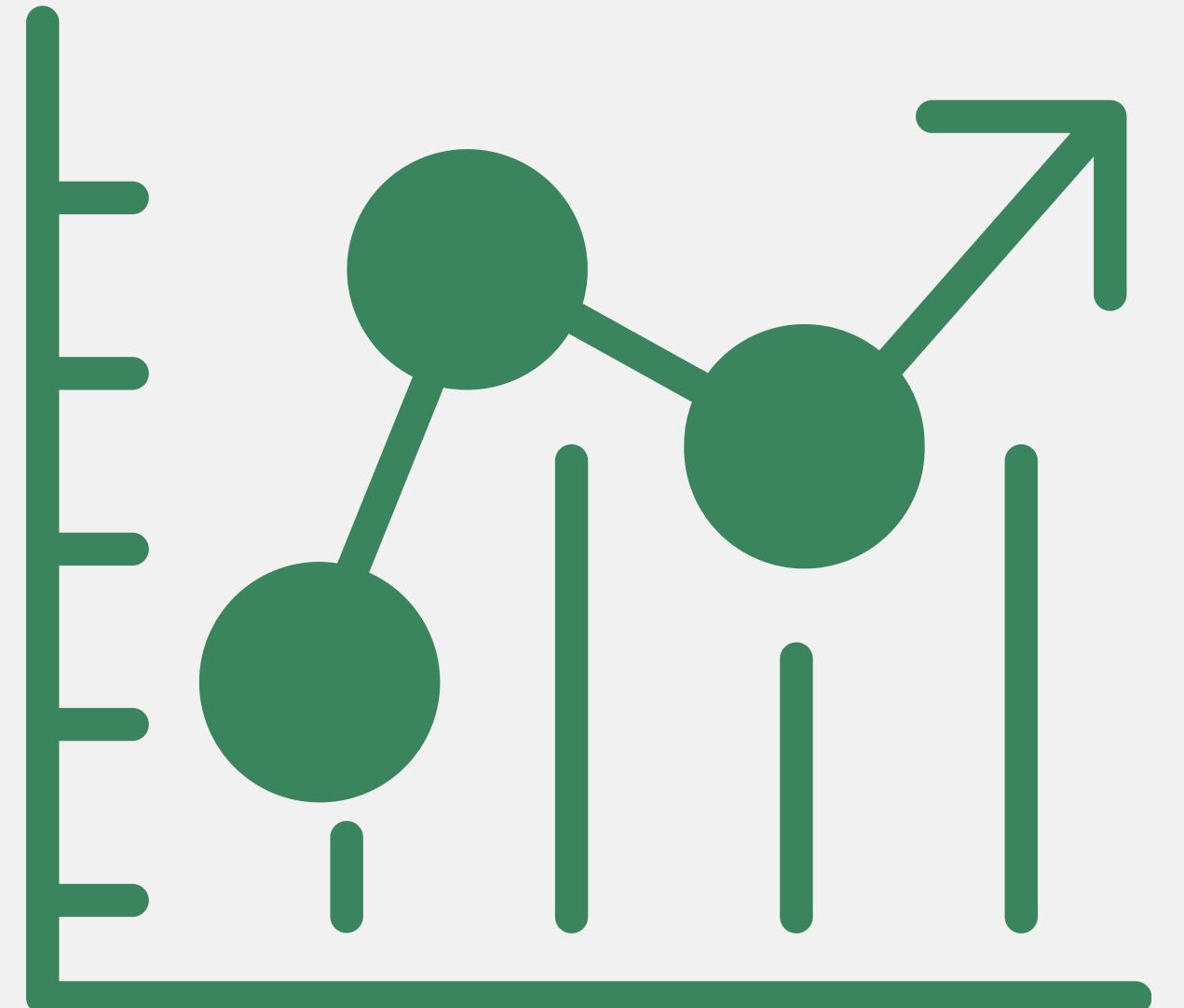
# Problem Statement

## Research Questions:

1. How much food is wasted annually in NYC, and how has this changed over the years?
2. Which boroughs generate the most food waste?
3. What factors contribute to higher food waste in specific boroughs (e.g., population, income levels, restaurant density)?
4. How effective are NYC's food waste management programs in reducing waste?

## Supporting Questions:

1. How does food waste vary across different income groups in NYC?
2. Is there a relationship between restaurant density and food waste levels?



# Literature Review

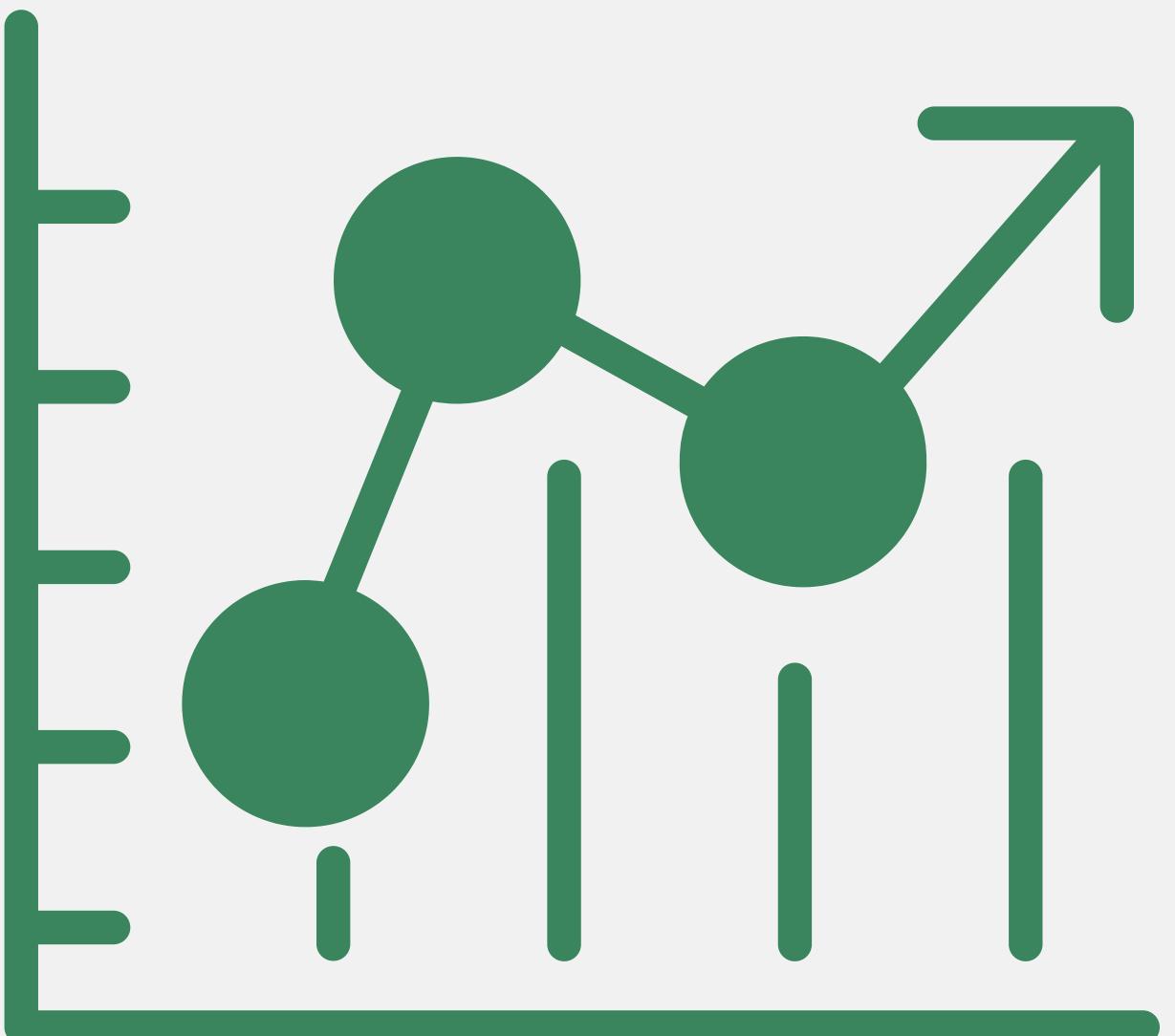
- “Food Waste in Urban Areas: A Spatial Analysis”  
by Eden Merkle (2019)

**Food waste is spatially uneven; tied to income & infrastructure.**

- “Food Waste at the Retail and Consumption Level” by Principato et al. (2015)

**Restaurants contribute heavily; behavior-focused solutions needed.**

Unlike prior work, our analysis uses NYC’s open data sources to forecast food waste, evaluate intervention programs, and provide borough-level policy guidance





# Data Sources

This research investigates food waste trends in New York City (NYC) from **2015 to 2025**.

## **Data Used:**

- DSNY Monthly Tonnage Data (Food Waste Volumes)
- DSNY Organics Collection Tonnages (Composed Values)
- Median Household Income Data (U.S. Census Bureau)
- Restaurant Density by Borough
- Population Density Data (NYC Population by Borough)

## **Dependent Variable:**

- Annual food waste (tons)

## **Independent Variables:**

- Median Income
- Restaurant Density
- Population Density

# Data Description

## 1. DSNY Monthly Tonnage Data (2015–2025)

Rows: ~6500+ (monthly per borough)

Key Columns: REFUSETONSCOLLECTED, RESORGANICSTONS, PAPERTONSCOLLECTED

Derived Column: Total\_Waste = Sum of tonnage fields per row

## 2. DSNY Organics Collection Tonnage (10 years)

Key Columns: DSNY, Non-DSNY, Total\_Organics

Used to calculate: Percent of Waste Composted annually

## 3. Median Household Income (ACS 2023)

Used to assess Correlation between: Income ↔ Waste

## 4. NYC Restaurant Inspection Results

Rows: 500,000+

Grouped by: Borough and Year (2015–2025)

Metric Used: Unique CAMIS IDs per borough = Restaurant Count

## 5. NYC Population by Borough (2020)

Rows Used: 5 (1 per borough)

Key Column Used: 2020 Population

Derived Column: Population\_Density = Population / Area (sq mi)

# Methodology

## Data Cleaning

Missing values were removed and numeric conversions applied.

## Exploratory Data Analysis (EDA)

To visually explore differences in waste over time and across boroughs.

## Correlation Analysis

Tested linear associations between food waste and predictors.

## Linear Regression Modeling

To measure how much each factor contributes to food waste.

## Poisson Regression

To validate results using a model suited for count data.

## K-Means clustering

Clustering for borough pattern segmentation



01.

Food waste would increase over time due to growing population and consumption



02.

Boroughs with more restaurants and lower income would generate more waste

03.

Composting would help reduce landfill waste

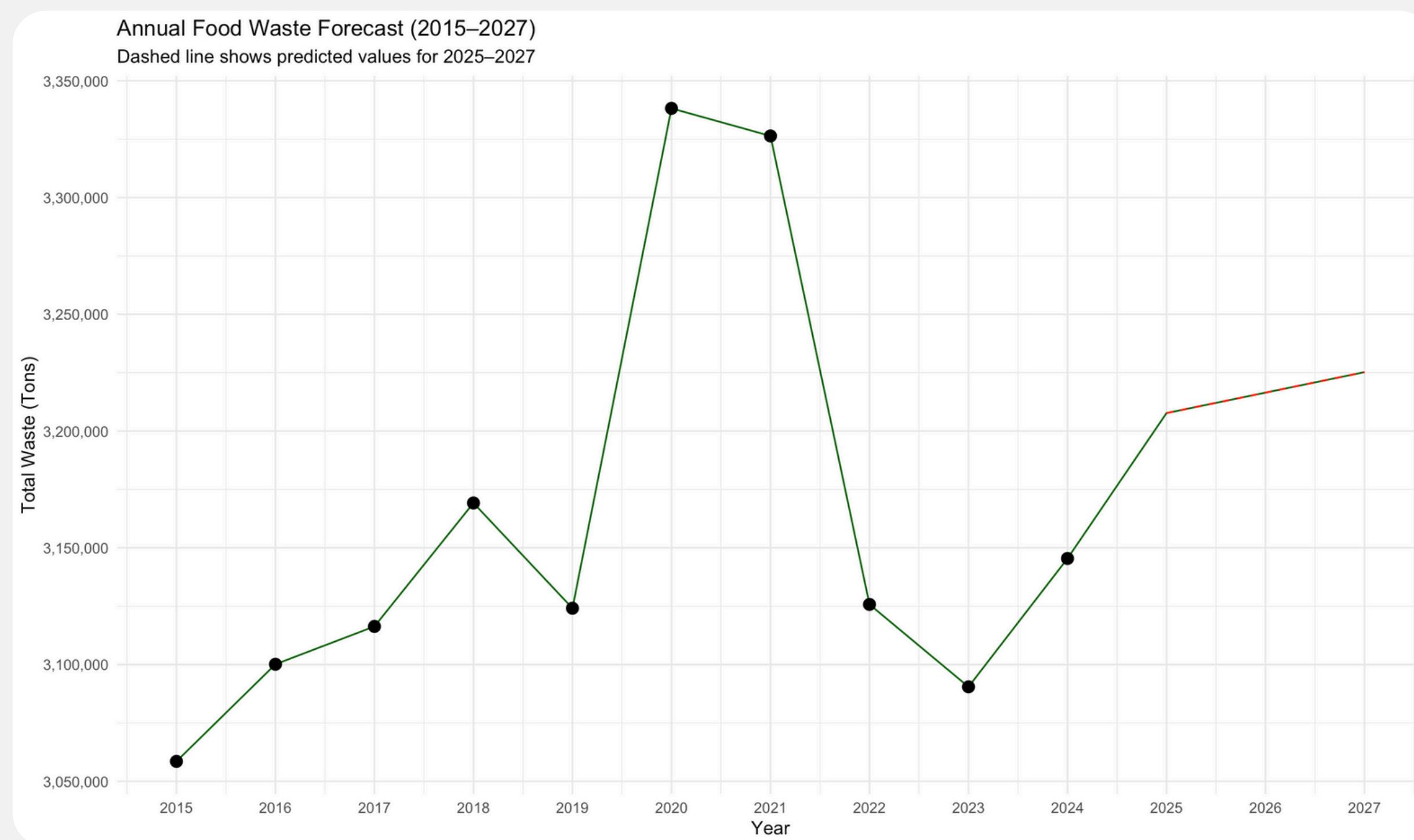
## Anticipated Hypothesis:

04.

Redistribution efforts like food banks could significantly help

# Annual Food Waste Trends (2015–2025)

## Linear Regression Model



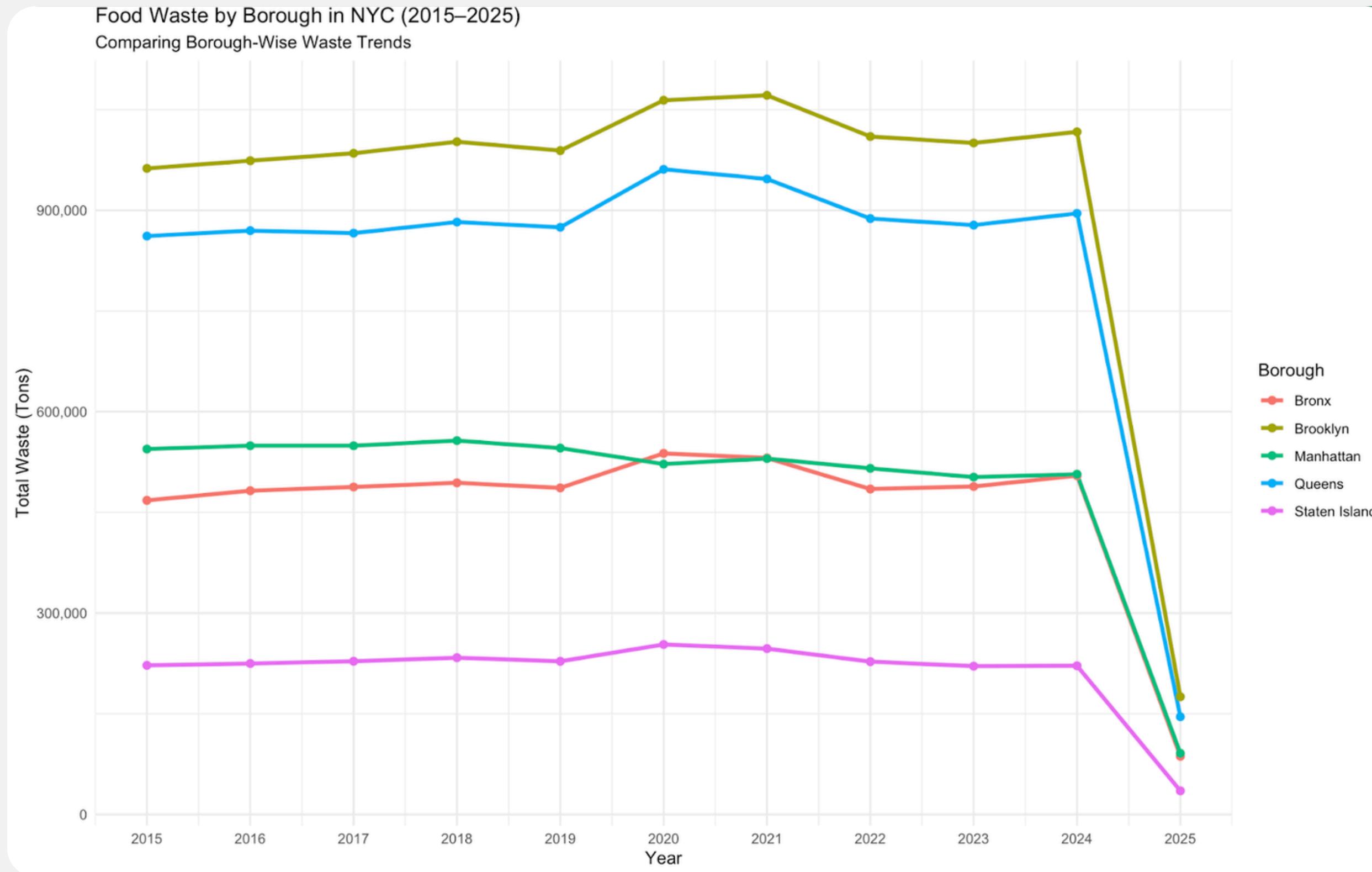
This chart shows annual food waste in NYC from 2015 to 2024 and a forecast through 2027 using linear regression.

R-squared (0.93) - explains 93% of the variation in food waste across boroughs.

RMSE of ~79,000 tons reflects the average prediction error, which is reasonable given NYC's ~3M ton scale.

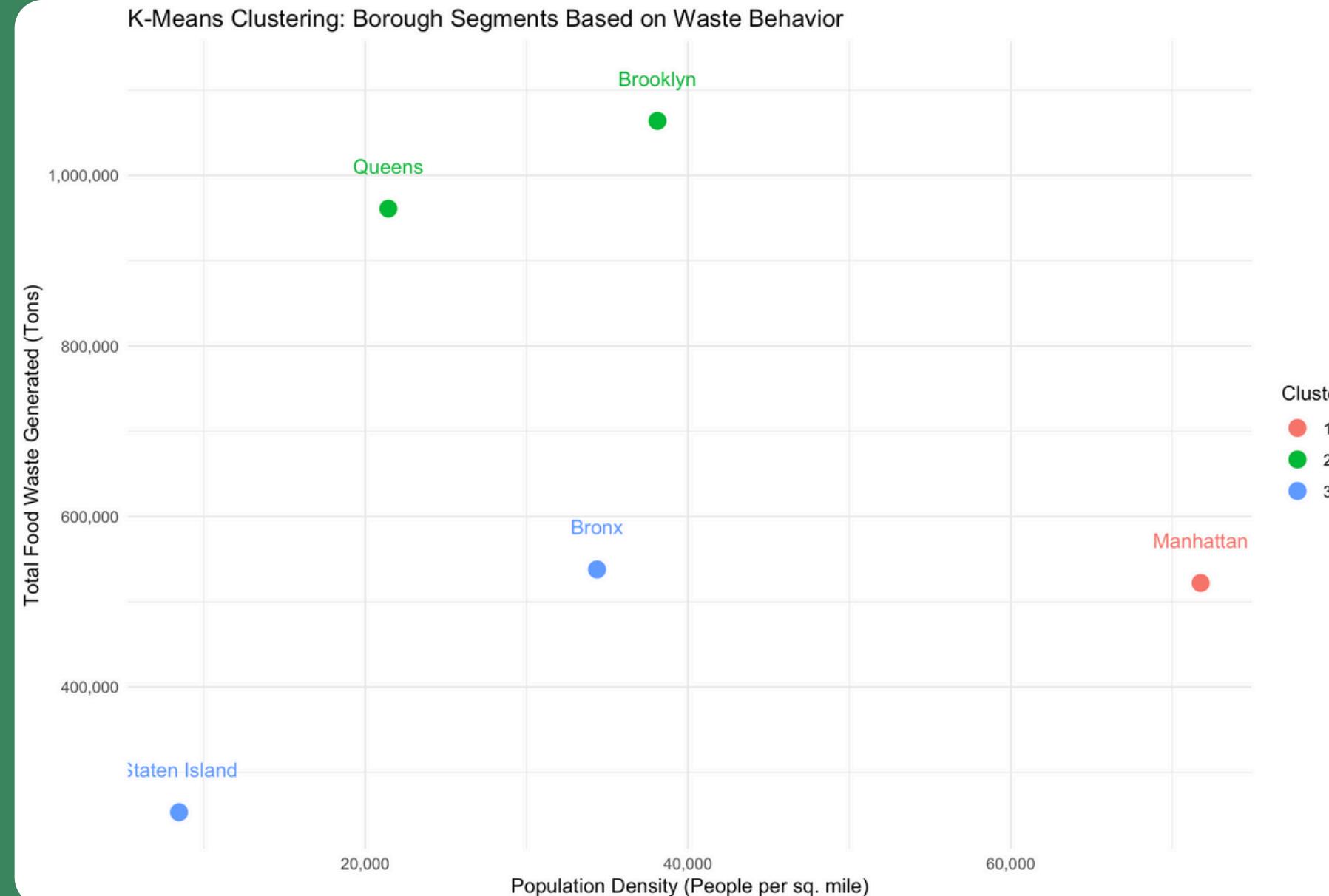
```
> predicted <- predict(model, newdata = final_model_data)
> actual <- final_model_data$Total_Tons
> rmse_val <- sqrt(mean((actual - predicted)^2))
> cat("RMSE:", rmse_val, "\n")
RMSE: 79438.07
> r_squared <- summary(model)$r.squared
> cat("R-squared:", r_squared, "\n")
R-squared: 0.9303582
> |
```

# Borough-Level Comparisons



Brooklyn and Queens generate the most food waste consistently across years, while Staten Island produces the least. These trends highlight the need for borough-specific waste reduction strategies.

# Food Waste vs Population Density by Borough

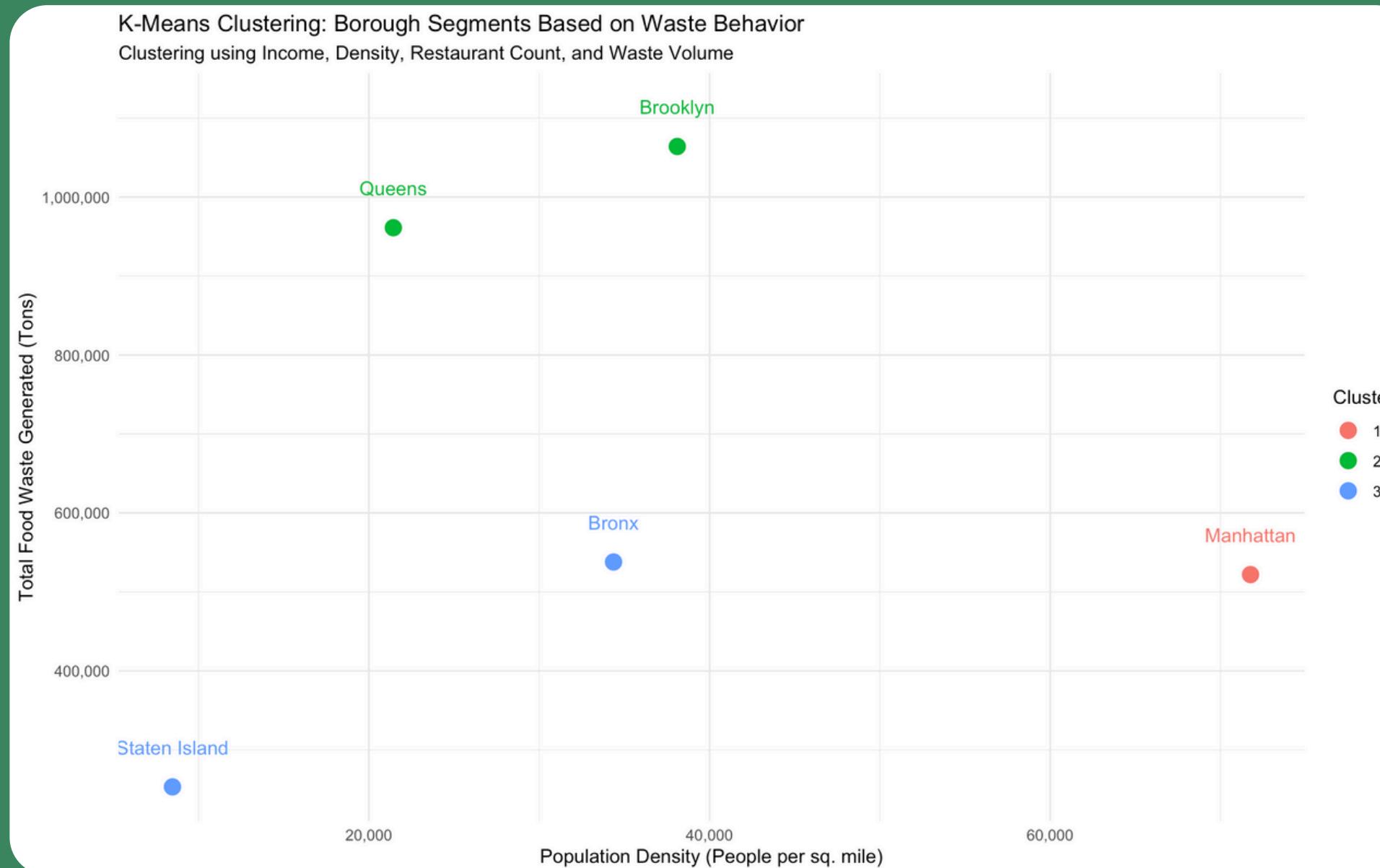


There is a **weak positive correlation** between population density and food waste.

While **Manhattan** has a significantly higher population than the **Bronx**, both boroughs exhibit similar levels of food waste. This suggests that population alone isn't the primary driver.

Other factors, such as **income** and **restaurant density**, may play a stronger role.

# Food Waste vs Restaurant Density by Borough



The positive correlation indicates that areas with higher restaurant density (like Manhattan and Brooklyn) produce more food waste. Bronx shows a particularly high waste output with a relatively low restaurant count.

```
# A tibble: 5 × 2
  Borough      Restaurant_Count
  <chr>           <int>
1 Bronx            2321
2 Brooklyn         6877
3 Manhattan        10358
4 Queens            6100
5 Staten Island     998
> |
```

# Socioeconomic Factors



- Restaurant count and food waste have a moderate positive correlation (0.45), suggesting that areas with more restaurants generate more food waste.
- Population density and food waste have a weaker correlation, indicating that density does not strongly impact food waste levels.
- Median income and food waste have a negative correlation, hinting that boroughs with lower income tend to generate more food waste, possibly due to higher consumption rates in lower-income areas.

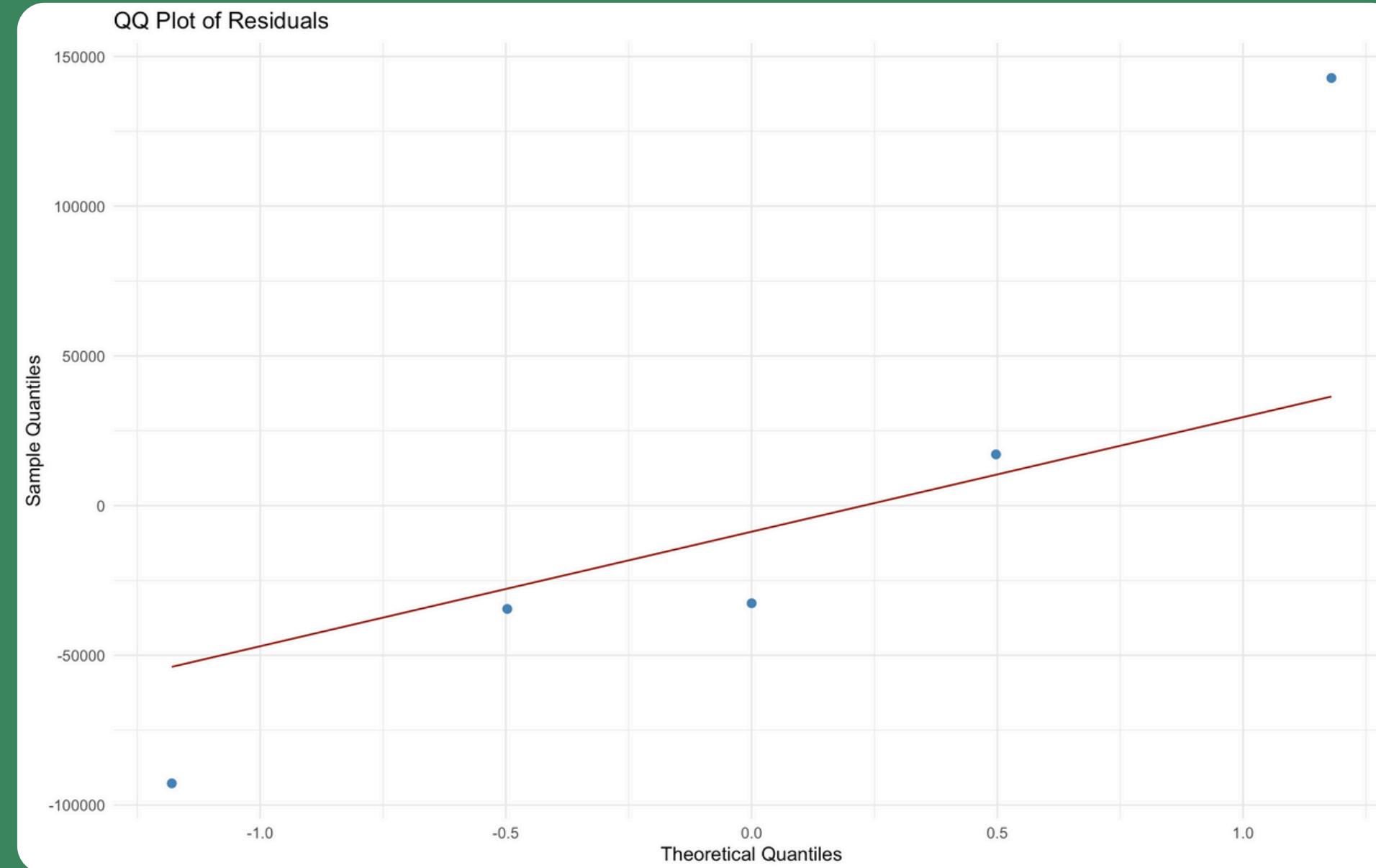
```
> model <- lm(Total_Tons ~ Median_Income + Population_Density + Restaurant_Count, data = final_model_data)
> summary(model)

Call:
lm(formula = Total_Tons ~ Median_Income + Population_Density +
    Restaurant_Count, data = final_model_data)

Residuals:
      1      2      3      4      5 
-32622 142816 -34521 -92775 17102 

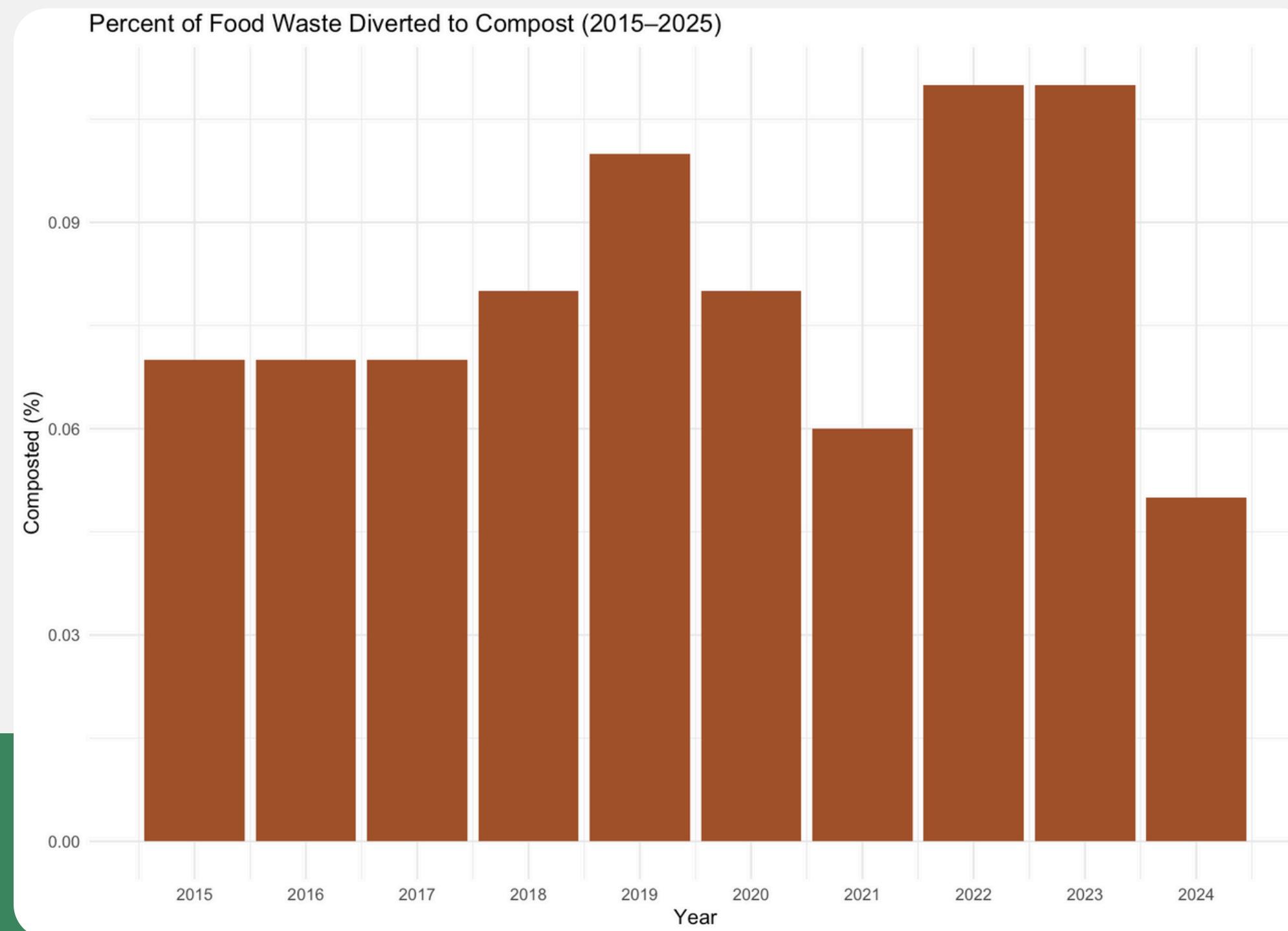
Coefficients:
            Estimate Std. Error t value Pr(>|t|)    
(Intercept) 1.443e+06 3.866e+05  3.734   0.167    
Median_Income -1.271e+01 4.969e+00 -2.558   0.237    
Population_Density -2.005e+01 7.276e+00 -2.756   0.222    
Restaurant_Count  1.773e+02 5.015e+01  3.536   0.175    
                                                        
Residual standard error: 177600 on 1 degrees of freedom
Multiple R-squared:  0.9304, Adjusted R-squared:  0.7214 
F-statistic: 4.453 on 3 and 1 DF,  p-value: 0.3321
```

# Residual Plot for Linear Regression



Residuals are fairly centered around zero, indicating a good model fit. The absence of strong patterns suggests linear regression assumptions are reasonably met despite a small sample size.

# Percent of Food Waste Diverted to Compost (2015–2024)



This bar chart displays the percentage of food waste diverted to composting.

NYC's composting efforts improved after 2021, peaking in 2023. However, the drop in 2024 reflects inconsistent program participation or implementation, signaling the need for stability and better outreach.

# Results

```
> summary(poisson_model)

Call:
glm(formula = Total_Tons ~ Median_Income + Population_Density +
    Restaurant_Count, family = poisson(link = "log"), data = final_model_data)

Coefficients:
            Estimate Std. Error z value Pr(>|z|)
(Intercept) 1.470e+01 2.938e-03 5003.0 <2e-16 ***
Median_Income -2.488e-05 4.595e-08 -541.5 <2e-16 ***
Population_Density -2.824e-05 4.712e-08 -599.3 <2e-16 ***
Restaurant_Count 2.962e-04 3.967e-07 746.7 <2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1

(Dispersion parameter for poisson family taken to be 1)

Null deviance: 711762  on 4  degrees of freedom
Residual deviance: 29521  on 1  degrees of freedom
AIC: Inf

Number of Fisher Scoring iterations: 4

> |
```

To confirm results, a Poisson regression was run. All predictors remained statistically significant, reaffirming that restaurant count is positively associated with food waste, while income and density reduce it.

01.

High restaurant density significantly influences borough food waste.

02.

Wealthier boroughs have marginally better waste management or awareness.

03.

Population density's weaker influence highlights other socioeconomic factors' significance.

# Conclusion

In conclusion, food waste in NYC is still a major issue, with borough-level differences driven by restaurants and income.

While composting is on the rise, it's not enough yet. Moving forward, city agencies need targeted policies, stronger restaurant partnerships, and more consistent diversion programs.





Thank you  
very much!