# Living in an Urban Growth Boundary

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# What is an Urban Growth Boundary?

- An Urban Growth Boundary puts geographical limits on how much a city can expand.
- The main goals of an UGB are to:
  - Prevent city sprawl
  - Promote smart, inward growth of cities
  - Prevent rural environmental destruction

- UGB Cities:
  - San Jose, Miami, Honolulu, Seattle, Portland, St. Paul, Minneapolis, Lexington, Boulder, Virginia Beach

# Study set

- Top 100 U.S. cities by population
  - U.S. Census (2010)
- Cities within the top 100 that have a UGB
  - Researched and manually compiled a list
  - Pulled data from Top 100 U.S. Cities

# Hypothesis and Summary

- Because inward growth is necessitated in cities with a UGB, we hypothesized that these cities would be more densely concentrated and living would be more urban-centric.
  - 4 topics for study:
    - Housing
    - Transportation
    - Population Growth
    - Population Density

# Question 1: Housing

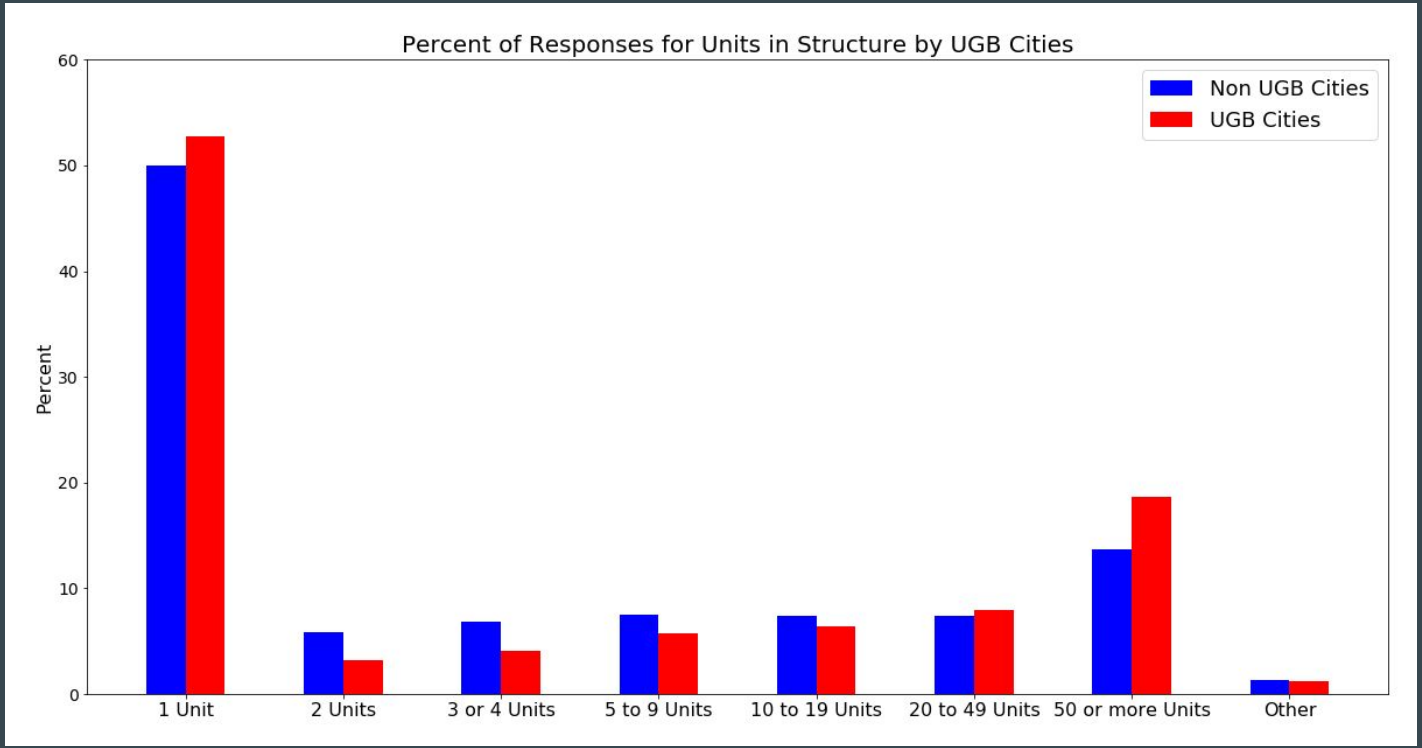
A) Do cities with a UGB have more multi-unit structures than non UGB cities?
B) Do cities with a UGB have higher overall cost of housing than non UGB cities?

**Data Exploration and Clean-up:**

- Source: American Community Survey 1-year Data (2018) API from U.S. Census Bureau
- Using place and state FIPS codes for the top 100 cities, the API request called 2 variables from ACS: “Units in Structure” and “Median Housing Costs”
- Formatted data (renamed columns, changed data type), created UGB city identifier, and combined a few question options.

# A) Do cities with a UGB have more multi-unit structures than non UGB cities?

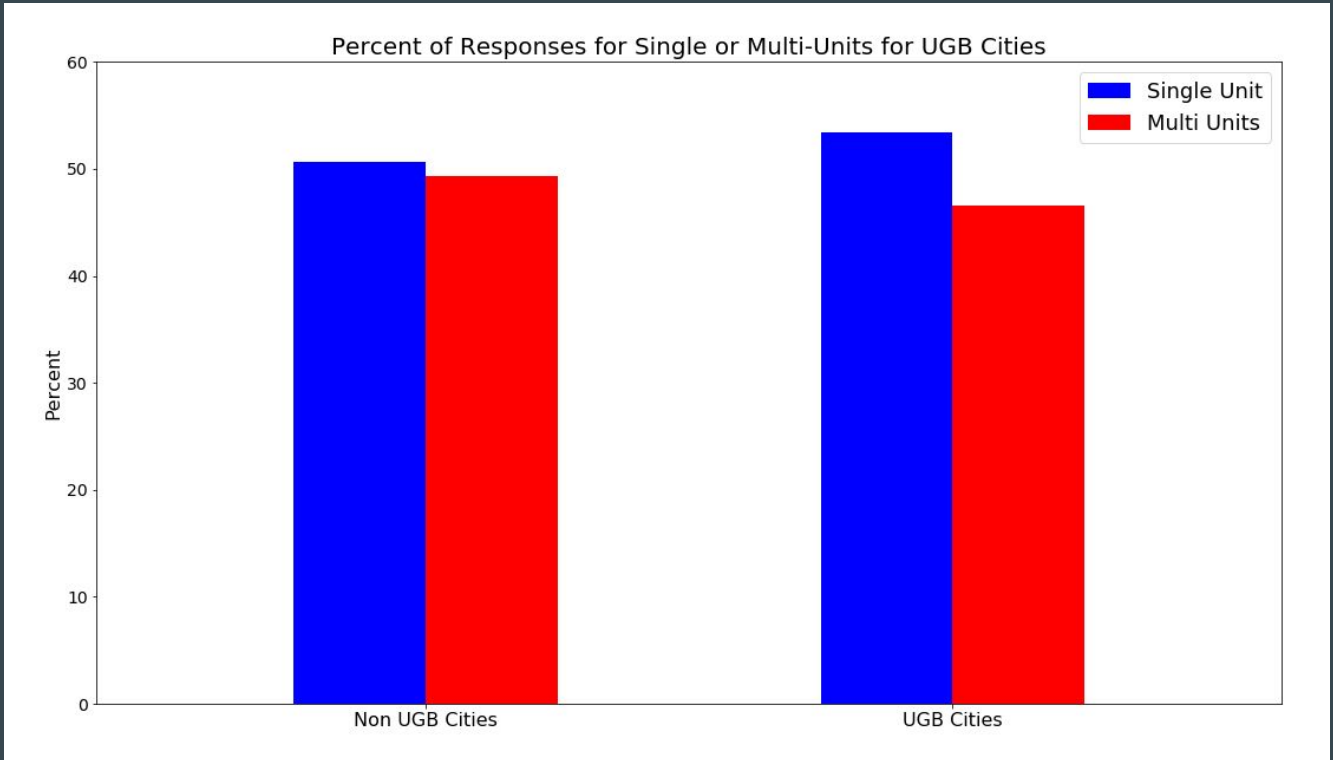
## Summary of responses to ACS question: How many units in structure?




Notes: "1 unit" includes "1, attached" and "1, detached". "Other" includes "mobile home" and "boat, RV, van, etc.".
Source: American Community Survey 1-Year data (2018).

# A) Do cities with a UGB have more multi-unit structures than non UGB cities?

Distribution of responses for single-unit or multi-unit structures




Source: American Community Survey 1-Year data (2018).

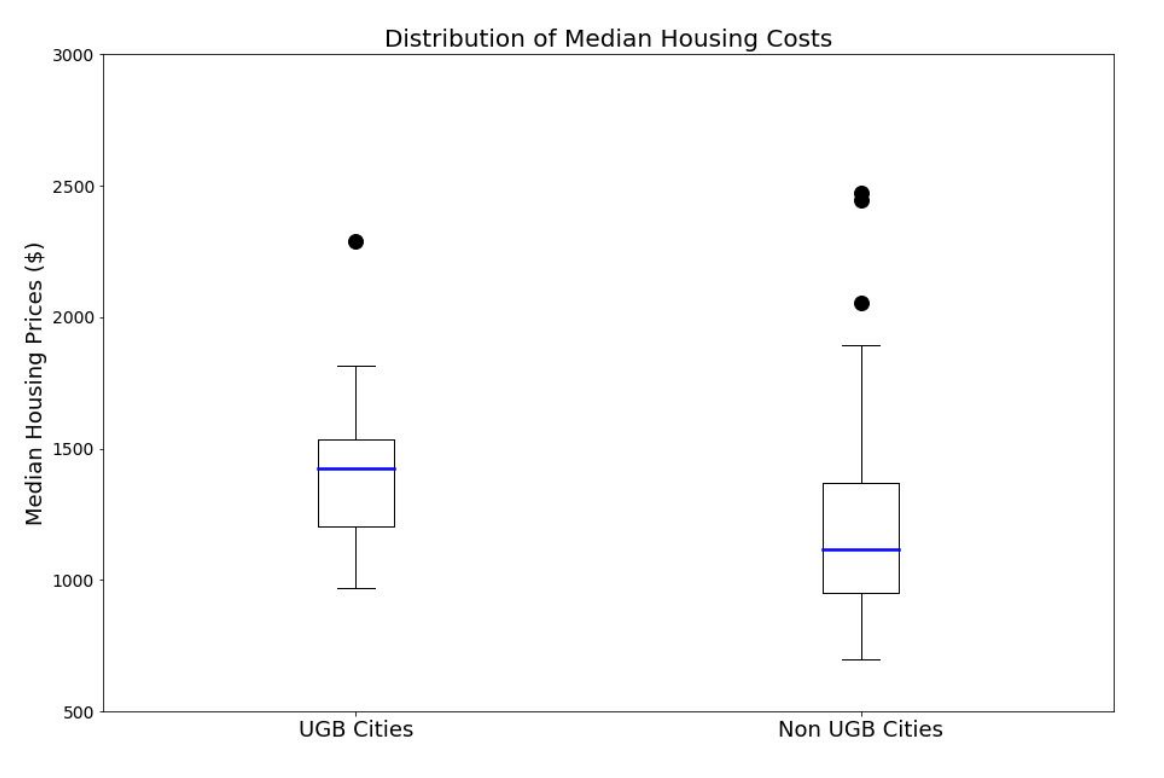
# Question 1 - A

**Do cities with a UGB have more multi-unit structures than non UGB cities?**

- Hypothesis: the distribution of responses for single-unit and multi-unit structures within UGB cities is no different than the distribution of responses for non UGB cities
- Analysis: chi-squared goodness of fit (used non UGB cities ratio to calculate expected values)
- Results: reject null hypothesis
    - critical value = 3.84, statistic = 5940.80, p-value < 0.05
- Conclusion: there is a statistically significant difference between the distribution of single-unit and multi-unit structures within UGB cities than what would be expected.

## B) Do cities with a UGB have higher overall cost of housing than non UGB cities?

Distribution of responses to ACS variable: Median Housing Costs




Source: American Community Survey 1-Year data (2018).

# Question 1 - B

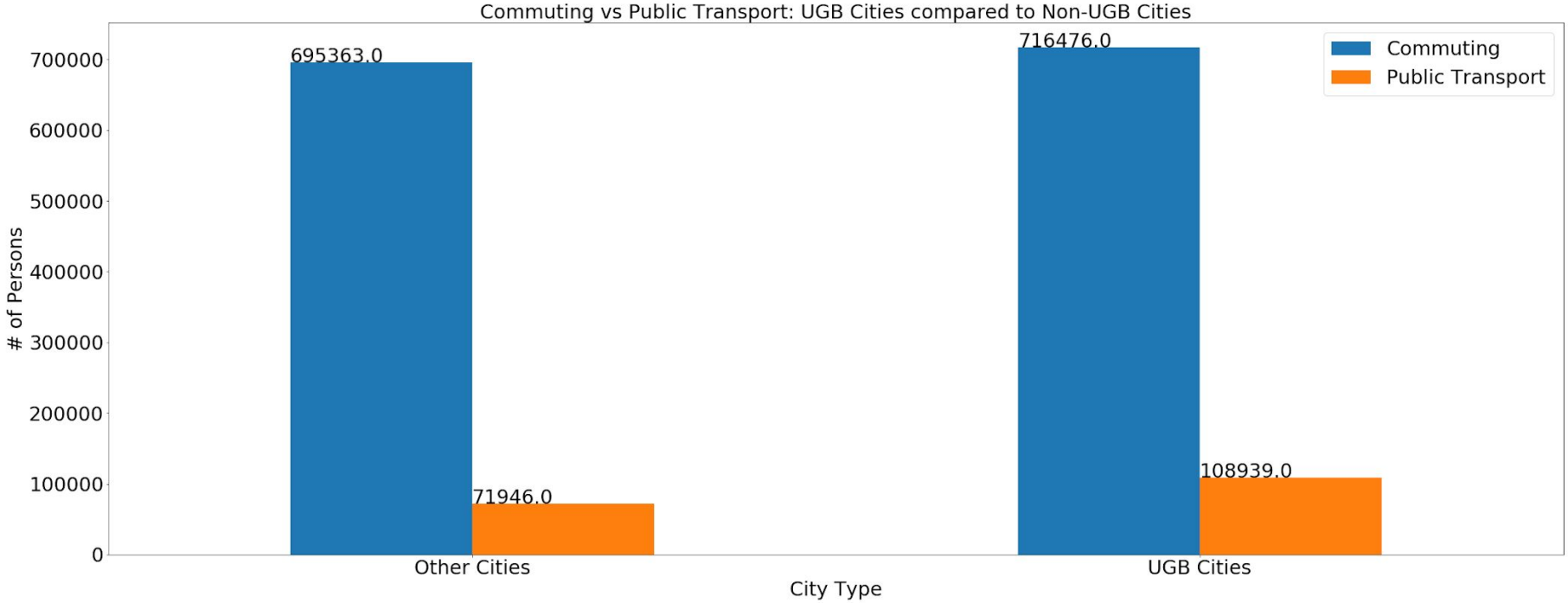
**Do cities with a UGB have higher overall cost of housing than non UGB cities?**

- Hypothesis: the median housing costs for UGB cities is no different than median housing costs for non UGB cities
- Analysis: independent t-test
- Results: fail to reject null hypothesis
    - t-statistic = 1.79, p-value = 0.1057
- Conclusion: there was insufficient evidence to conclude that there is a difference between the median housing costs between UGB cities and non UGB cities.

# Question 2: Transportation

**Do Residents in UGB Cities use Public Transportation more than those in non-UGB Cities?**

- Hypothesis: there is no correlation between the type of city (UGB or non-UGB) and the percentage of residents who utilize public transportation compared to commuting.
- Pulled data for top 100 cities from The Federal Transit Administration National Transit Database
- Method:
  - Grouped data (.cvs file) in pandas by “UGB” and combined types of commuting and types of public transport for totals of each type.
  - calculated the averages (mean) of commuting and public transport for UGB cities vs. other cities and percentages


Commuting vs Public Transport: UGB Cities compared to Non-UGB Cities
# of Persons
City Type
Other Cities
UGB Cities
Commuting
Public Transport
695363.0
71946.0
716476.0
108939.0
0
100000
200000
300000
400000
500000
600000
700000

# Question 2

- Results: Residents of UGB Cities do utilize public transportation more than residents of other top 100 cities (13% in UGB compared to 7% in other cities)

- Conclusion: The percentage of UGB residents using public transportation is significantly higher than percentage of residents in non-UGB cities.

- Limitations: this does not take into account the availability or access to public transportation which could impact the ratios. This data also does not indicate number of vehicles in the city, just used methods of transportation.

# Question 3: Population Growth

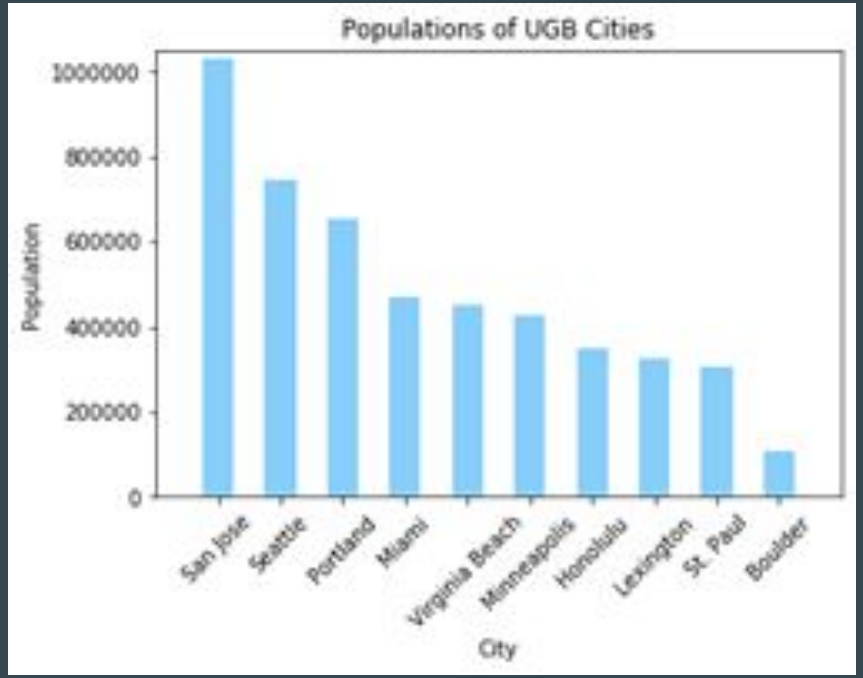
- Do UGB cities have lower population growth than the top 100 US cities? Lower than the the average US population growth?

Data Exploration and Clean-up

- Sources:
  - https://console.cloud.google.com
    - Google Places API for heatmap of population growth
  - https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk
    - CSV files from census for population statistics and population growth of cities
  - https://www.multpl.com/us-population-growth-rate/table/by-year
    - Total estimated US population and population growth for 2017-2018
- Clean-up/Analysis
  - Created dataframes for UGB cities and the Top 100 population cities in US
  - Merge population and growth dfs, eliminate repeat/extraneous columns
  - Create summary tables for statistics, perform ind-Ttest, plot graphs and create heatmap

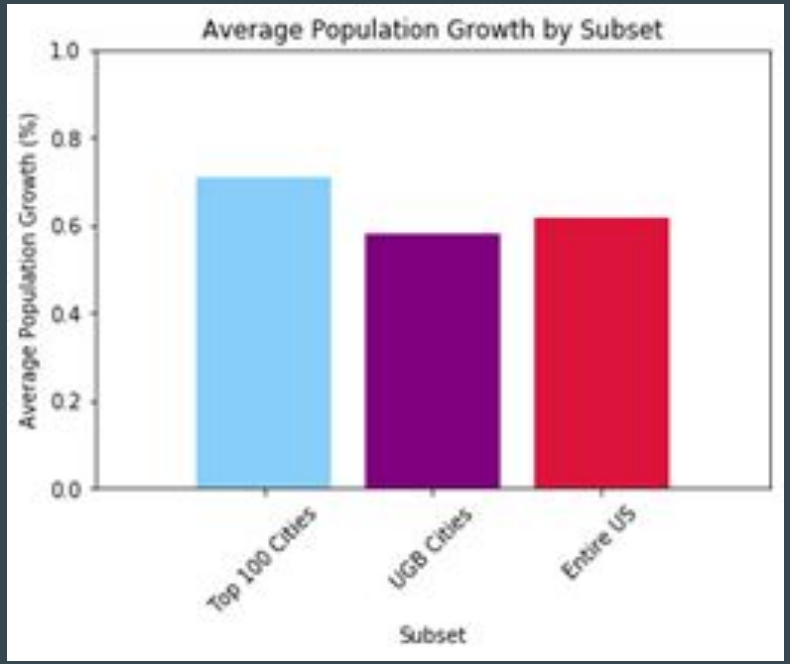
# Population of UGB Cities

- UGB average population: 486,092
- Top 100 Cities average population: 645,951
- Ind-Ttest: p-value = .21...
  - No significant difference in populations
  - This is good...and expected

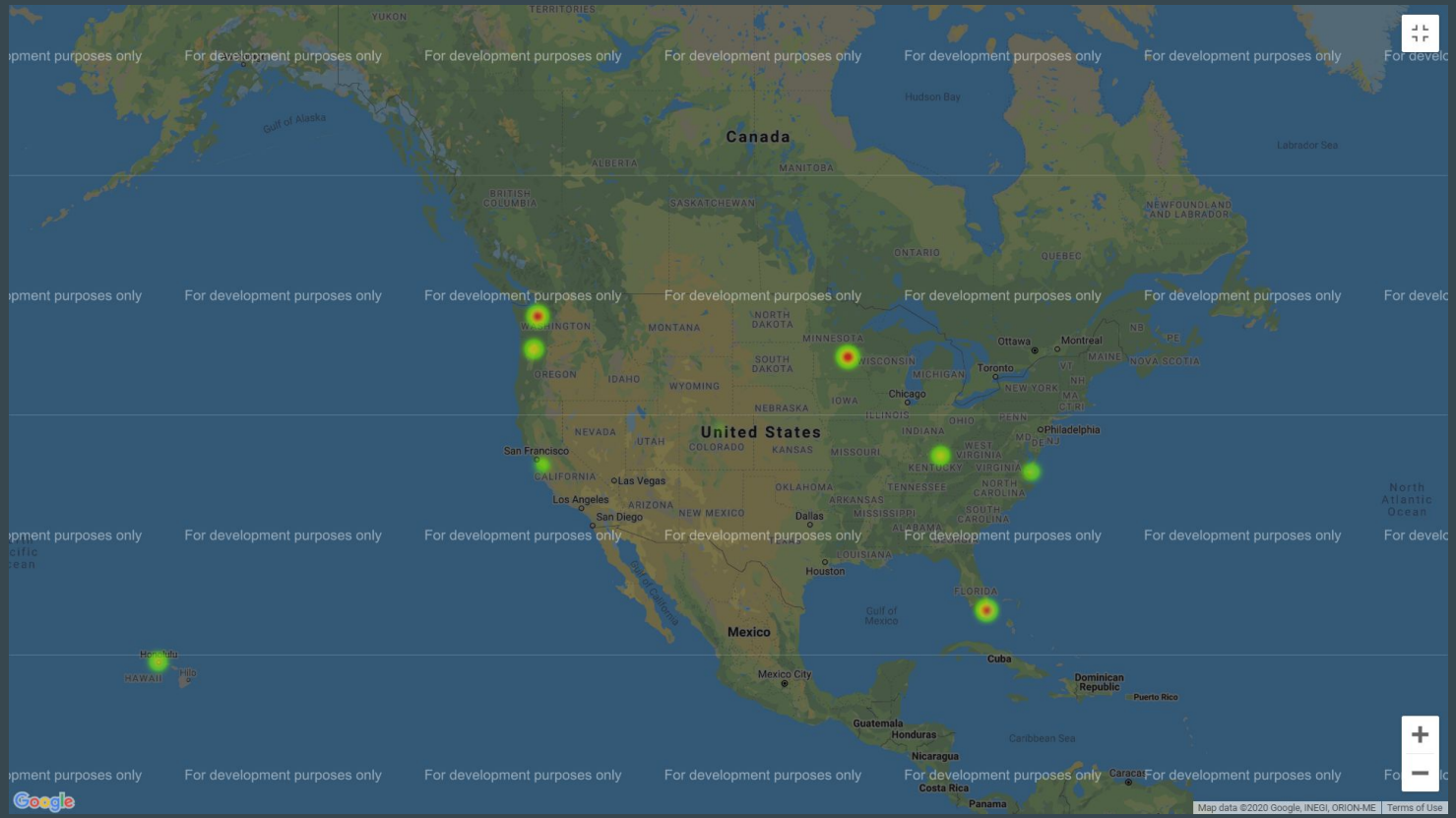


# Population Growth of UGB vs. Top 100 vs. USA

- Comparison of average population growth across 3 subsets
- UGB: .58%
- Top 100 Cities: .712%
- USA: .62%
- Applied to an average Top 100 City:
  - Population increases by
    - 3,746
    - 4,599
    - 4004
- Ind-Ttest (UGB vs. Top 100)
  - P-value = 0.67...



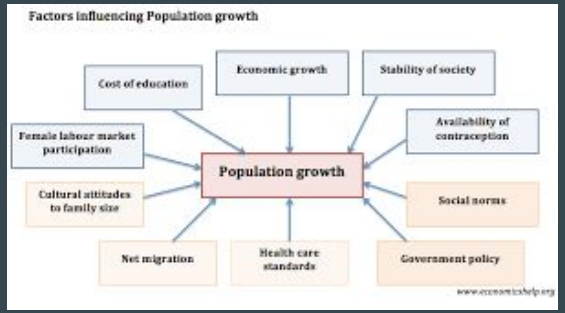
# Heatmap of UGB Cities Population Growth



# Population Growth Conclusions

Due to zoning laws restricting city expansion, UGB cities will have significantly lower population growths compared to their unrestricted Top 100 City counterparts.

- Cannot reject null hypothesis; IndTtest p-value = 0.67...
- No significant difference in population growth between UGB or Top 100 Cities
- The laws in place for creating UGBs are not limiting or dissuading people from living or moving to UGB cities; further exploration into hundreds of factors.



# Question 4: Population Density

- Do cities with a UGB have a higher population density than overall U.S. cities?

## Data Exploration and Clean up:

- Combined population csv with density csv
- Pulled out UGB cities
- Ran summary stats
- Sources : (simplemaps.com -used USGS and Census data)

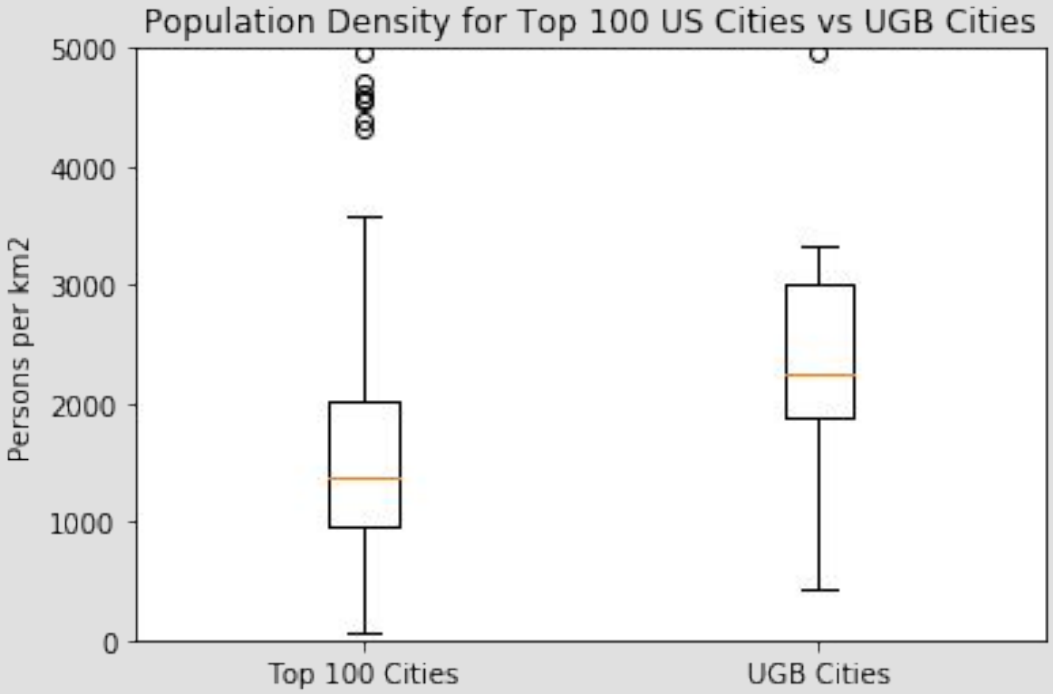
# Question 4: Data Analysis

- Used heat map to visualize population density
- Side-by-side boxplots comparing population density between U.S. cities and those with a UGB.
  - Top cities median : 1,386 // UGB median : 2, 667 persons per square km
- Ran an independent t-test :
  - T-stat = -1.778, p-value of 0.1016
  - cannot reject null hypothesis.

# Heat map


Blue markers = UGB cities

# Box plot


Population Density for Top 100 US Cities vs UGB Cities
Persons per km2
5000
4000
3000
2000
1000
0
Top 100 Cities
UGB Cities

# Final Conclusion and Discussion

- Overall, our analyses had insufficient evidence to conclude that there is a significant difference present between UGB cities and non UGB cities in the four topics: housing, transportation, population growth, and population density.
- These findings could suggest that even though cities with a UGB have more inward growth, the presence of a UGB does not affect daily living for the cities' residents.
- However, further research must be conducted.

# Difficulties/Post-Mortem

- Small sample size (Only 10 cities have a UGB and only 9 of these were present in our data set)
- Some cities without a UGB are constrained by other factors, such as the natural boundaries that constrain NYC.
- Numerous other factors contribute to population dynamics than boundaries
    - Unable to delve into all of them in scope of this project

# Resources

- American Community Survey 1-year Data (2018) API from U.S. Census Bureau
- 2018 State, County, Minor Civil Division, and Incorporated Place FIPS Codes from U.S. Census Bureau
- Simplemaps.com dataset
- https://console.cloud.google.com/
- https://factfinder.census.gov/faces/tableservices/jsf/pages/productview.xhtml?src=bkmk
- https://www.greenbelt.org/blog/urban-growth-boundaries-need/
- Federal Transit Administration 2018 Annual Survey https://www.transit.dot.gov/ntd/ntd-data