

Introduction to GIS
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Fall

Mapping San Francisco's Growth: An Exploration of Population, Income, and Land Use Dynamics

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Introduction

San Francisco has experienced significant population growth and economic prosperity in recent years. However, this growth has not been evenly distributed across the city. My study aims to explore the relationships between population growth, income distribution, and land use patterns in San Francisco using Geographic Information Systems (GIS) technology.

The rapid growth of San Francisco's tech industry has fueled economic prosperity, leading to a rise in housing costs and income inequality (City of San Francisco, 2023). This has resulted in concerns about displacement, affordability, and the changing character of neighborhoods (SF Planning, 2020). For the policy makers it is important to understand the spatial distribution of these factors in order to improve the future planning and make better development decisions.

My case study is seeking to solve the following questions: How have population density and income levels changed across San Francisco? Are there any spatial patterns or correlations between population growth, income distribution, and land use types? Can GIS analysis be used to inform strategies for promoting equitable and sustainable development in San Francisco? My study area will focus on the entire city of San Francisco in order to have a comprehensive understanding of the city's population and income growth dynamics and land use spatial patterns.

In general, my case study goal is to help people have a better understanding of the complex relationships between population growth, income, and land use is essential for

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promoting equitable and sustainable development in San Francisco. This study aims to contribute valuable insights and thoughts that can improve some continuing or if other policies need to be proposed and plan the city more strategically so that all residents will benefit from the city's growth in the long run.

Methods

This study uses publicly available data from the City of San Francisco's Open Data Portal for population estimation growth and the data set named SFDPH reporting - geography population estimates from 2016 to 2021. For the census income data set is named B27015 Health Insurance Coverage Status and Type by Household Income in the Past 12 Months ACS 5 years 2015. Those two tables were joined. In the meantime, the land square feet used for the 2020 shape file named Land Use from City of San Francisco's Open Data has also been imported to the geodatabase.

For more specific data processing and analysis, the water part in the original San Francisco has been clipped so that the city map can be presented more concisely and organized. Population and income difference tables have been joined. For the land map use creation, the union tool has been applied in San Francisco population growth feature and land use feature and output as San Francisco building after that calculating geometry attributes for calculating building square feet in the city has been used so that how much land use can be summarized.

The preliminary analysis of the data reveals several interesting observations: Areas of high population growth estimation tend to be located in central and eastern San Francisco, while areas of low population growth estimation are located in the western and southern parts of the city. There is a positive correlation between household income and population density since I chose the income level \$100,000 or above \$100,000 and Income level under \$25,000 to observe, the result suggesting that wealthier neighborhoods tend to be denser. However, with lower income areas, there is less population growth and tends to be more clustered in the San Francisco downtown

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area. For San Francisco land use is concentrated in the downtown core and along major transportation corridors, while residential land use is more dispersed throughout the city except Piers, Golden Gate Park, Presidio Park and other recreation areas.

Results

San Francisco Income Population & Land Use Distribution

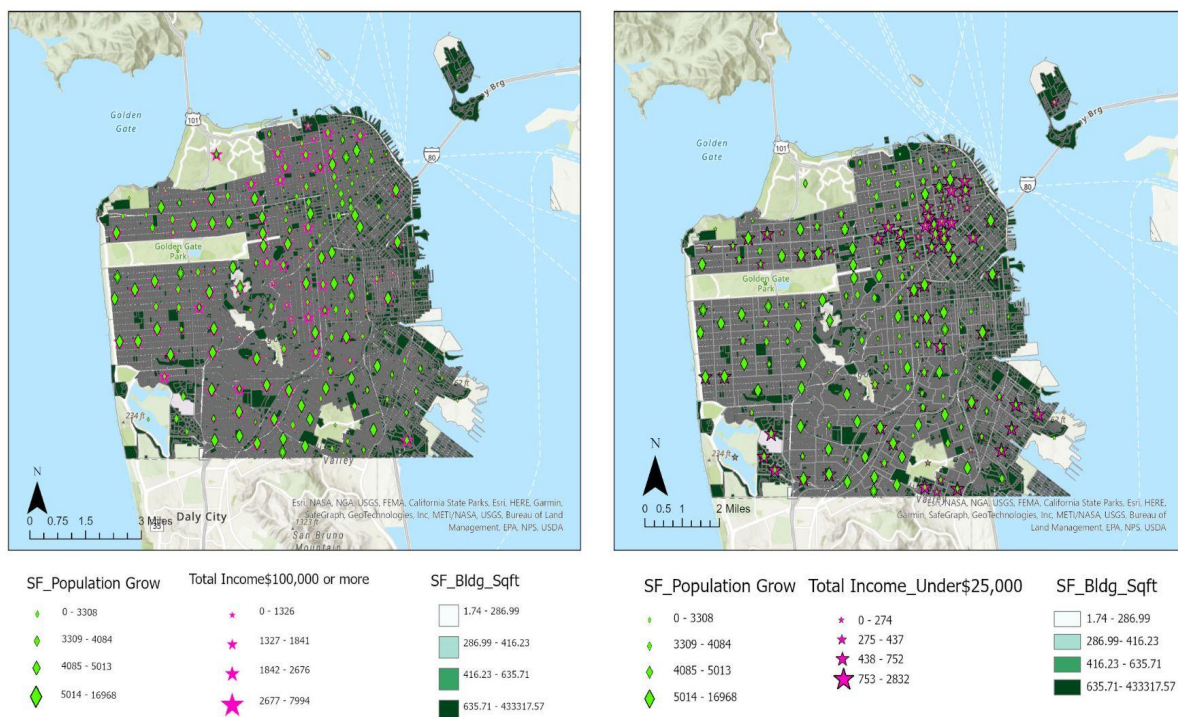


Figure 1: The Distribution of Income, Population Growth Estimation and Land Use In San Francisco

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For the first map, the areas where households' income level reaches \$100,000 and above are in Central and Western San Francisco and there also exhibit strong population growth estimation, the neighborhoods like parts of Richmond, SoMa, Mission Bay, Inner Sunset and some parts of Chinatown. The areas of high population growth generally correspond with high concentrations of wealthy households. In contrast, the second map, western and southern areas like Lakeside and areas closer to downtown where lower income levels have less population growth prediction. The land use for both maps above represents the total square footage of buildings in each census block, providing an indicator of land use intensity in San Francisco. The city is dominated by dense buildings, with few parks or lakes to offer residents respite, which likely contributes to the high rent.

Furthermore, from the maps dense development concentrates in the downtown core, encompassing areas like SoMa, Financial District, and Chinatown. This aligns with the areas of high population growth and income concentration. Less dense developments are more prevalent in western and southern neighborhoods, mirroring the areas with lower population growth and income levels. Interestingly, in the Inner Sunset, despite having a higher income level, a lower population growth rate appears. This may suggest a potential shift in demographics or housing types within the neighborhood.

The main takeaways are that San Francisco's population growth is unevenly distributed, with central and eastern neighborhoods experiencing significant surges, while western and southern areas slightly lag behind. Wealthy households tend to concentrate in areas with high population growth, highlighting a potential correlation between economic prosperity and population shifts. Land use patterns largely mirror population and income trends for the whole city.

The results have also raised crucial questions that warrant further investigation: The factors driving these uneven growth patterns and if the concentration of wealth in specific areas impact affordability and displacement? What kind strategies can be

implemented to ensure equitable and sustainable development that benefits all San Francisco residents in the long run.

Conclusion

San Francisco's recent growth paints a complex and multifaceted picture, as revealed by the intricate interplay between population shifts, income distribution, and land use patterns depicted in the provided maps. My case study discovered some key takeaways: The city population growth is far from uniform. The neighborhoods like SoMa and Mission Bay exhibit vibrant increases, fueled by the tech boom and economic prosperity. On the other hand, areas like the Outer Sunset and Richmond District experience stagnation or even decline, highlighting disparities in the city's growth trajectory.

There is a clear link emerging between areas of high population growth and concentrations of affluent households. For instance, SoMa and Mission Bay on both maps illustrate this trend, suggesting a potential correlation between economic prosperity and population shifts. Land use patterns largely mirror population and income trends for the entire San Francisco. The abundance of high-rise apartments and office buildings in the city, alongside the scarcity of parks and lakes, contributes significantly to the high cost of living. Intriguingly, the area like Inner Sunset has higher income but the population growth rate is lower. This hints at potential demographic shifts and worth further investigation.

In order to enrich the understanding of San Francisco's growth story, several contexts can be explored for further case study. Additional data sets, such as housing costs, education levels, and transportation patterns can be incorporated and it will provide a more comprehensive picture of the factors driving growth patterns and their impacts on different communities. Longitudinal analysis can also be applied for examining data over a longer time period and it will reveal the trends and shifts in population, income, and land use, allowing for deeper understanding of the city's

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dynamics and development. If possible, engaging with residents from diverse neighborhoods can provide valuable insights into the lived experiences of San Francisco's growth and inform policy decisions that promote equitable and sustainable development for all.

References

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<https://sf.gov/departments/city-administrator/datasf>
- SF Planning. (2020, October). TNCs and Land Use Planning.
https://sfplanning.org/sites/default/files/documents/citywide/TNCs-land-use/TNC_Land_Use_Study_2022.pdf
- FDPH reporting - geography population estimates from 2016 to 2021
https://data.sfgov.org/Economy-and-Community/SFDPH-reporting-geography-population-estimates/35v5-seg9/about_data
- Land Use 2020
<https://data.sfgov.org/Housing-and-Buildings/Land-Use/us3s-fp9q>

Links to Web Maps

<https://arcg.is/1e9anS>

<https://arcg.is/1eDCPm0>