

Urban greenery and land surface temperature

NASA Landsat Satellites

Landsat 5 and 8 are modern iterations of NASA's flagship optical Earth observation satellites. Landsat 5, launched in 1984, and Landsat 8, launched in 2013, provide time series data of the Earth's surface reflectance and land surface temperature at approximately two-week revisit intervals. Their surface reflectance and land surface temperature data allowed us to calculate trends in urban greening and heating over the San Francisco Bay Area for the duration of our study period (1990 - 2020). Trends for greening and land surface temperature were calculated at 30- and 120-meter spatial resolution, respectively.

- Landsat 5 DOI: <https://doi.org/10.5066/P9IAXOVV>
- Landsat 8 DOI: <https://doi.org/10.5066/P9OGBGM6>

USDA NAIP & ESA Sentinel-2

NAIP stands for the National Agricultural Imagery Program and is acquired every 3-years in California by the United States Department of Agriculture. This program provides visible and near-infrared aerial imagery at 1-meter spatial resolution. Sentinel-2 is the European Space Agency's (ESA) flagship optical Earth observation satellite. Sentinel-2 launched in 2015 and provides time series data of the Earth's surface reflectance in visible and near infrared at approximately two-week intervals. Sentinel-2 data is available at its native 10-meter spatial resolution.

NAIP and Sentinel-2 were used together to perform green space classification in the San Francisco Bay Area. Sentinel-2 time series starting in 2015 and NAIP survey imagery from 2020 and 2022 were used for the classification. To reconcile the varying spatial resolutions, we implemented a geographic object-based image analysis (GeOBIA) segmentation to collect spatial statistics of like-segments in our study area. We then performed image classification using statistics from these segmented images and resampled our final classification to 5-meter spatial resolution.

- NAIP DOI: <https://naip-usdaonline.hub.arcgis.com/>
- Sentinel-2 DOI: <https://sentinel.esa.int/web/sentinel/user-guides/sentinel-2-msi>

Socioeconomic indicators

The vector layers on the map aim to illustrate relationships between environmental variables (either greenness level or land surface temperature) and socioeconomic indicators. The socioeconomic variables are as follows:

1. **Social Vulnerability Index:** The CDC's 2018 [Social Vulnerability Index](#) assigns scores to tracts based on 15 variables from the U.S. census, including unemployment, minority status, and disability.

2. **High-income move-in rate:** This variable is calculated by determining the proportion of high-income renters in each census tract that moved *into* that census tract each year, and then taking the average of that proportion across three years (2017-2019). 'High-income' in this case is defined as having an income that is at least 120% of the yearly county Area Median Income.
3. **Low-income move-out rate:** This variable is calculated by determining the proportion of low-income renters in each census tract that moved *out* of that census tract each year, and then taking the average of that proportion across three years (2017-2019). 'Low-income' in this case is defined as having an income that is less than 80% of the yearly county Area Median Income.