

Quantifying Changes in Urban Tree Canopy Cover and Land Surface Temperature to Understand Their Impacts on Neighborhood Throughout Richmond, California



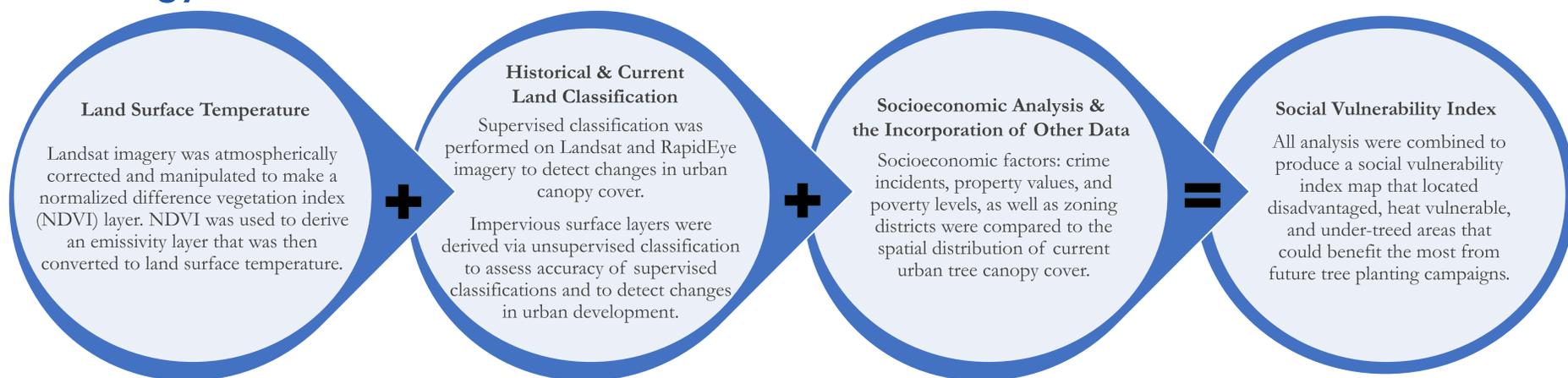
Abstract

With the aim of improving air quality and mitigating increases in land surface temperature (LST), the city of Richmond, California, and partnering organizations have planted 35,000 trees over the past decade. Groundwork Richmond (GR) a local partner, has approximately 22,000 tree planting opportunities to further increase the urban tree canopy (UTC). This project utilized a multi-resolution approach by leveraging Landsat 5 Thematic Mapper (TM), Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS), and Planet RapidEye satellite imagery to quantify the impact of Groundwork Richmond's tree planting campaigns. Historical analysis of Richmond between 1985 and 2015 revealed that a 6% increase in impervious surface area has been accompanied by an average change in LST of 6° F between 2015 and the 30-year mean. Current analysis quantified UTC cover for 2015 and 2017. Combining these findings with socioeconomic and demographic data, disadvantaged, tree deficient neighborhoods that are susceptible to high land surface temperatures were identified. The results of this project will help Groundwork Richmond determine if they are achieving canopy coverage and locate neighborhoods that could benefit the most from increased green infrastructure. Lastly, educational materials were produced that can be used during Groundwork Richmond's canvassing campaigns to educate the local community about the benefits of trees from a scientific perspective.

Objectives

- ▶ **Assess** and compare patterns of land cover, socioeconomic data and land surface temperatures
- ▶ **Locate** socioeconomically disadvantaged areas that are also vulnerable to increased LST and lacking urban canopy
- ▶ **Provide** Groundwork Richmond with educational materials incorporating project results to educate local community behind the benefits of trees

Methodology



Results

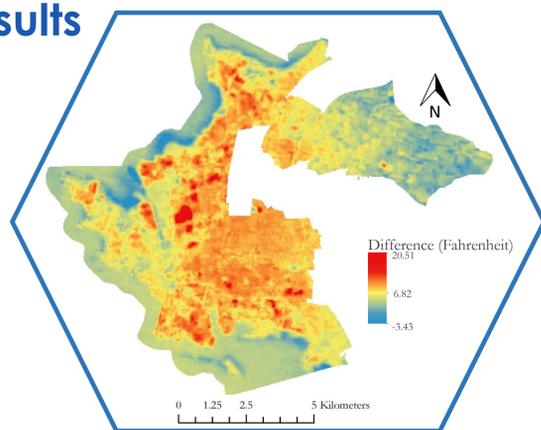


Figure 1. Difference in land surface temperature (LST) between 2015 and the 30-year mean (1985-2015). Red is warmer than average; blue is cooler than average.

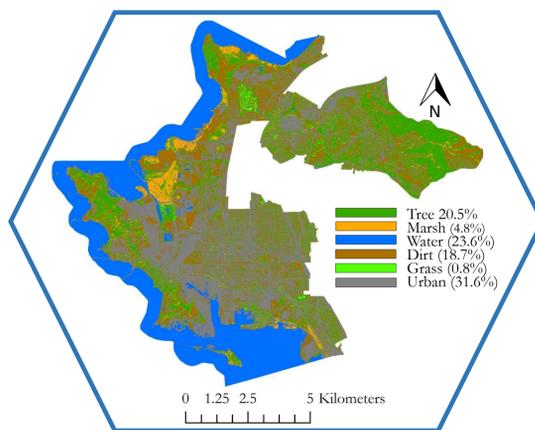


Figure 2. Land classification performed on imagery acquired in 2015 by the Planet RapidEye satellite constellation.

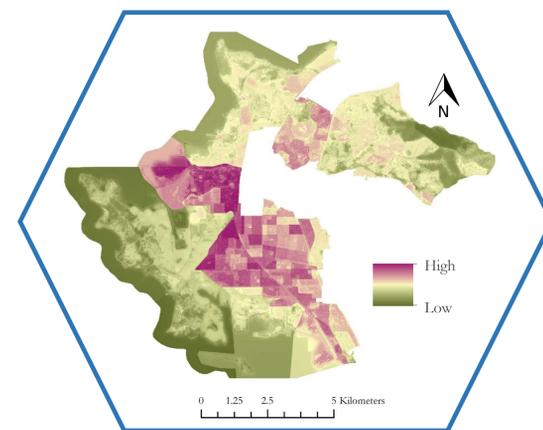


Figure 3. Social Vulnerability Index (SVI)
SVI = LST + impervious surface + zoning data + poverty level – property values – tree canopy.

Conclusions

- ▶ Area covered by impervious surfaces has increased by 6% between 1985 and 2015.
- ▶ Average difference in temperature between 2015 and the 30-year mean is 6 degrees Fahrenheit.
- ▶ Change in urban tree canopy cover between 2015 and 2017 is inconclusive.
- ▶ Social vulnerability index highlights communities that are under-treed, socioeconomically disadvantaged, and vulnerable to high heat exposure, thus making them areas that could benefit the most from future tree-planting campaigns.

Acknowledgements

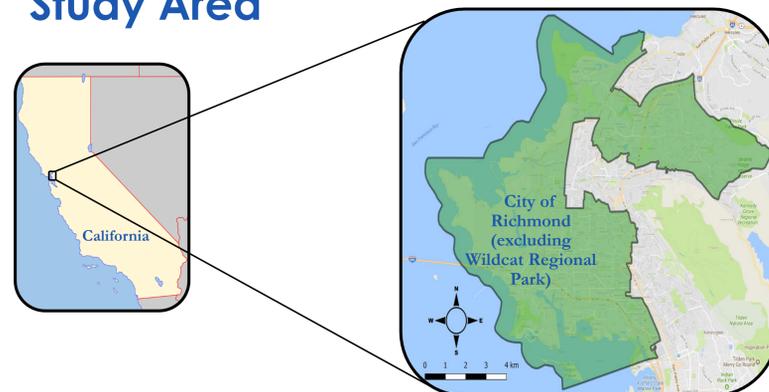
Science Advisor

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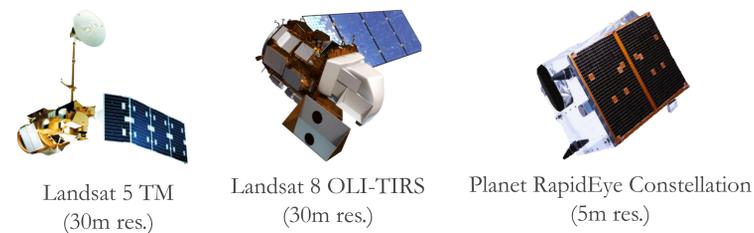
DEVELOP Staff at NASA Ames Research Center

- ▶ Jenna Williams (Center Lead)
- ▶ John Dilger (Geoinformatics Fellow)

Study Area



Earth Observations



Landsat 5 TM
(30m res.)

Landsat 8 OLI-TIRS
(30m res.)

Planet RapidEye Constellation
(5m res.)

Project Partner

Groundwork USA,
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