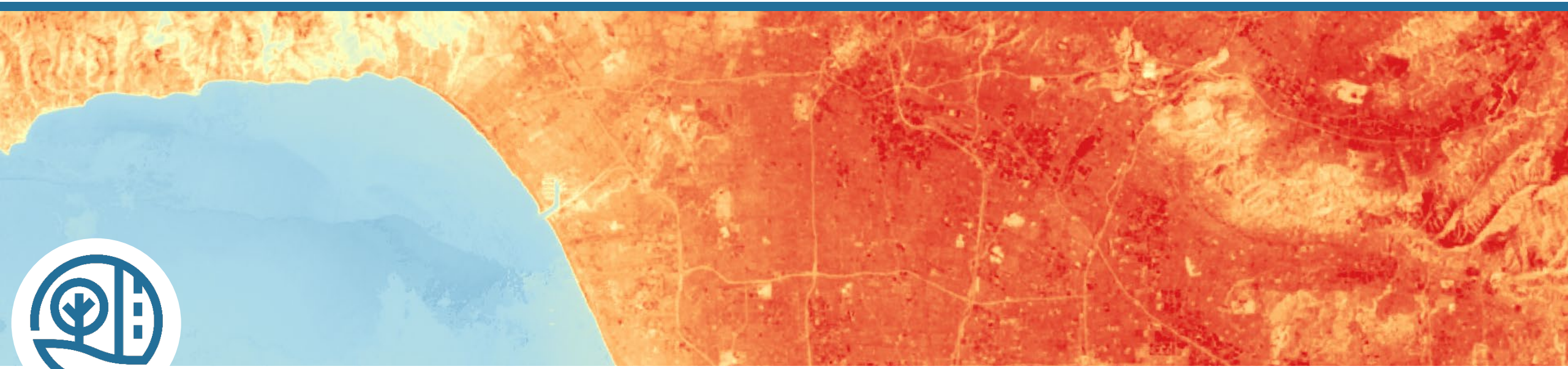
National Aeronautics and Space Administration



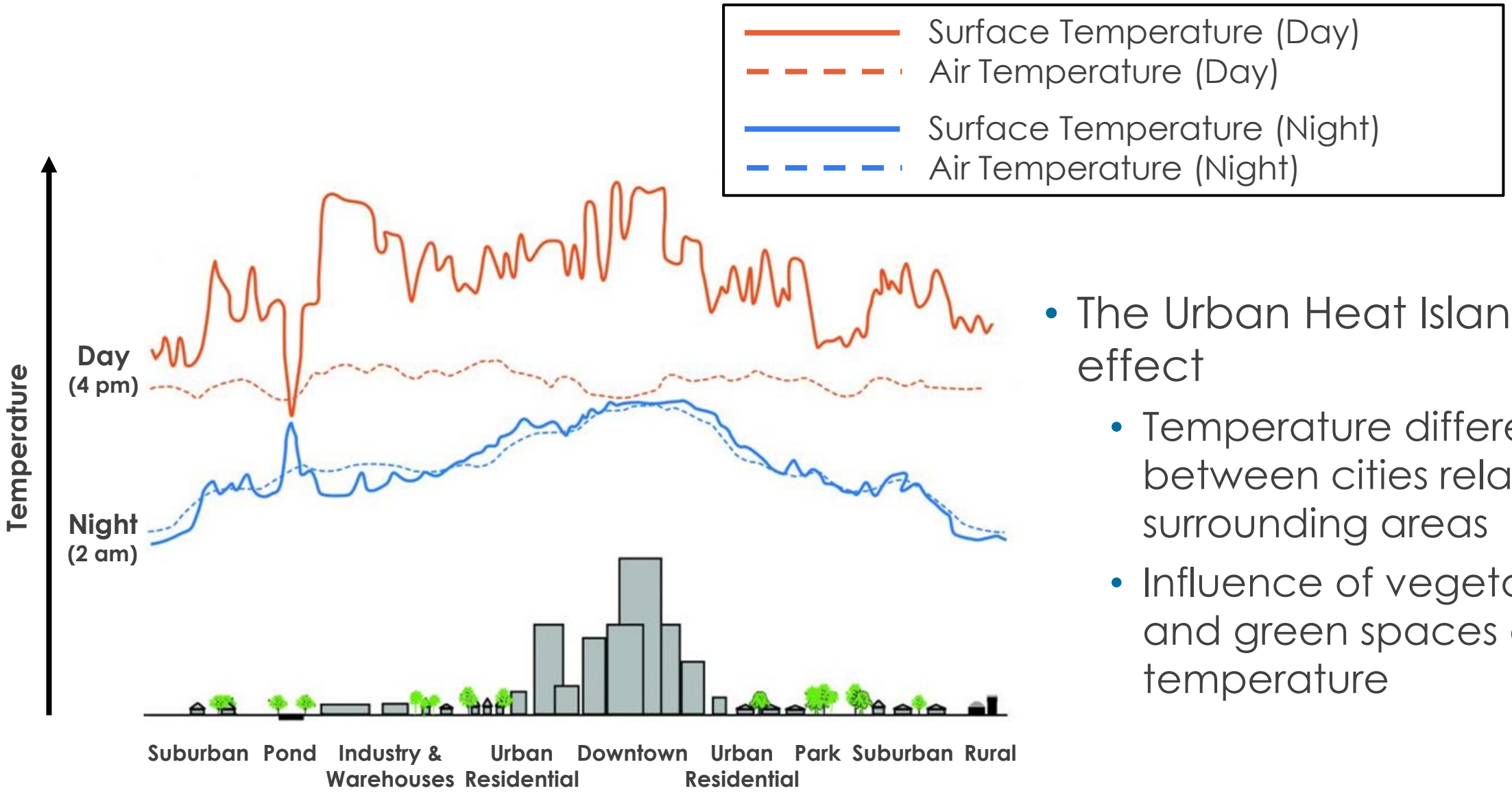
Los Angeles Urban Development

Utilizing NASA Earth Observations to Evaluate the Impact of Tree Coverage on Urban Heat Mitigation

Leyla Namazie • Julie Gevorgian • Theo Ross • Stephanie Hernandez

25TH EVELOP

BACKGROUND

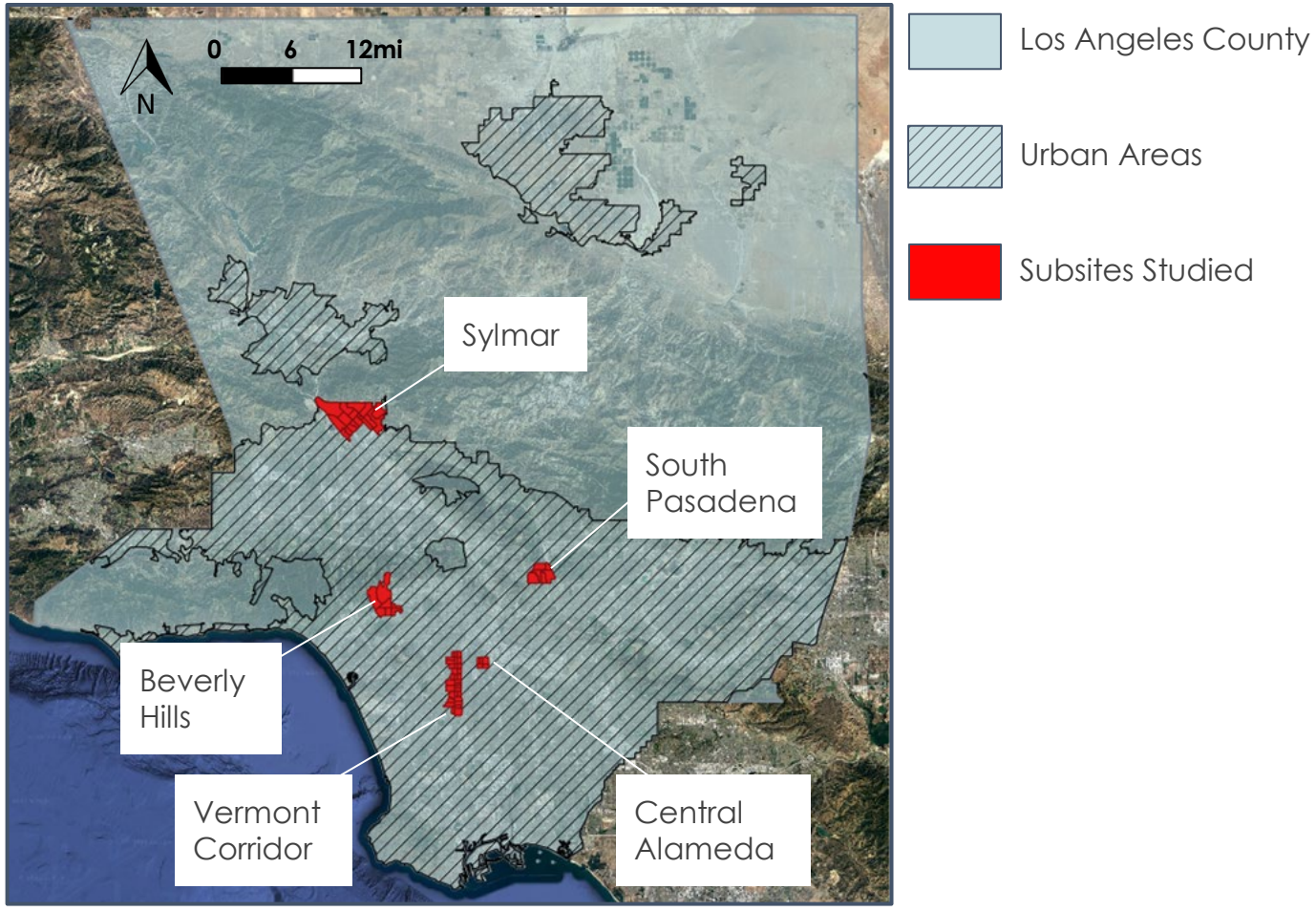


- The Urban Heat Island (UHI) effect
  - Temperature difference between cities relative to surrounding areas
  - Influence of vegetation and green spaces on temperature

Image Credit: Environmental Protection Agency

PROJECT LOCATION

- **Study Area:**
  - Los Angeles County, California
    - Population: 9.83 M (2022)
    - Has distinctive microclimates
  - 5 subsites of interest: Vermont Corridor, South Pasadena, Central Alameda, Sylmar, and Beverly Hills
- **Study Period:**
  - 2016 - 2022



PROJECT PARTNERS

In Collaboration With

- Los Angeles Water and Sanitation

End Users

- City Plants
- Los Angeles, Office of City Forest Management

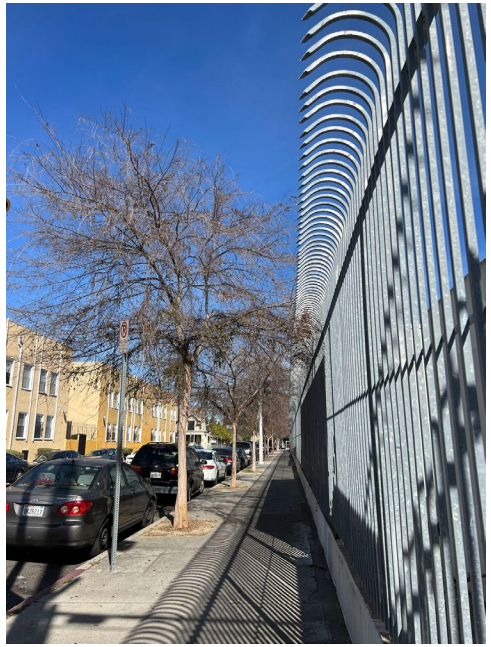
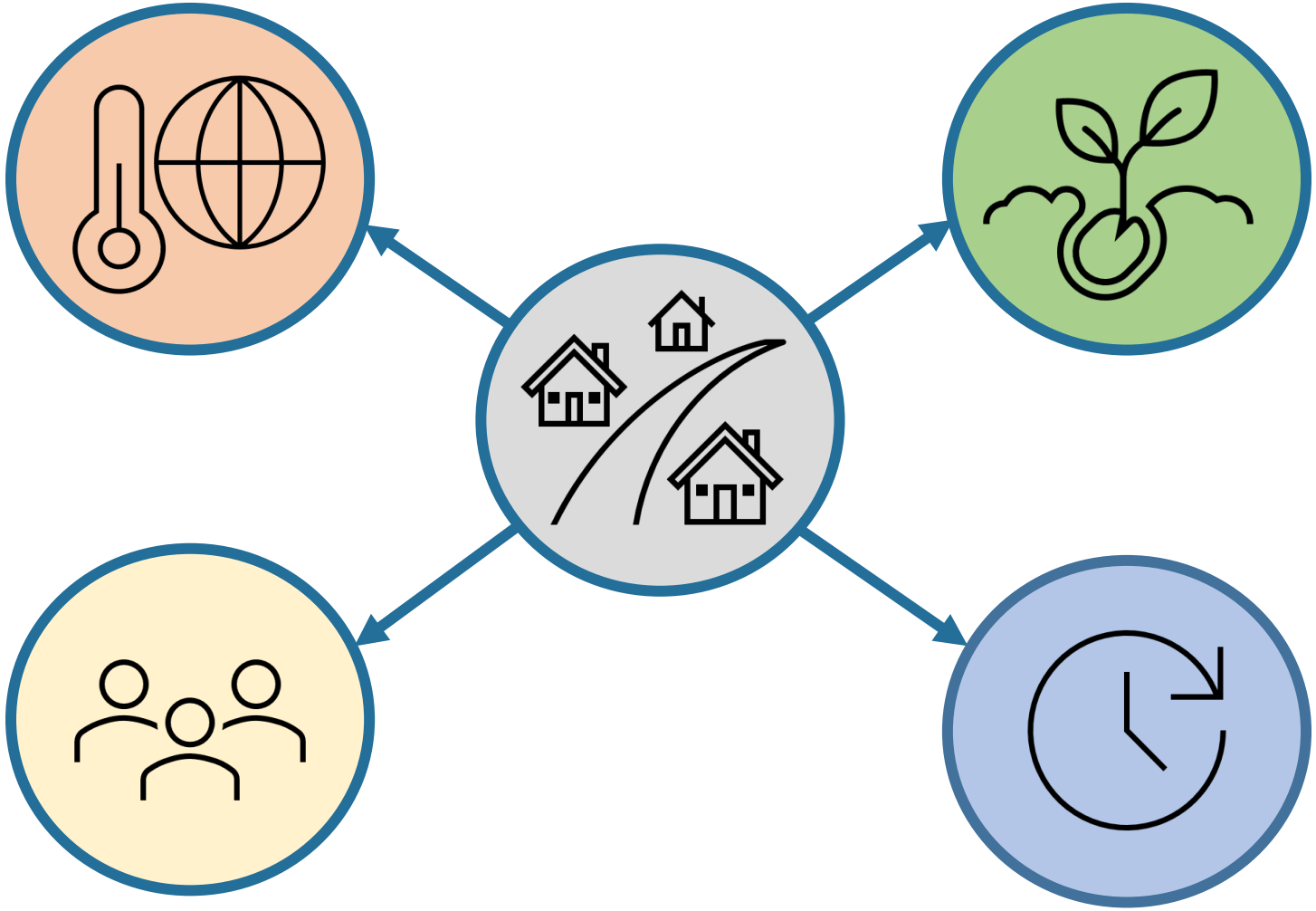
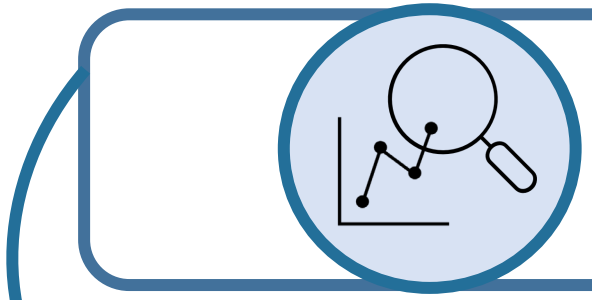


Image Credit: Michael Pazmino and Julie Gevorgian

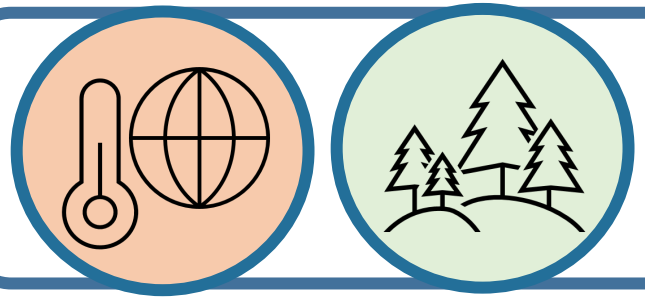
COMMUNITY CONCERNS



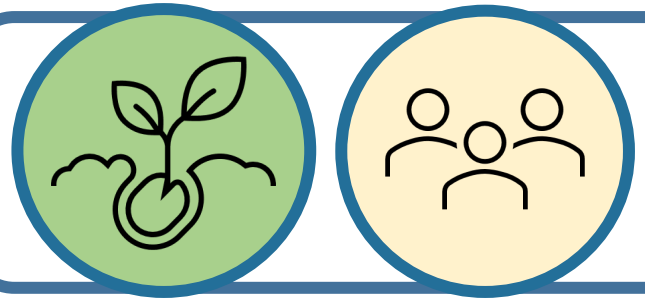
OBJECTIVES



- Provide a macro and micro scale analysis of urban heat islands and the effects of trees in Los Angeles

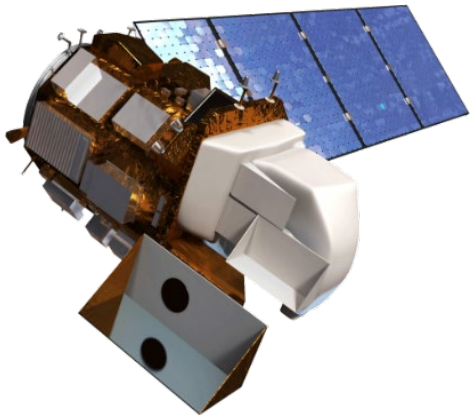


- **MACRO**: Create accessible data visualizations of heat distribution and tree cover in the city



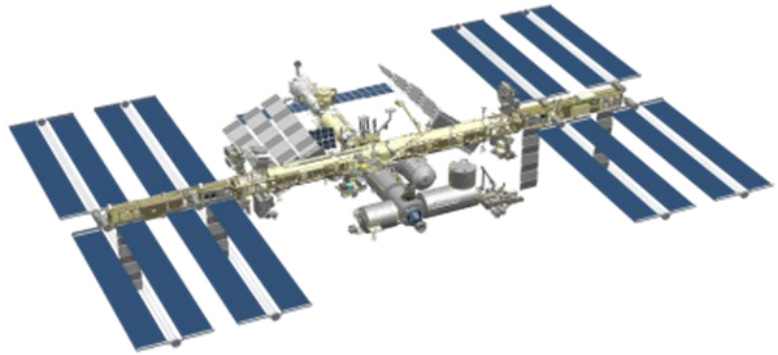
- **MICRO**: Assess the impact of tree planting programs on urban heat mitigation for the community

EARTH OBSERVATIONS



Landsat 8 (OLI & TIRS)

- Operation Land Imager & Thermal Infrared Sensor
- Spatial Resolution: 30 meters (OLI)
  100 meters (TIRS)
- Temporal Revisitation: 16 Days



ISS (ECOSTRESS)

- Ecosystem Spaceborne Thermal Radiometer Experiment on Space Station
- Spatial Resolution: 70 meters
- Temporal Revisitation: 1-7 days

Image Credit: NASA

METHODS

ISS ECOSTRESS
(2018-2022)

Landsat 8 (OLI & TIRS)
(2016-2022)

National Agriculture Imagery Program
(2016, 2018, 2020, 2022)

Python

ArcGIS Pro

Google Earth Engine

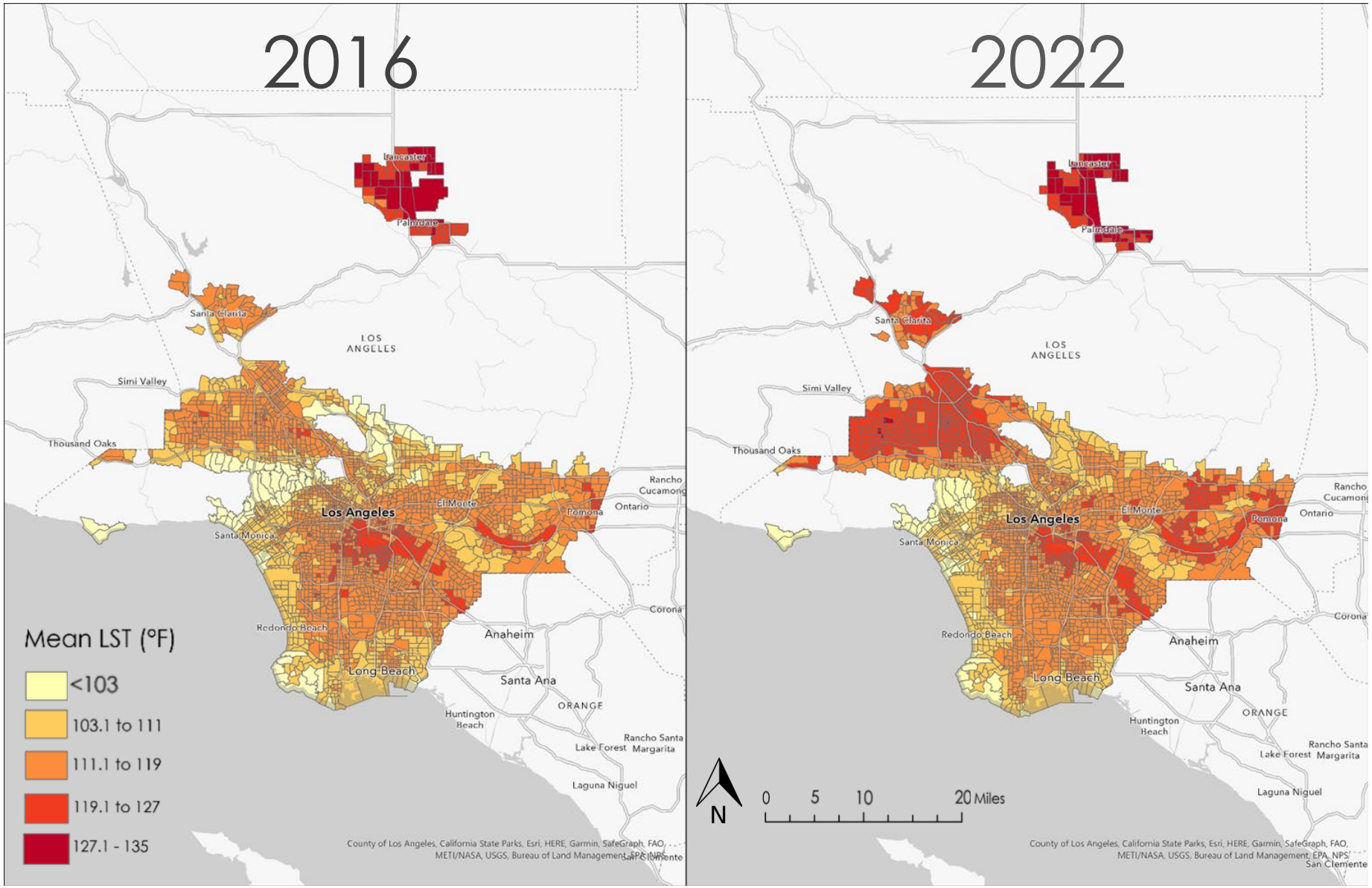
Google Earth Engine

Land Surface Temperature (LST)

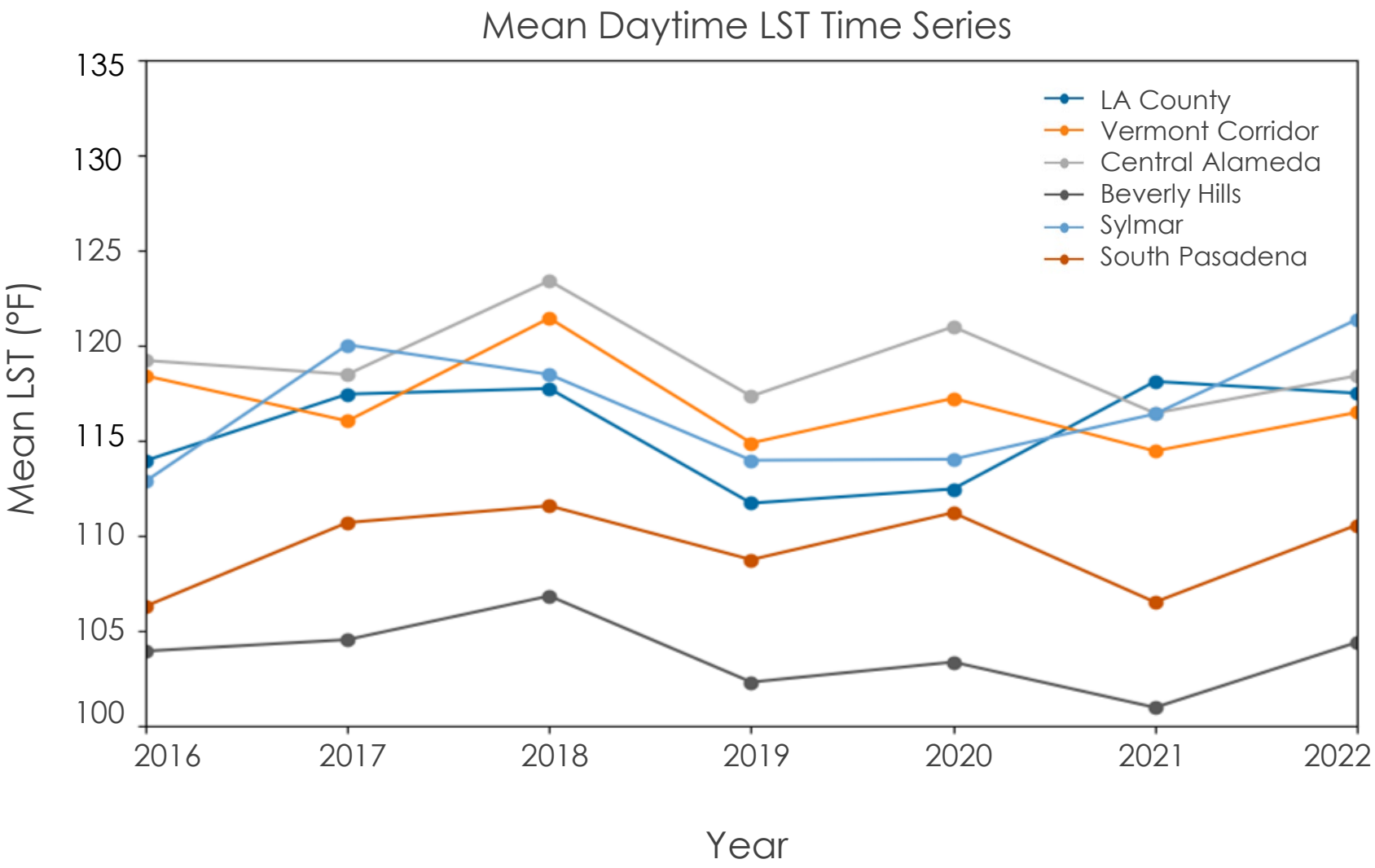
Normalized Difference Vegetation Index (NDVI)

Supervised Classification of Tree Canopy Cover

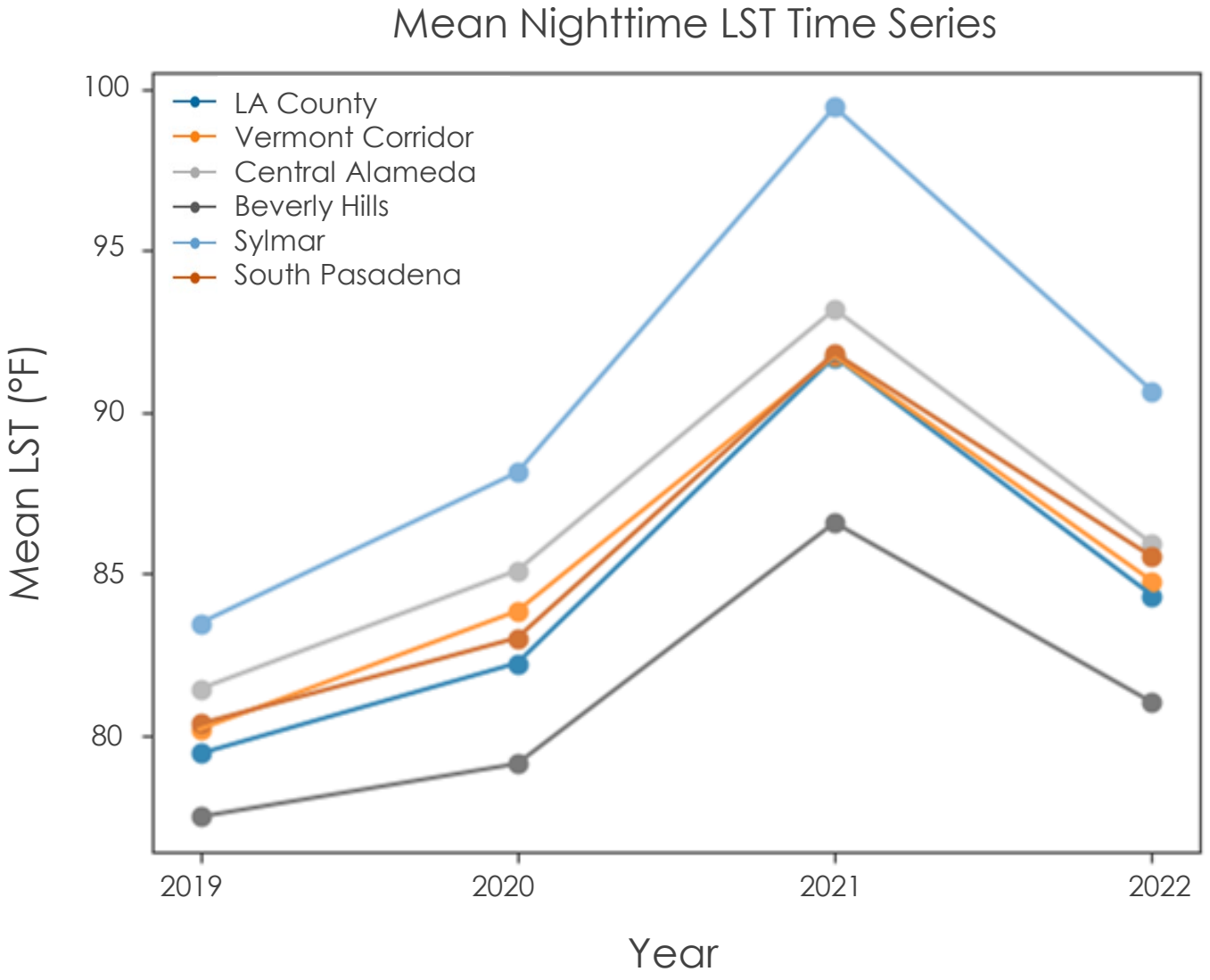
Daytime Mean LST (per census tract)



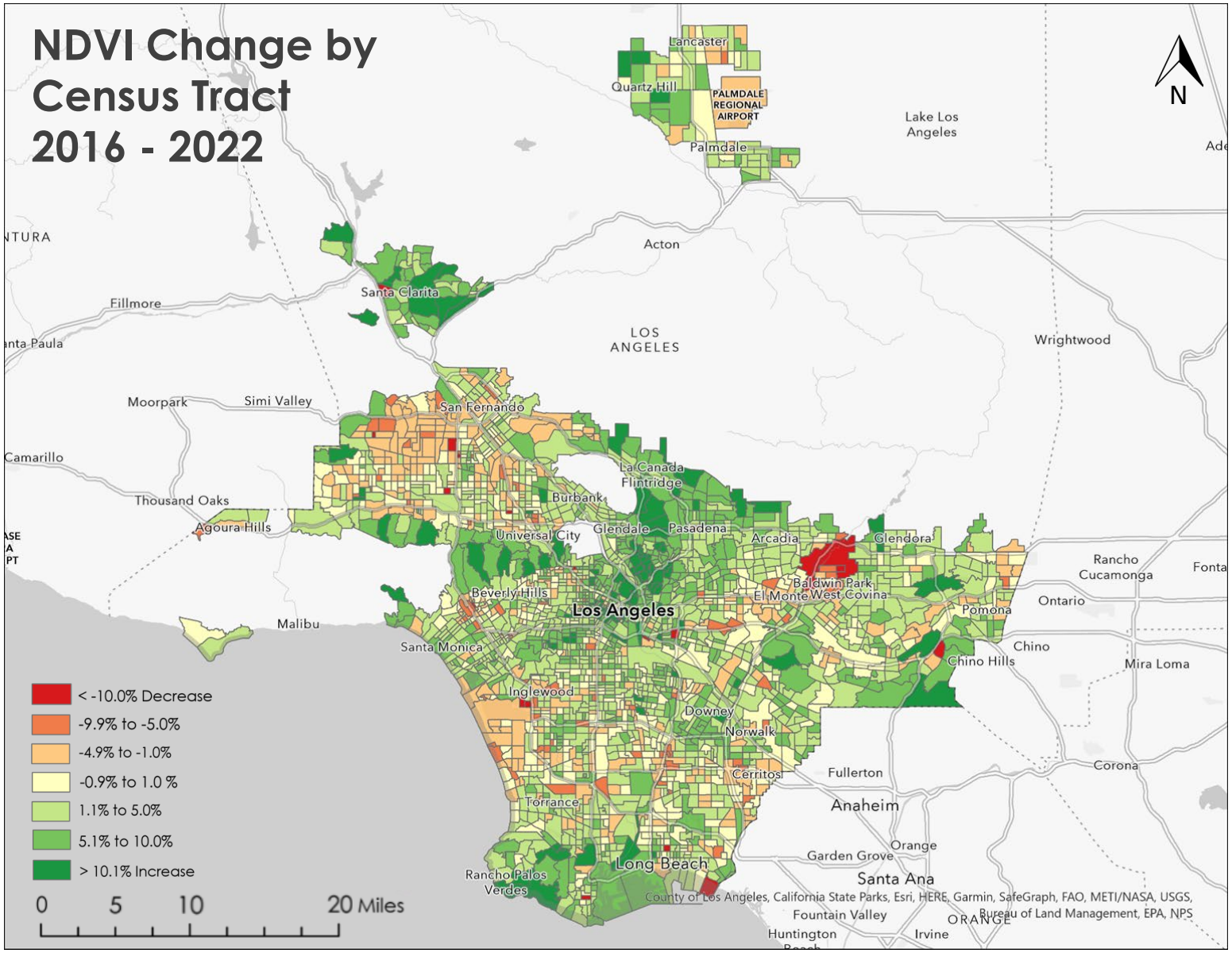
Daytime LST Time Series



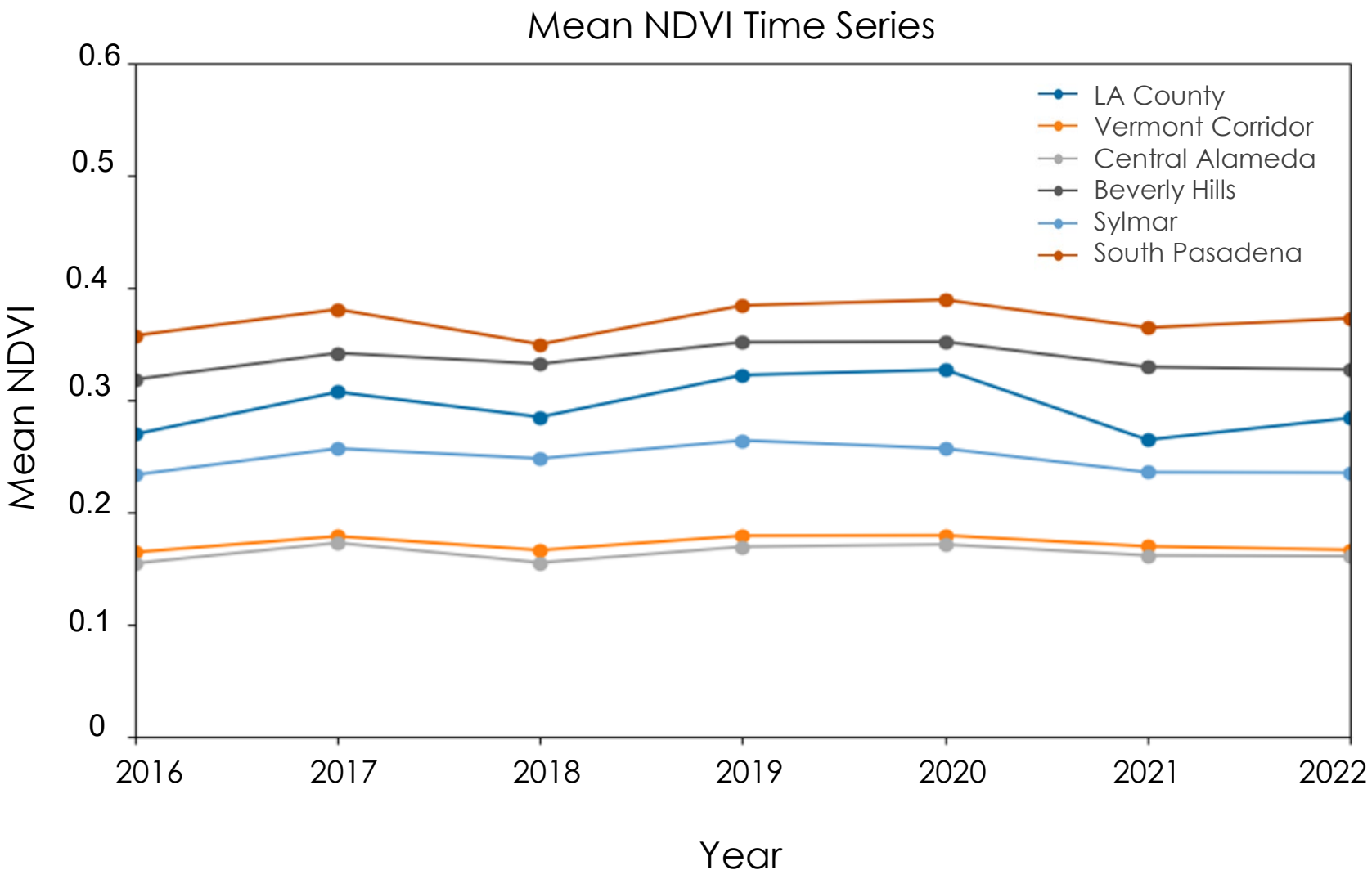
ECOSTRESS LST Nighttime Time Series



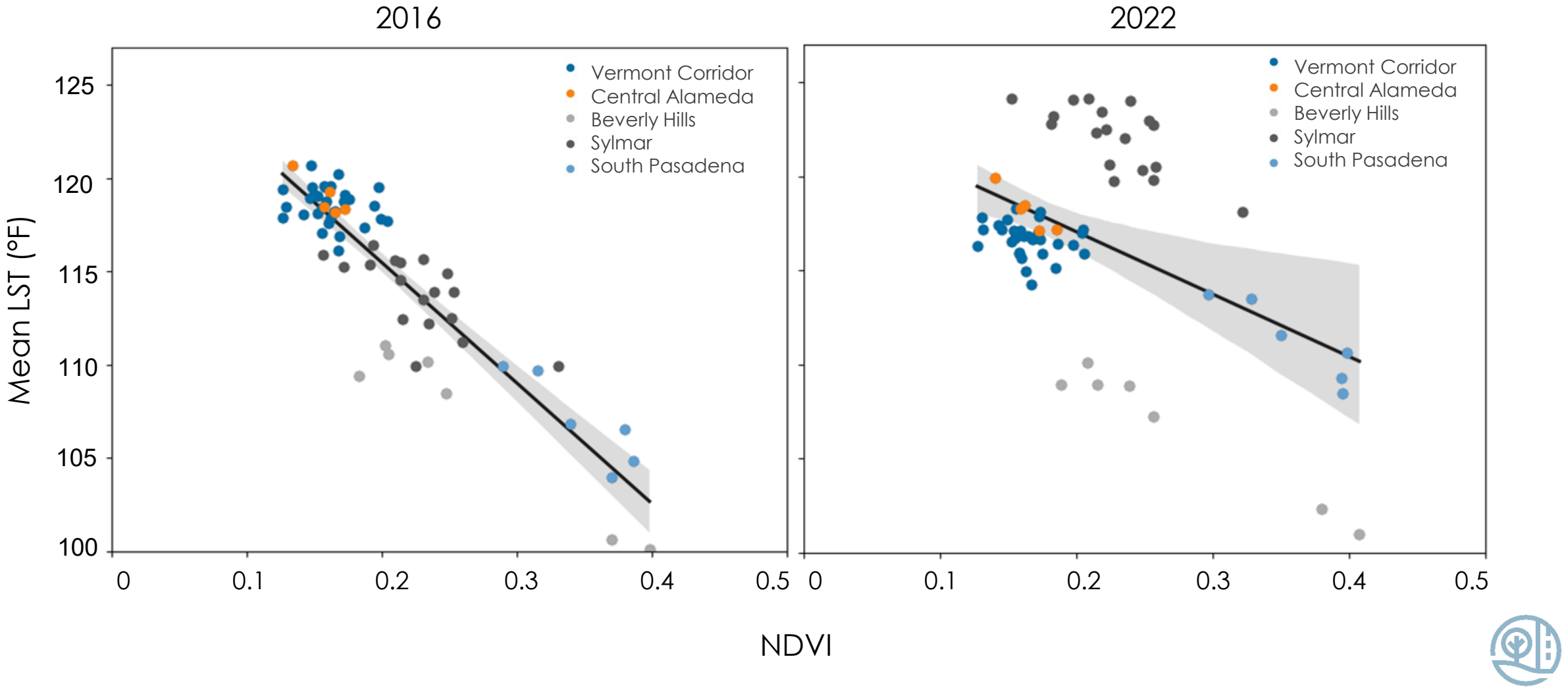
NDVI Change (per census tract)



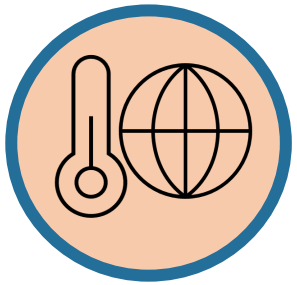
NDVI Time Series



LST (Daytime) and NDVI Correlation



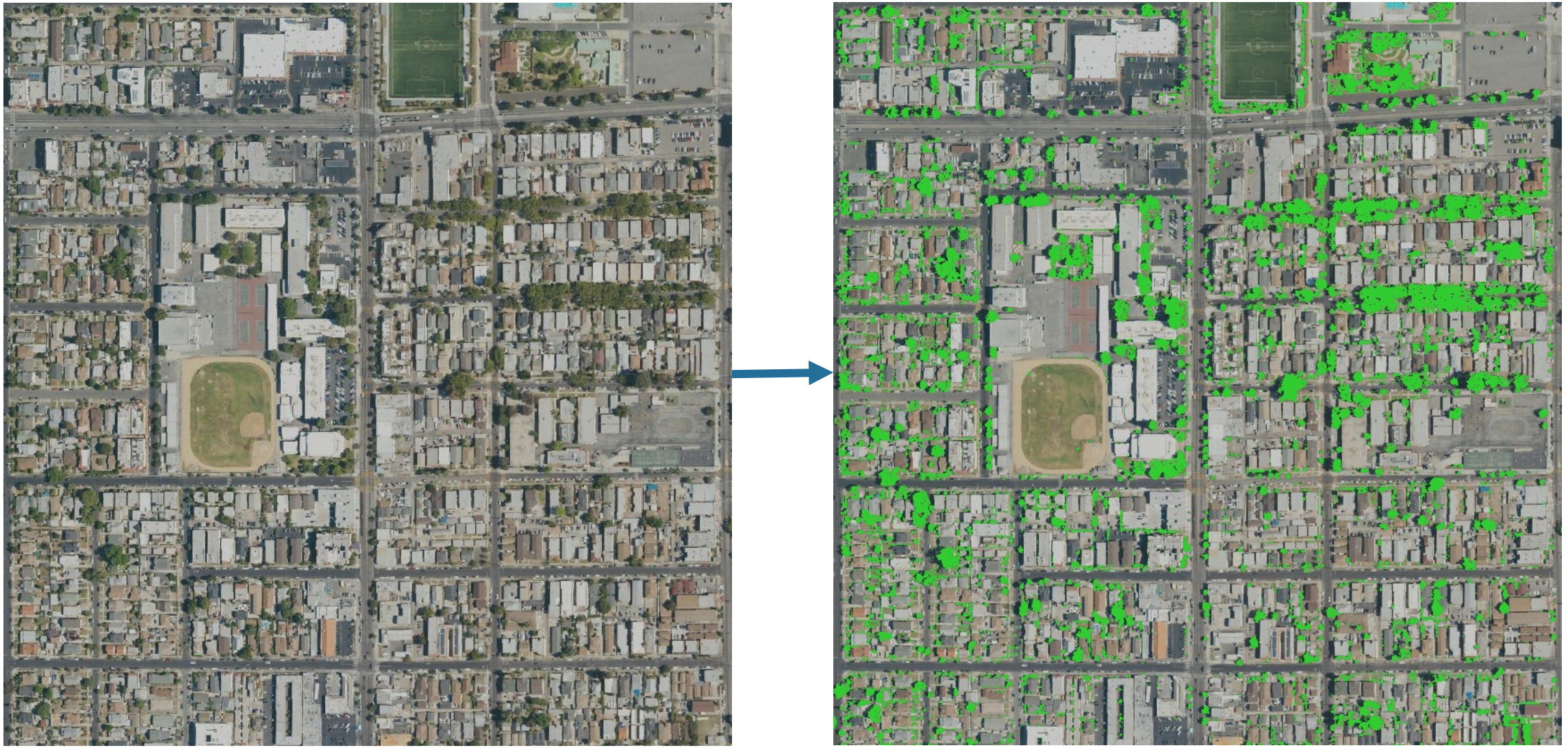
LST (Daytime) and NDVI Correlation



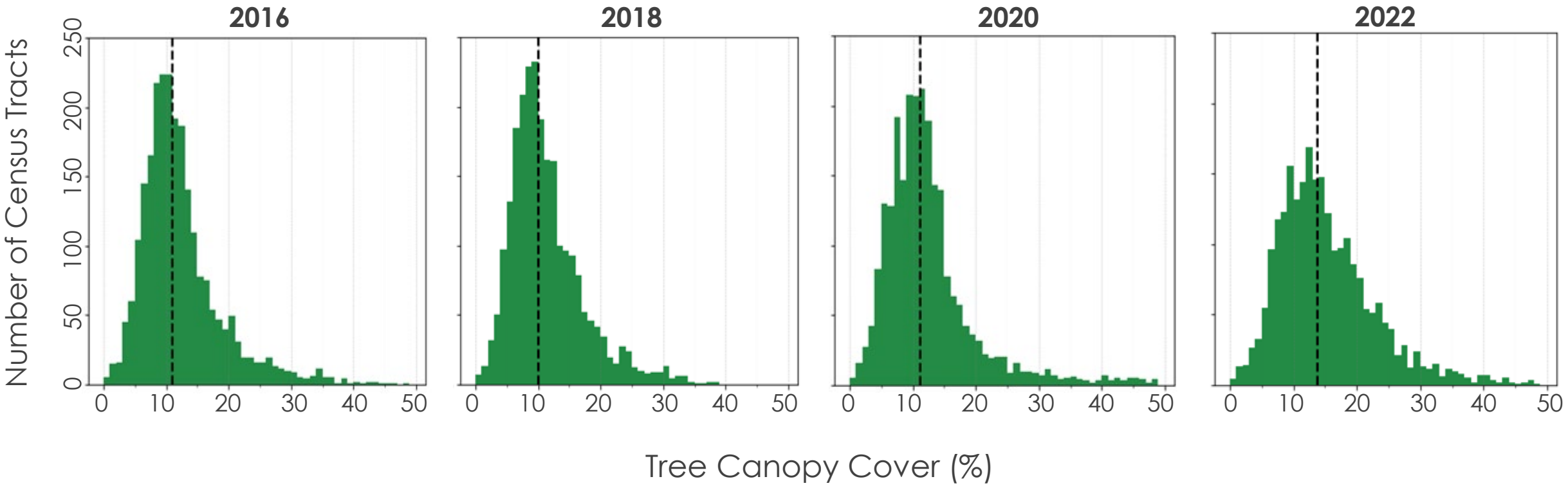
Year	R	R^2
2016	-0.90	0.81
2017	-0.48	0.23
2018	-0.82	0.67
2019	-0.70	0.49
2020	-0.76	0.58
2021	-0.66	0.44
2022	-0.47	0.23

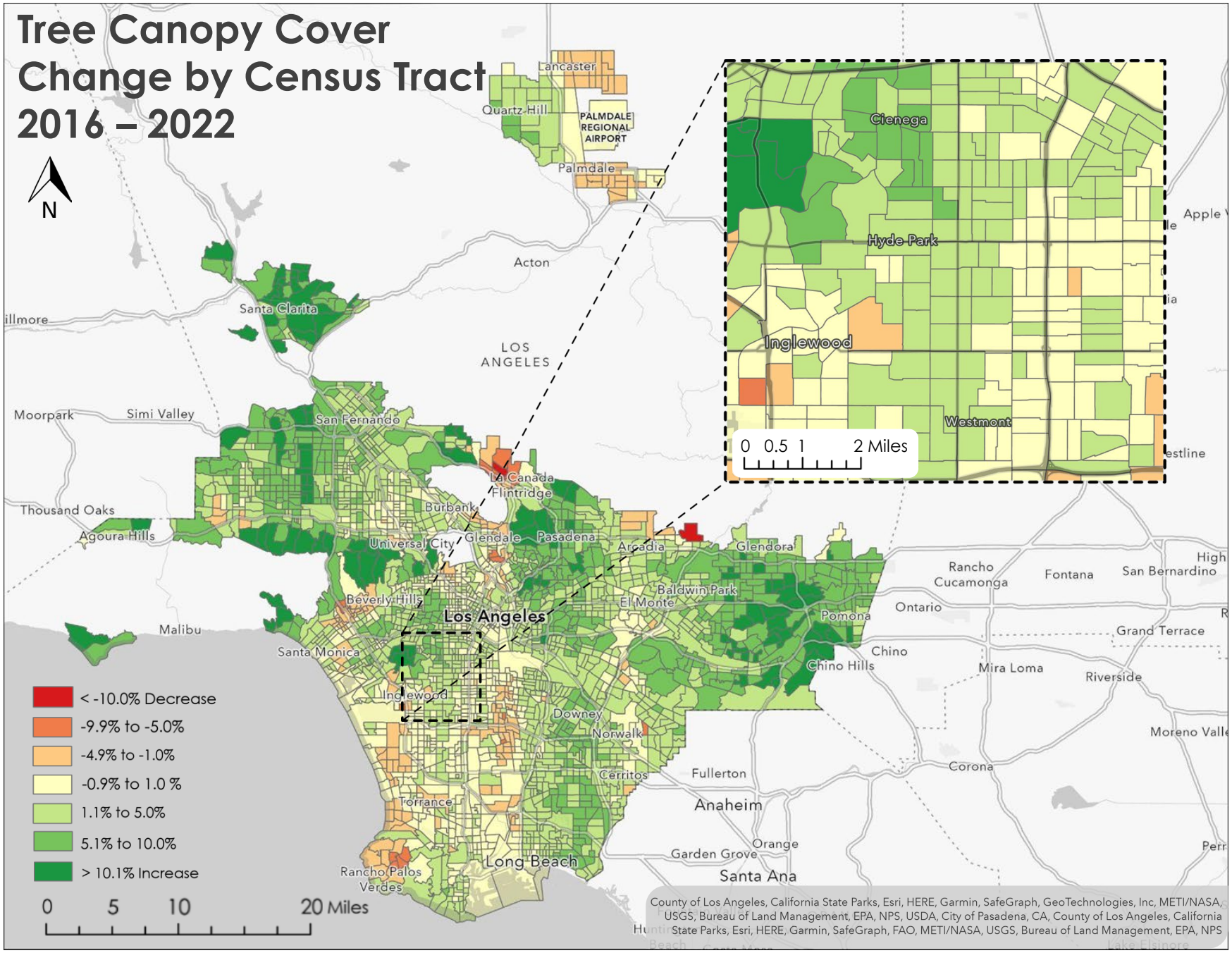
Negative Correlation
Temperature ↑ Vegetation ↓

Tree Canopy Cover Classification



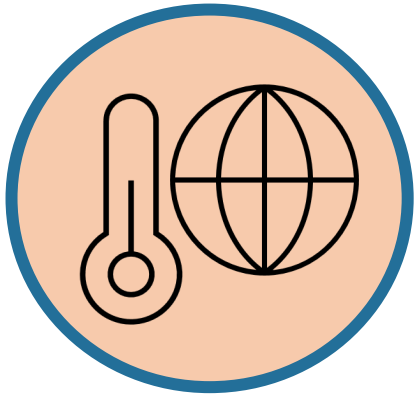
Tree Canopy Cover Change




Tree Canopy Cover Change by Census Tract 2016 – 2022
N
Lancaster
Quartz Hill
PALMDALE REGIONAL AIRPORT
Palmdale
Acton
Santa Clarita
LOS ANGELES
Moorpark
Simi Valley
San Fernando
La Canada Flintridge
Burbank
Thousand Oaks
Agoura Hills
Universal City
Glendale
Pasadena
Arcadia
Glendora
Rancho Cucamonga
Fontana
San Bernardino
Baldwin Park
El Monte
Beverly Hills
Los Angeles
Pomona
Ontario
Malibu
Santa Monica
Chino
Chino Hills
Mira Loma
Grand Terrace
Riverside
Inglewood
Downey
Norwalk
Cerritos
Fullerton
Corona
Torrance
Anaheim
Orange
Garden Grove
Long Beach
Santa Ana
Rancho Palos Verdes
Cienega
Hyde Park
Inglewood
Westmont
0 0.5 1 2 Miles
< -10.0% Decrease
-9.9% to -5.0%
-4.9% to -1.0%
-0.9% to 1.0 %
1.1% to 5.0%
5.1% to 10.0%
> 10.1% Increase
0 5 10 20 Miles
County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, GeoTechnologies, Inc, METI/NASA, USGS, Bureau of Land Management, EPA, NPS, USDA, City of Pasadena, CA, County of Los Angeles, California State Parks, Esri, HERE, Garmin, SafeGraph, FAO, METI/NASA, USGS, Bureau of Land Management, EPA, NPS

Conclusions

The amount of vegetation present affects the **temperature** of an area

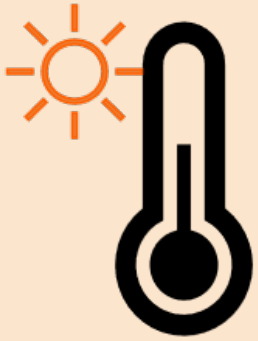


Tree planting **initiatives** have increased tree canopy cover in LA

Increasing **tree canopy** along streets is an effective way to cool communities in LA

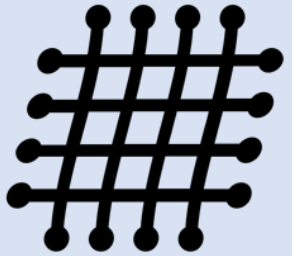
ERRORS & UNCERTAINTIES

LST is Not Experienced Temperature



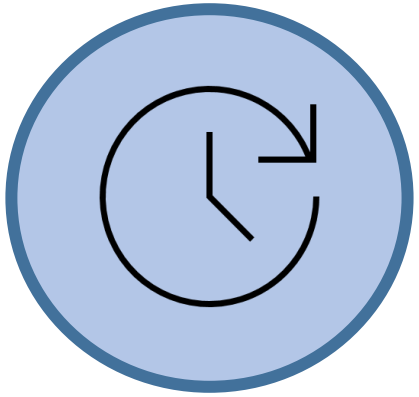
Irregular Orbits

Coarse Data Resolution



Spatial Extent

Future Work



- Incorporate the NASA Hyperspectral Thermal Emissions Spectrometer (HyTES), which has spectral resolution of 5m for LST
- Use a thermal infrared camera to show the temperature difference between trees and their directly surrounding areas
- Provide a more in depth analysis that isolates the effect of tree cooling from other urban materials
- Analyze the trends in tree canopy based on land use type

Acknowledgements

We would like to thank our…

- Science advisors: Dr. Kent Ross, Ben Holt, Dr. Anamika Shreevastava and Dr. Glynn Hulley
- Partners: Rachel Malarich from Los Angeles, Office of City Forest Management and Rachel O'leary from City Plants
- Fellow: Michael Pazmino, for providing support and guidance throughout the project

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Questions?

Image Credit: Michael Pazmino