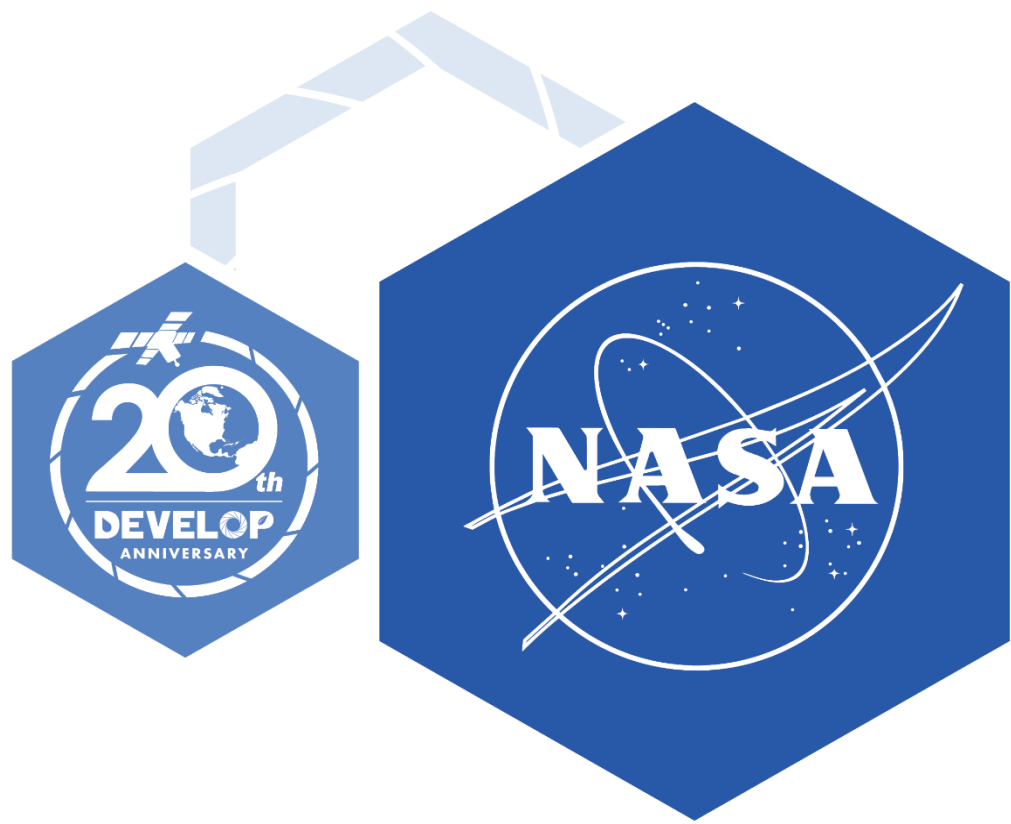# Utilizing NASA Earth Observations to Assess Urban Heat Island Reduction Strategies in Washoe County, Nevada

Abstract

Extreme heat events (EHEs) are one of the leading causes of natural hazard-related deaths in the world. With rising global temperatures, these events will continue to increase in frequency, duration, and magnitude. The urban heat island (UHI) effect exacerbates the consequences of EHEs, discourages active transportation, necessitates greater energy expenditures for air conditioning, and elevates the risk of heat-related and respiratory illness in urban populations. The NASA DEVELOP Washoe County Urban Development Team utilized NASA Earth observations including Landsat 5 Thematic Mapper (TM), Landsat 8 Operational Land Imager (OLI) and Thermal Infrared Sensor (TIRS), and Terra Advanced Spaceborne Thermal Emission and Reflection Radiometer (ASTER) to identify the biophysical characteristics, such as impervious surfaces, vegetation, and tree canopy cover, that contribute to the UHI effect and which ones have the greatest influence on land surface temperature (LST). The team also created a heat vulnerability index (HVI) by combining socioeconomic and health data from the US Census and the Centers for Disease Control and Prevention (CDC), respectively. These processed datasets were integrated onto a web map platform for users to visualize areas of high heat and high vulnerability. Results showed that urbanized areas of the Truckee Meadows region were warmer on average than surrounding suburban areas. Areas that experienced highest temperatures occurred in the northeast portion of the Reno-Sparks districts. The confluence of these highly vulnerable areas and biophysical characteristics will assist the Washoe County Health District's Air Quality Management Division (AQMD) with decision-making related to UHI mitigation strategies in the Truckee Meadows region.

Objectives

- **Measure** the extent and magnitude of the UHI in the Truckee Meadows region
- **Assess** biophysical factors including tree canopy cover, vegetation prevalence, surface albedo, and impervious surface in the region
- **Construct** a heat vulnerability index to identify vulnerable populations
- **Produce** a regression model that identifies the biophysical characteristics that contribute most to the UHI effect
- **Create** a web map that allows users to easily view and interact with processed data layers

Study Area
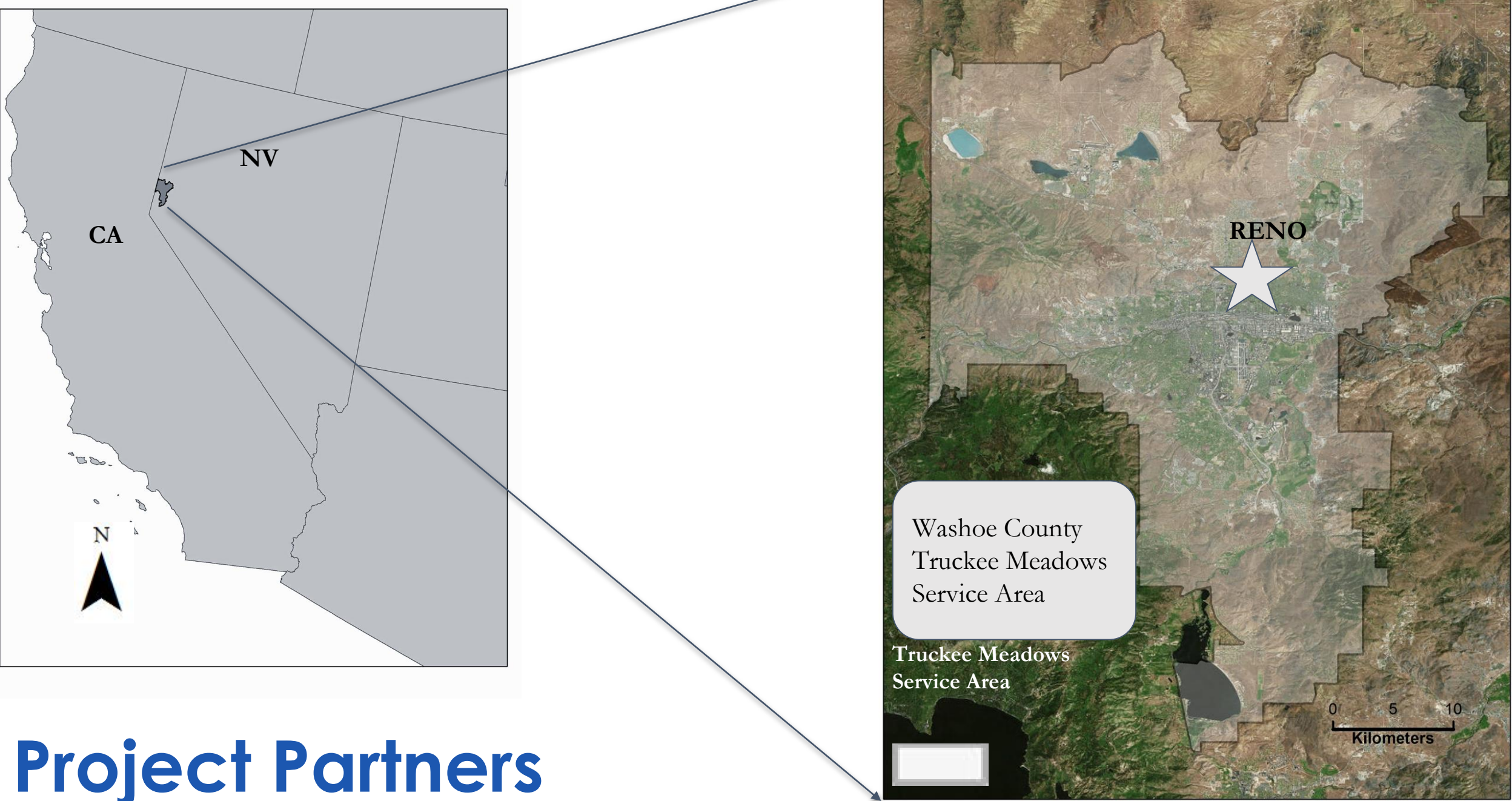
Project Partners

- Washoe County Health District, Air Quality Management Division
- Stantec Consulting Service, Inc.

Team Members

Julia Heslin
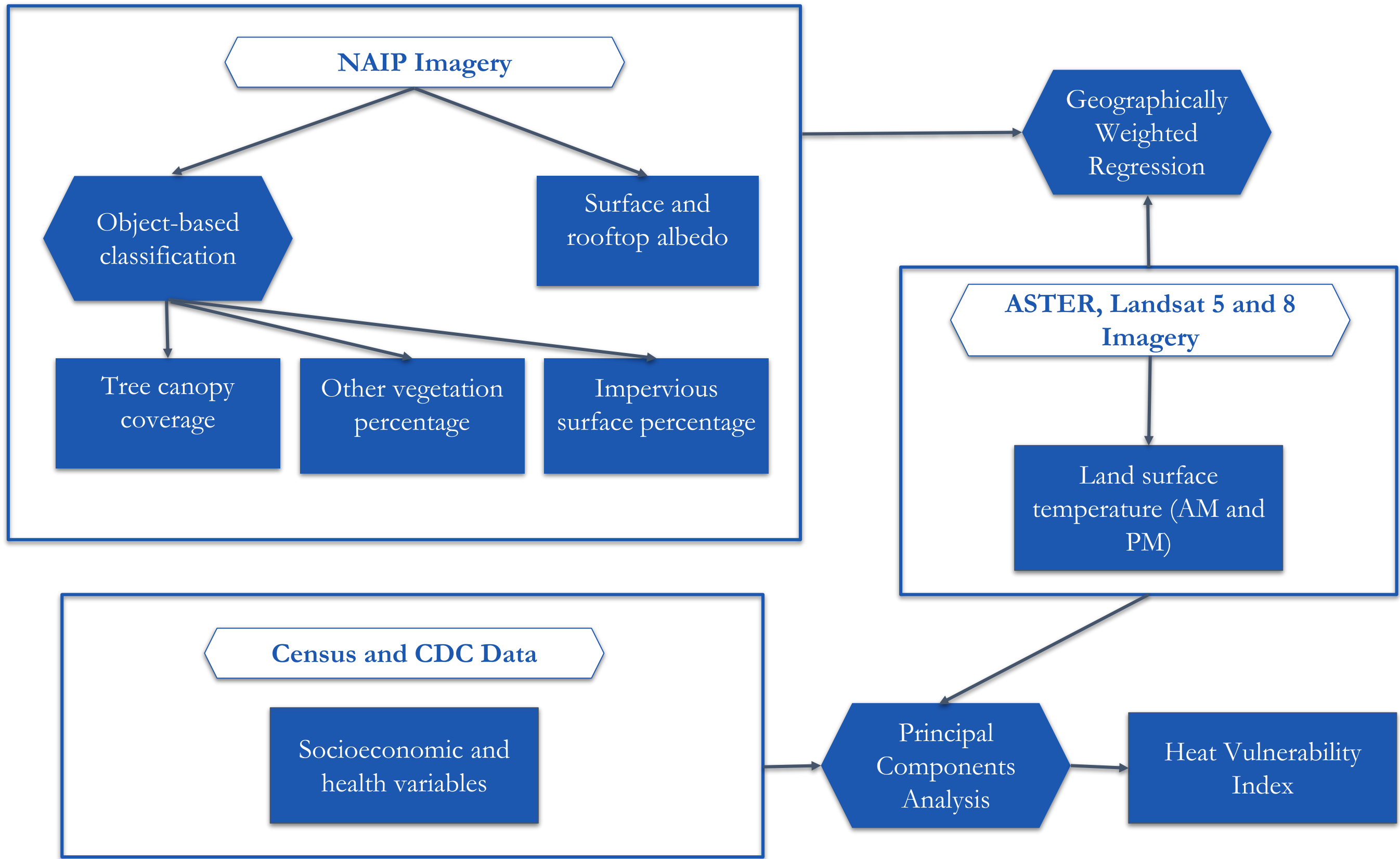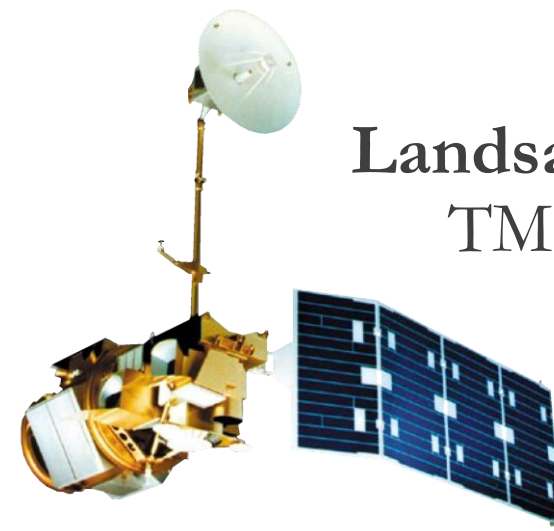Project Lead
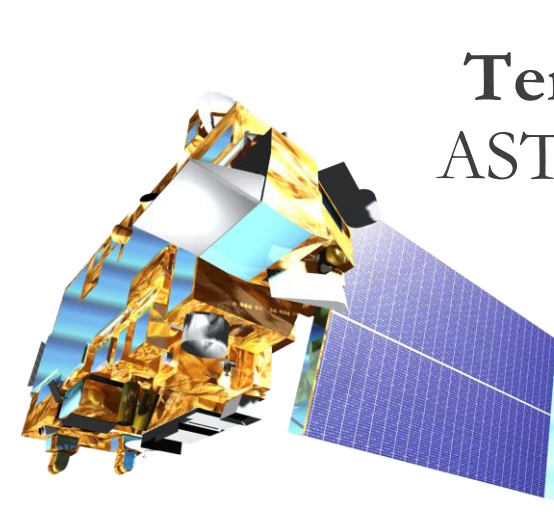
John Dialesandro

Mariah Heck

Chenxi Lin

Acknowledgements

Methodology

Earth Observations

Landsat 5
TM

Terra
ASTER
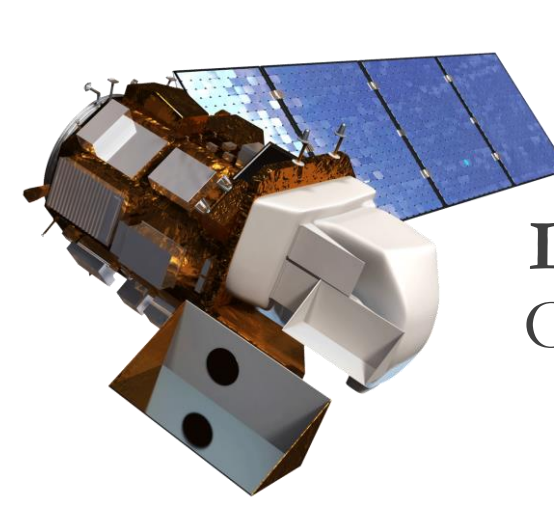
Landsat 8
OLI/TIRS

Results

Daytime Land Surface Temperature

Nighttime Land Surface Temperature

Albedo

Soil %

2010

NDVI

Built Index

2017

NAIP Land Cover Classification

Land Cover Class
- Barren
- Grass
- High Impervious
- Low Impervious
- Medium Impervious
- Tree
- Water
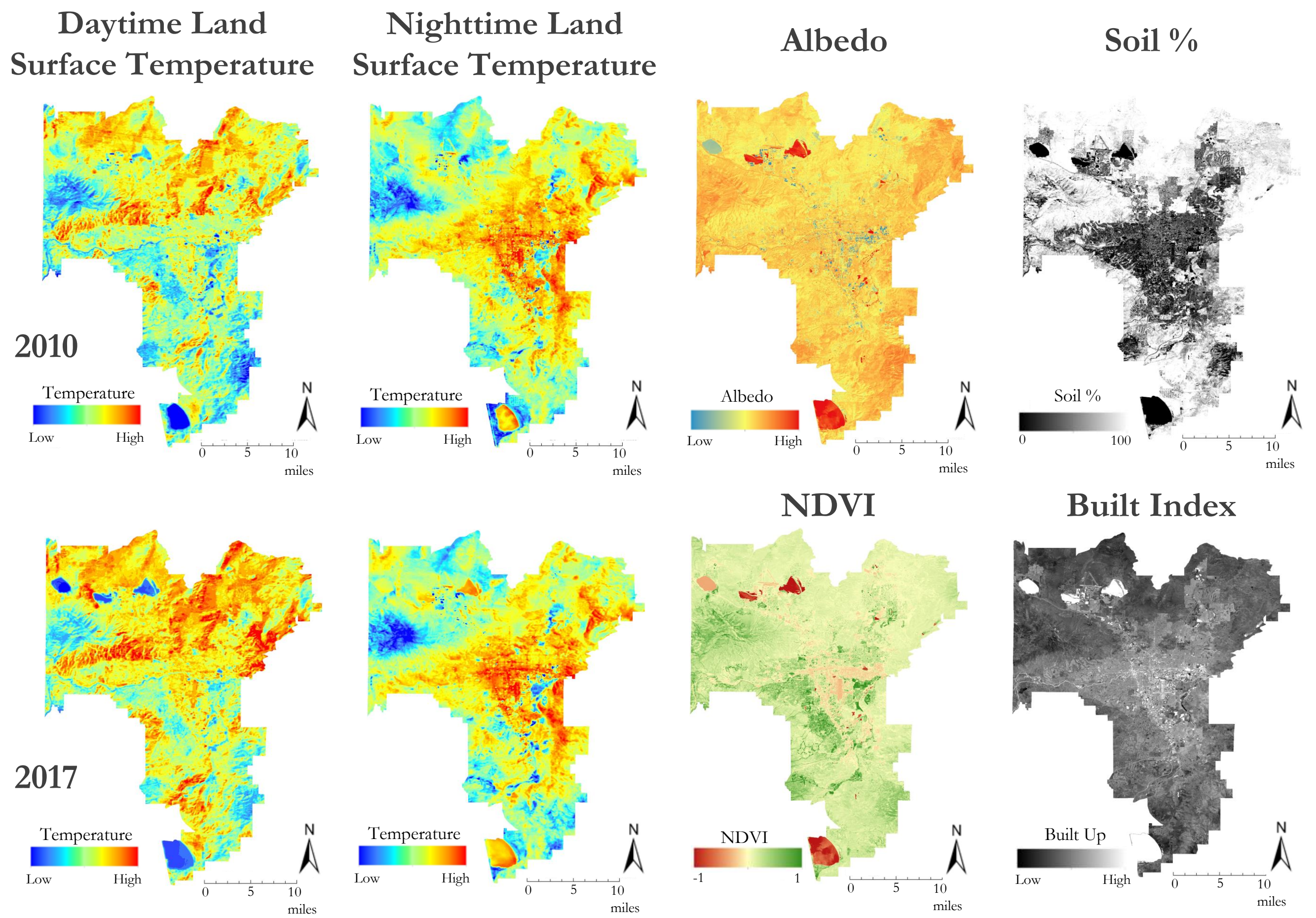
Conclusions

- Average urban land surface temperatures (LSTs) were greater than suburban LSTs for both 2010 and 2017.
- Average LSTs in the Truckee Meadows Service Area increased between 2010 and 2017.
- Urbanization is positively associated with LST while vegetation and tree canopy cover is negatively associated with LST.