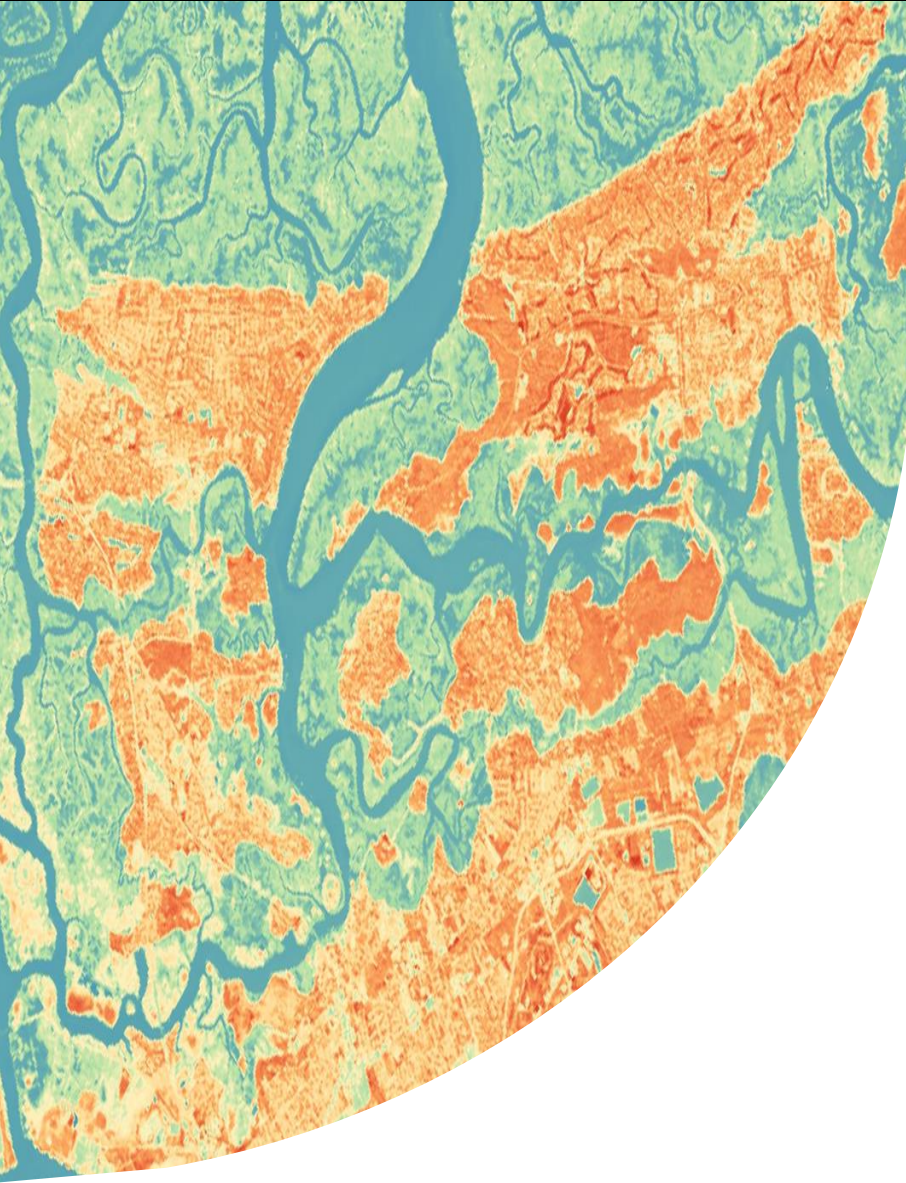




National Aeronautics and
Space Administration



Chatham County Health and Air Quality

Mapping Urban Heat to Identify
Priority Mitigation Areas in
Chatham County, Georgia

Patrick O'Shea, Austin Lavorata,
Ian Maywar, Sydney Pearce
(Analytical Mechanics
Associates)

Virginia — Langley | Spring 2025



The Team



Patrick O'Shea
Project Lead



Austin Lavorata
Team Member



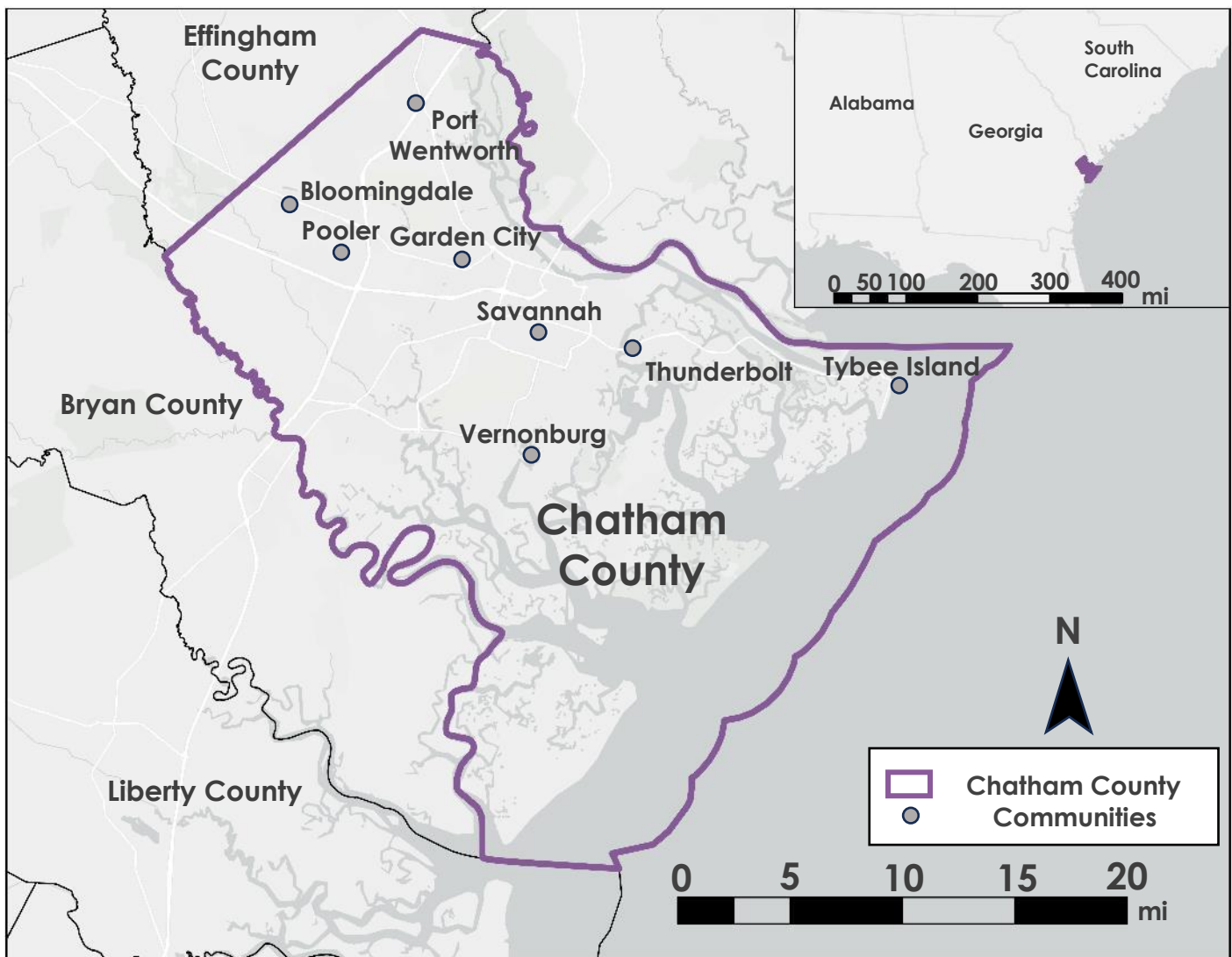
Ian Maywar
Team Member



Sydney Pearce
Team Member



Study Area and Period



Basemap Credits: Esri, HERE, Garmin, INCREMENT P, © OpenStreetMap contributors, and the GIS User Community

Study Area: Chatham County, GA

- Population: ~300,000 (2023)
- Area: 630 mi²

Study Period: 2014 – 2024

- Growing Period: May – October

Background: Urban Heat Islands in Chatham County



Between 1992 and 2011, areas that underwent land cover change saw temperature increases of up to 27 °F (Fragomeni, 2019)



Urban Heat Island (UHI) effect can be mitigated through tree planting



Chatham County lost 3 football fields of tree canopy per day between 1999 and 2014 (Savannah Tree Foundation, 2015)



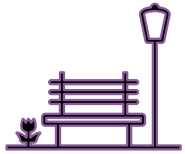
Chatham County Health & Air Quality



Image Credit: Chatham County

Partners

Local Government of Chatham County



Manage and **maintain** the health of communities within Chatham County

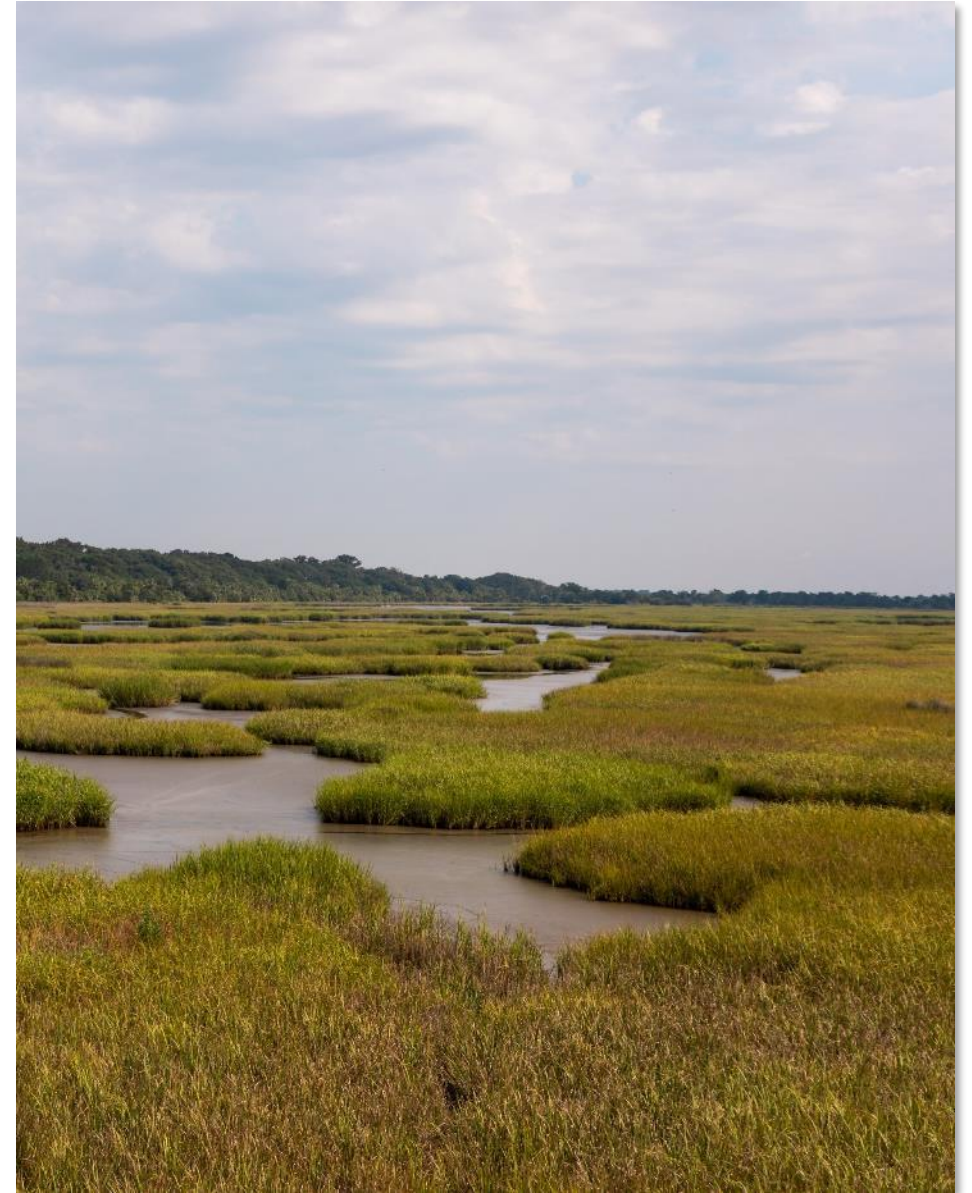


Image credit: Chatham County



Chatham County Health & Air Quality

Community Concerns

Urban
Development



Tree Canopy
Loss



Increased
Heat
Impacts



Population
Growth



Public
Safety



Project Objectives

Explore Environmental Changes Over Time



Image Credit: Google Earth

Identify Areas At Risk to Urban Heat Impacts

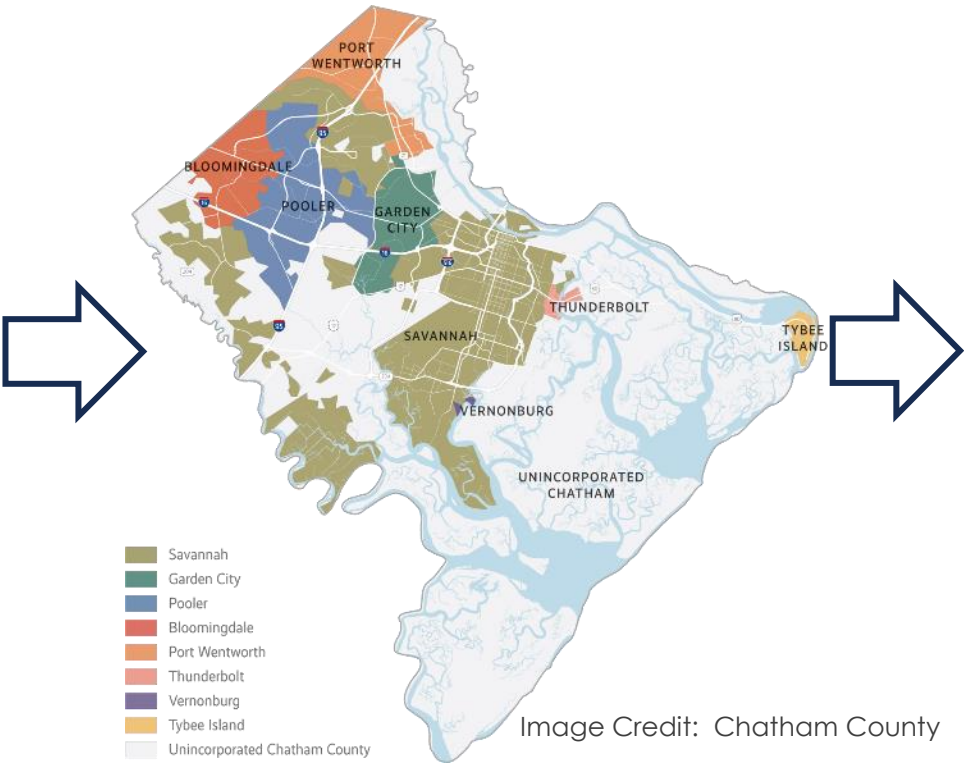


Image Credit: Chatham County

Inform Mitigation Strategies



Image Credit: Chatham County

Earth Observations

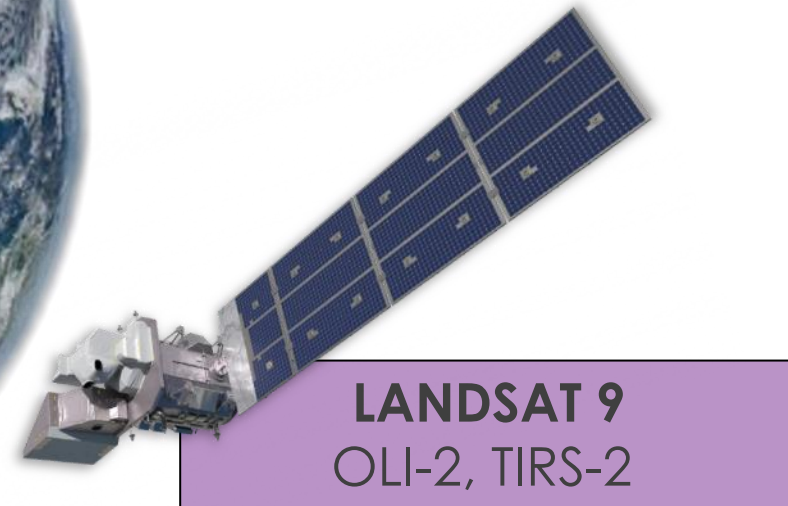
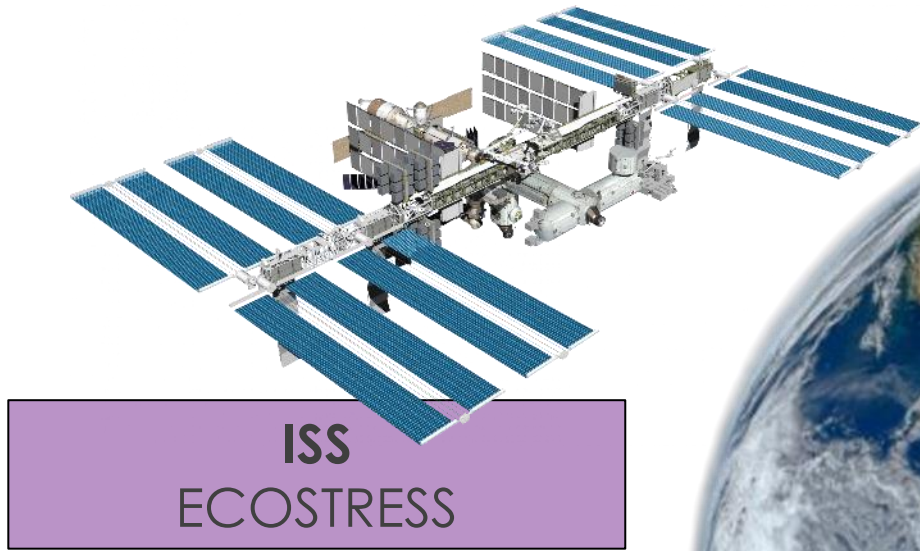
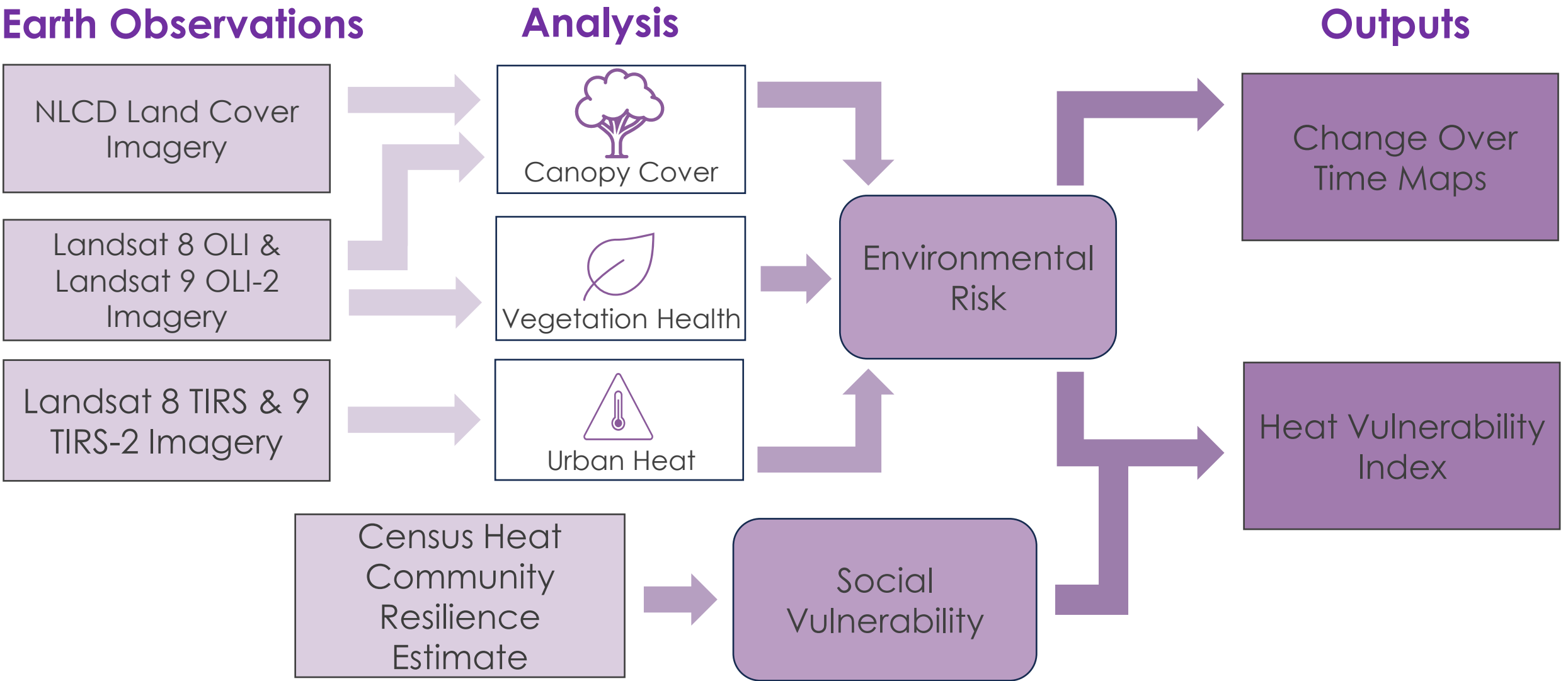


Image Credits: NASA



Methodology: Heat Vulnerability Factors



Results: Urban Heat

Basemap Credits: Esri, HERE, Garmin, INCREMENT P, © OpenStreetMap contributors, and the GIS User Community

2014

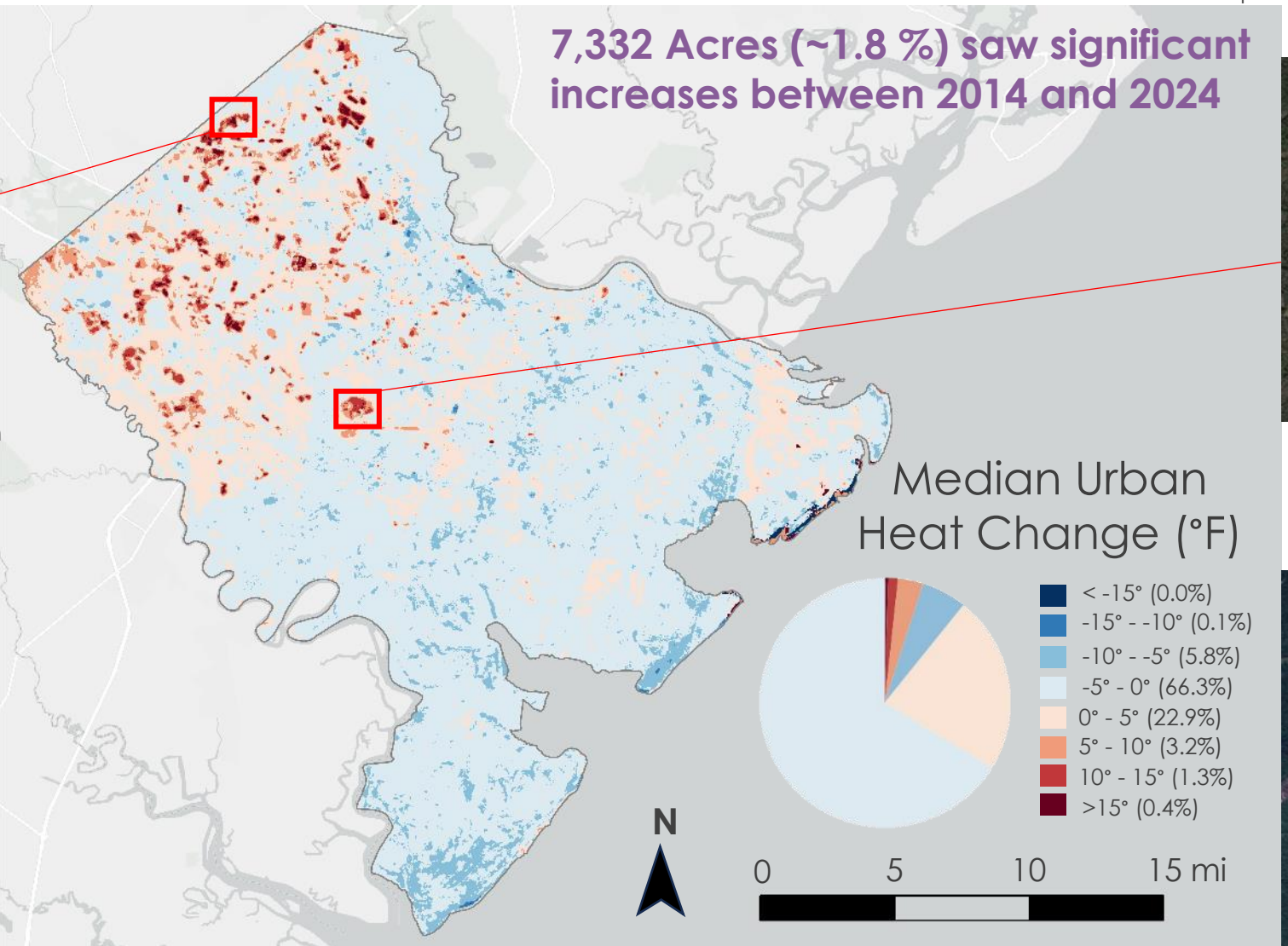


Image Credit: Google Earth

2024



Image Credit: Google Earth



2014



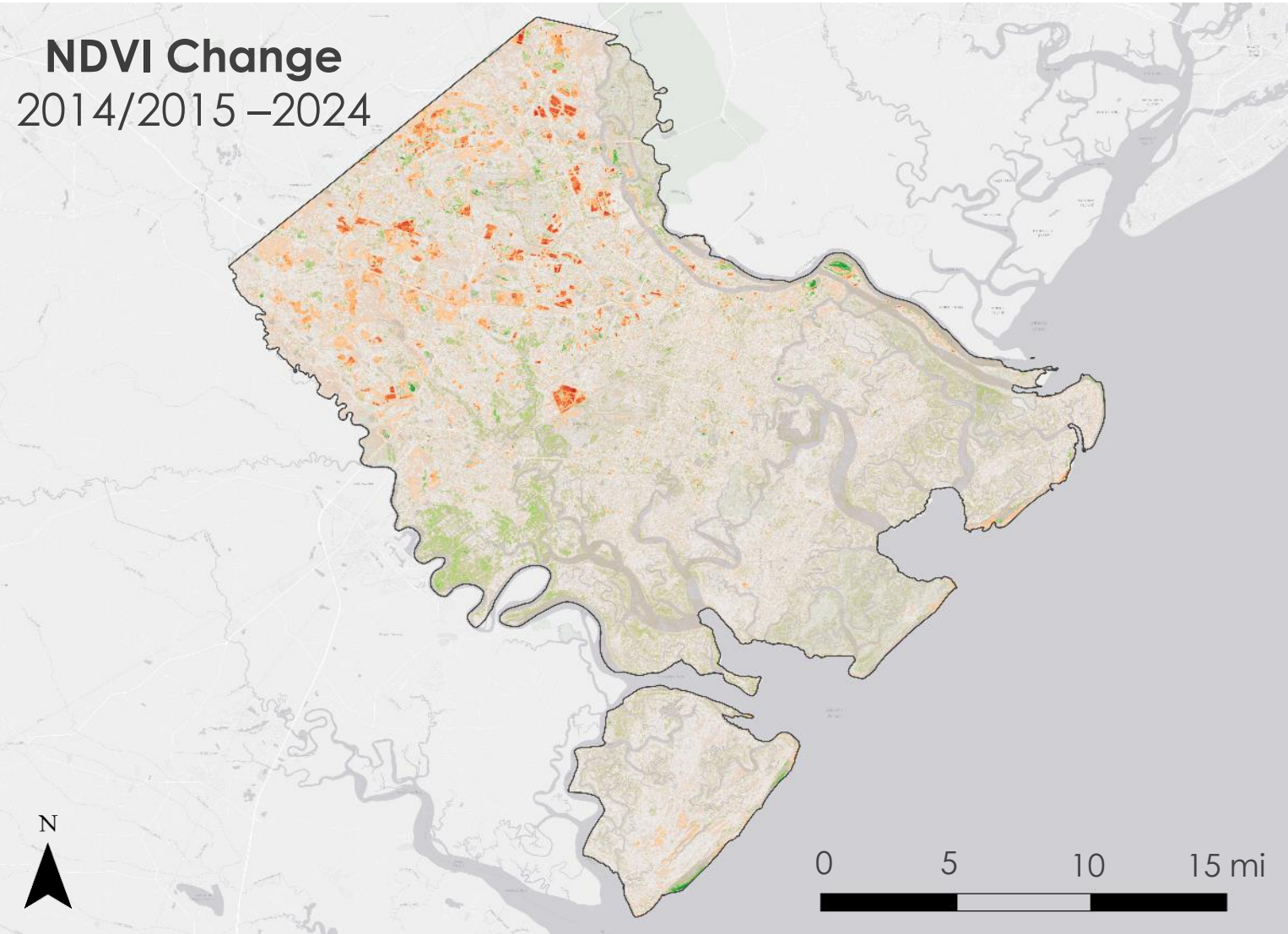
Image Credit: Google Earth

2024



Image Credit: Google Earth

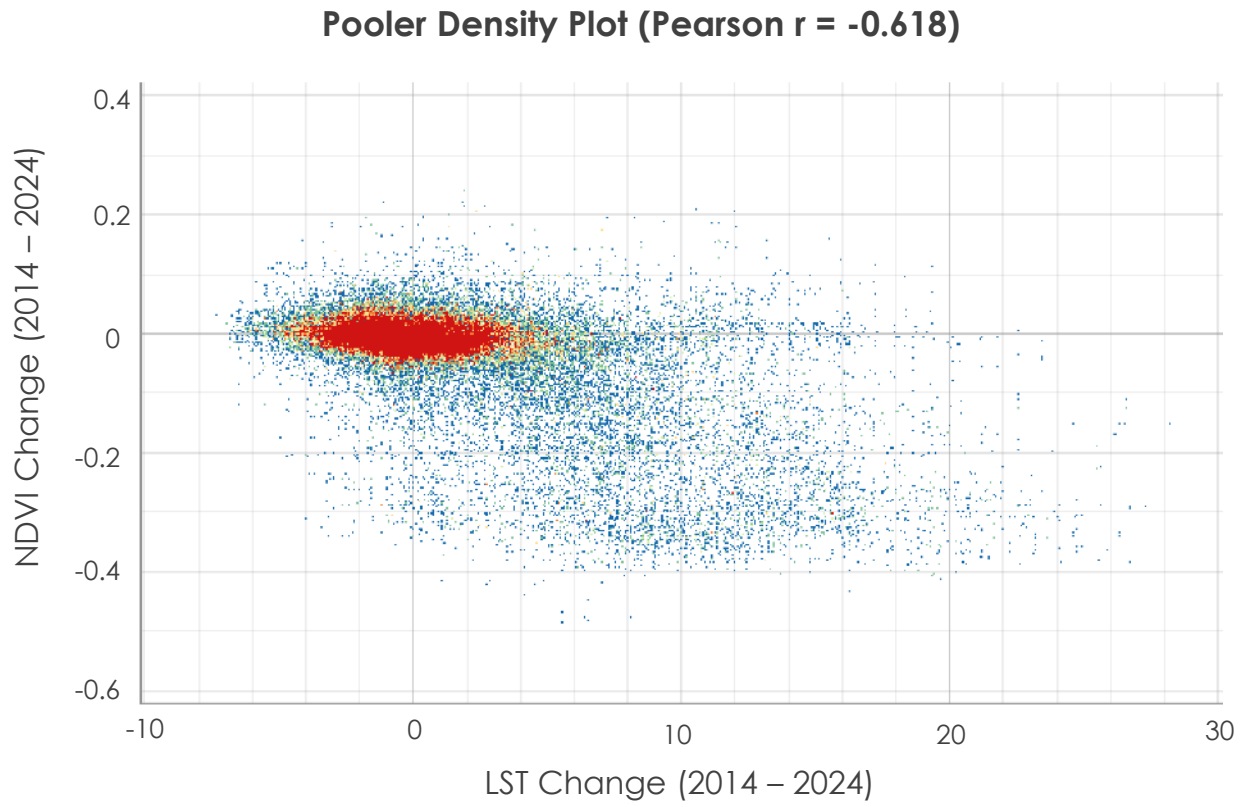
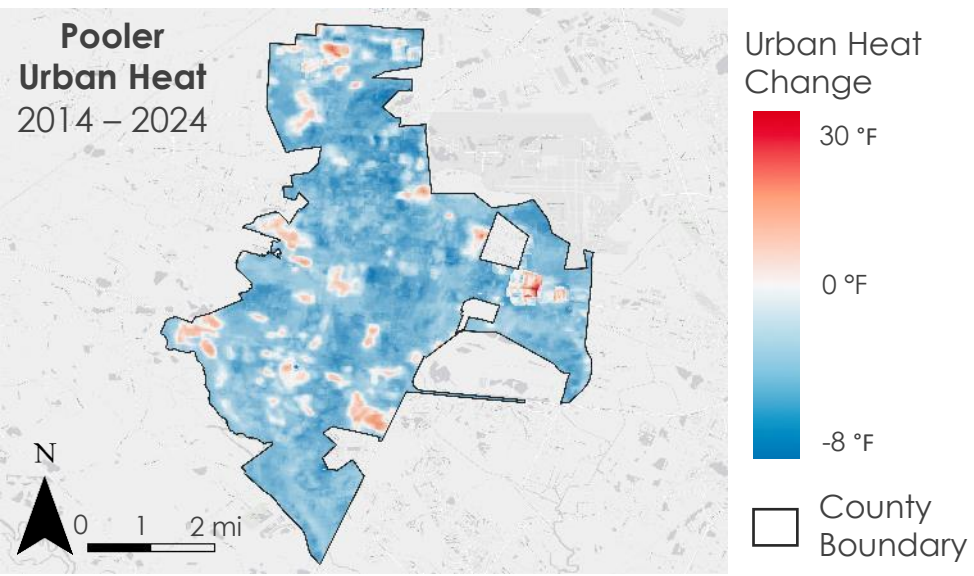
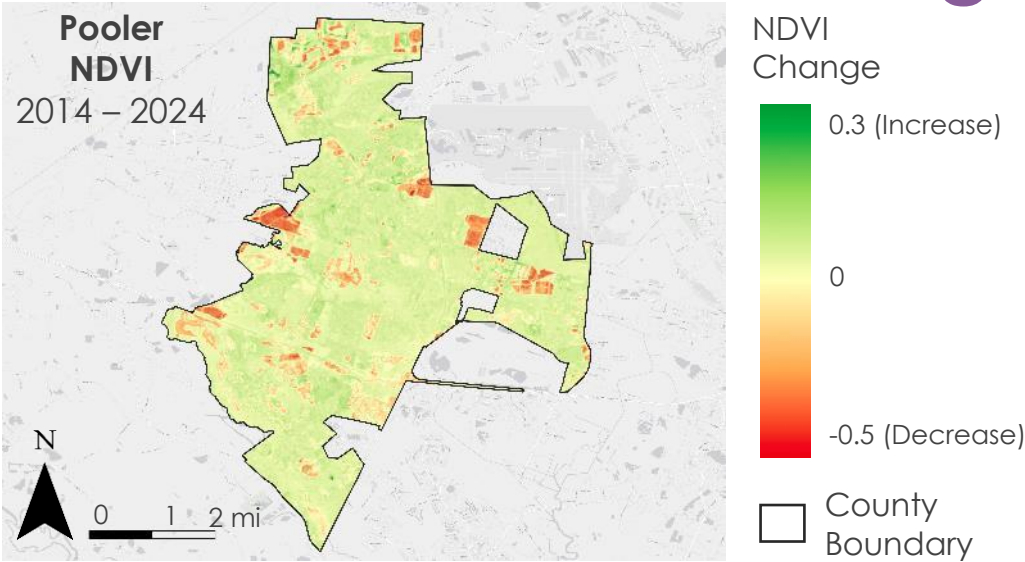
Results: Vegetation Health



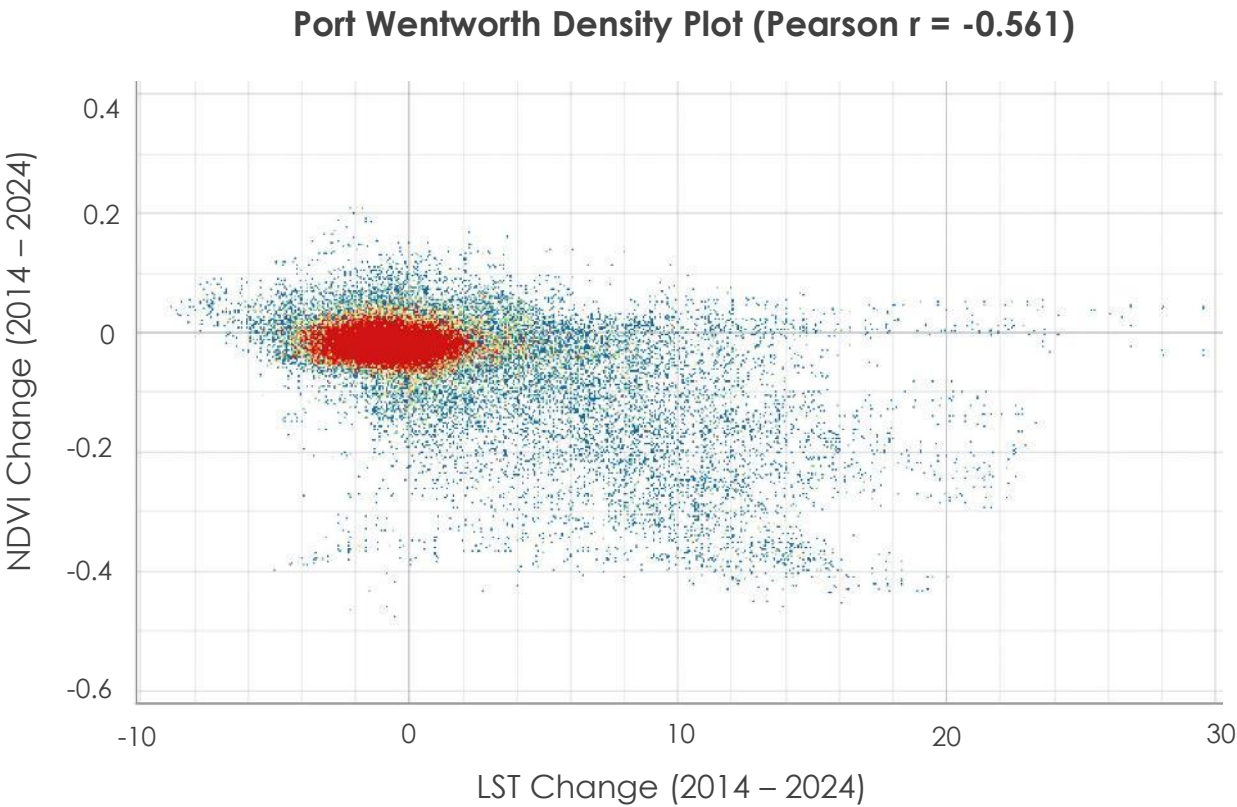
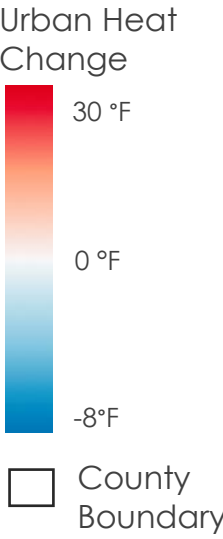
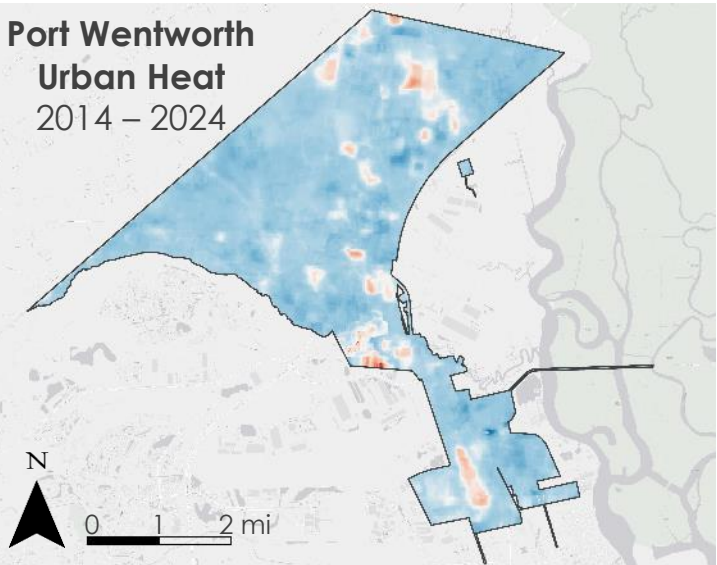
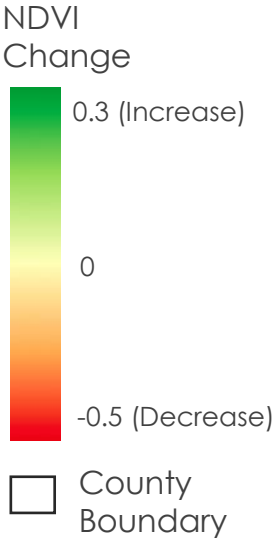
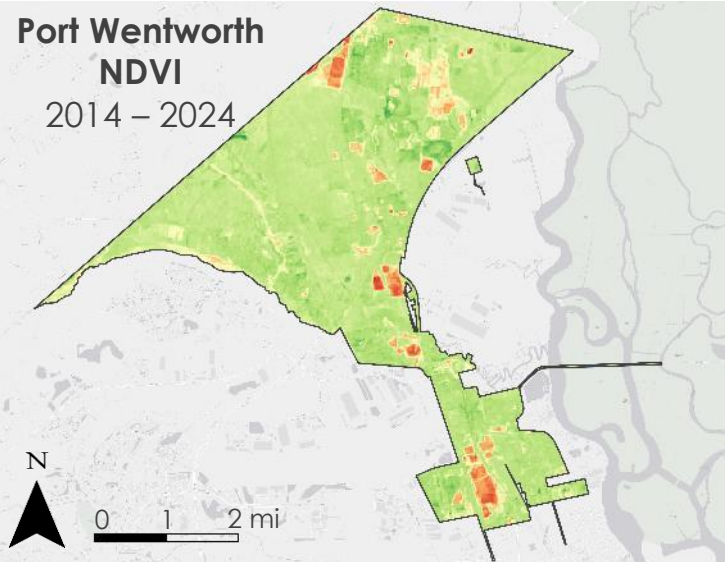
Basemap Credits: Esri, HERE, Garmin, INCREMENT P, © OpenStreetMap contributors, and the GIS User Community

9,435 acres (~3%) of Chatham County saw significant decreases in vegetation health between 2014 – 2015 and 2024.

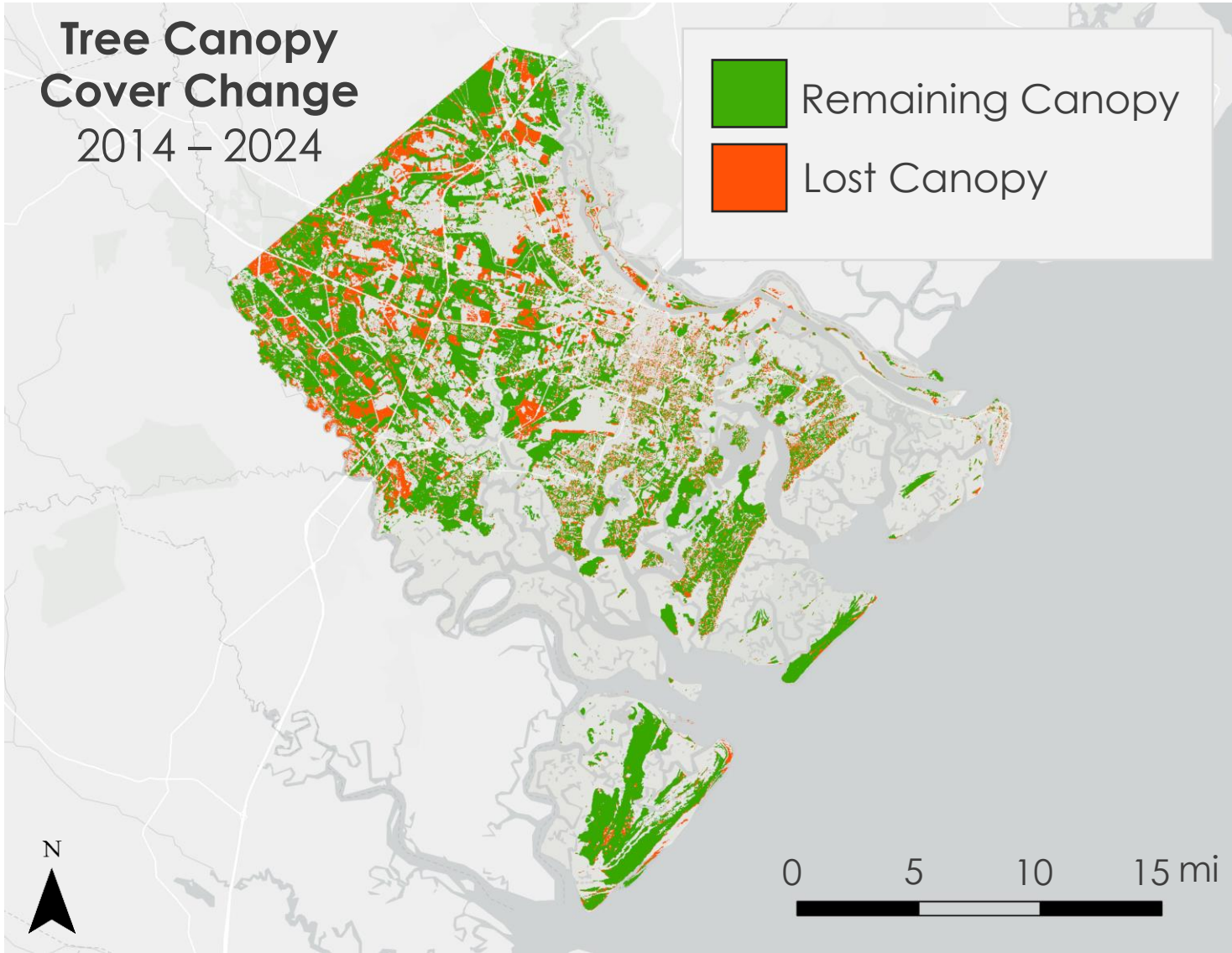
Results: Urban Heat & Vegetation Correlation – Pooler



Results: Urban Heat &Vegetation Correlation – Port Wentworth



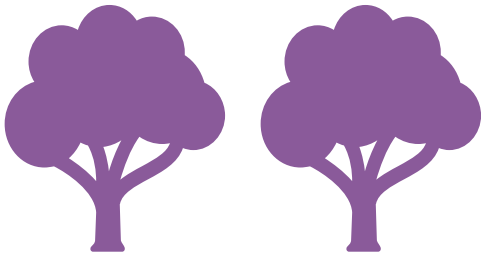
Results: 2014 – 2024 Canopy Cover Time Difference Map



Canopy Cover Change Over Time



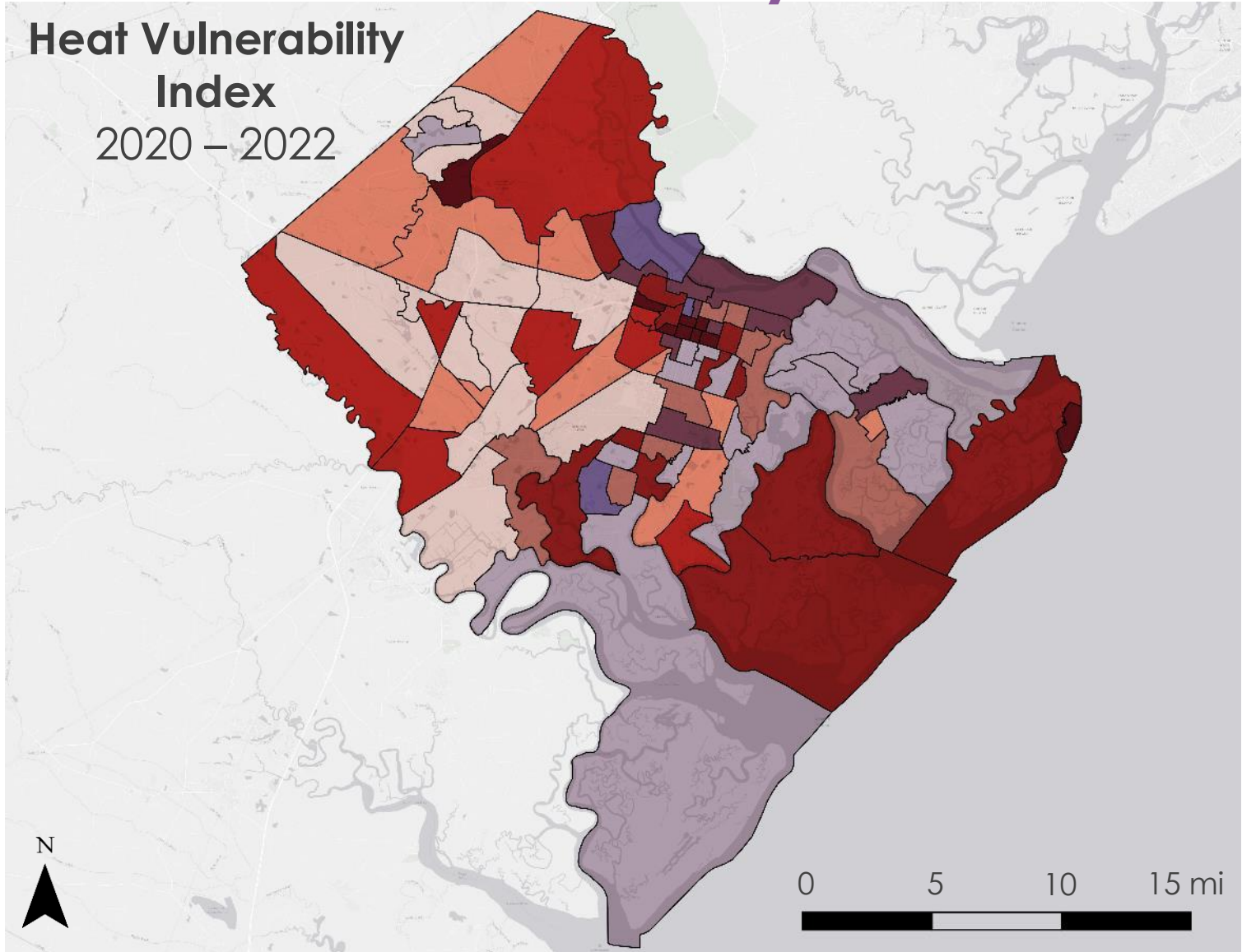
2014 Canopy Cover: 31.80%



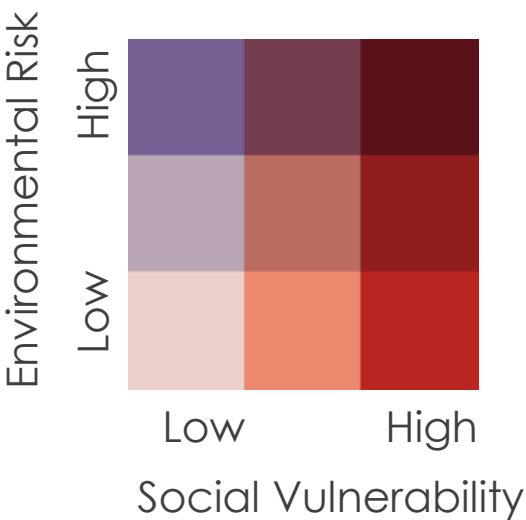
2024 Canopy Cover: 26.49%

Between 2014 and 2024, Chatham County lost approximately **17% of its existing canopy cover.**

Results: Heat Vulnerability Index



Heat Vulnerability Index

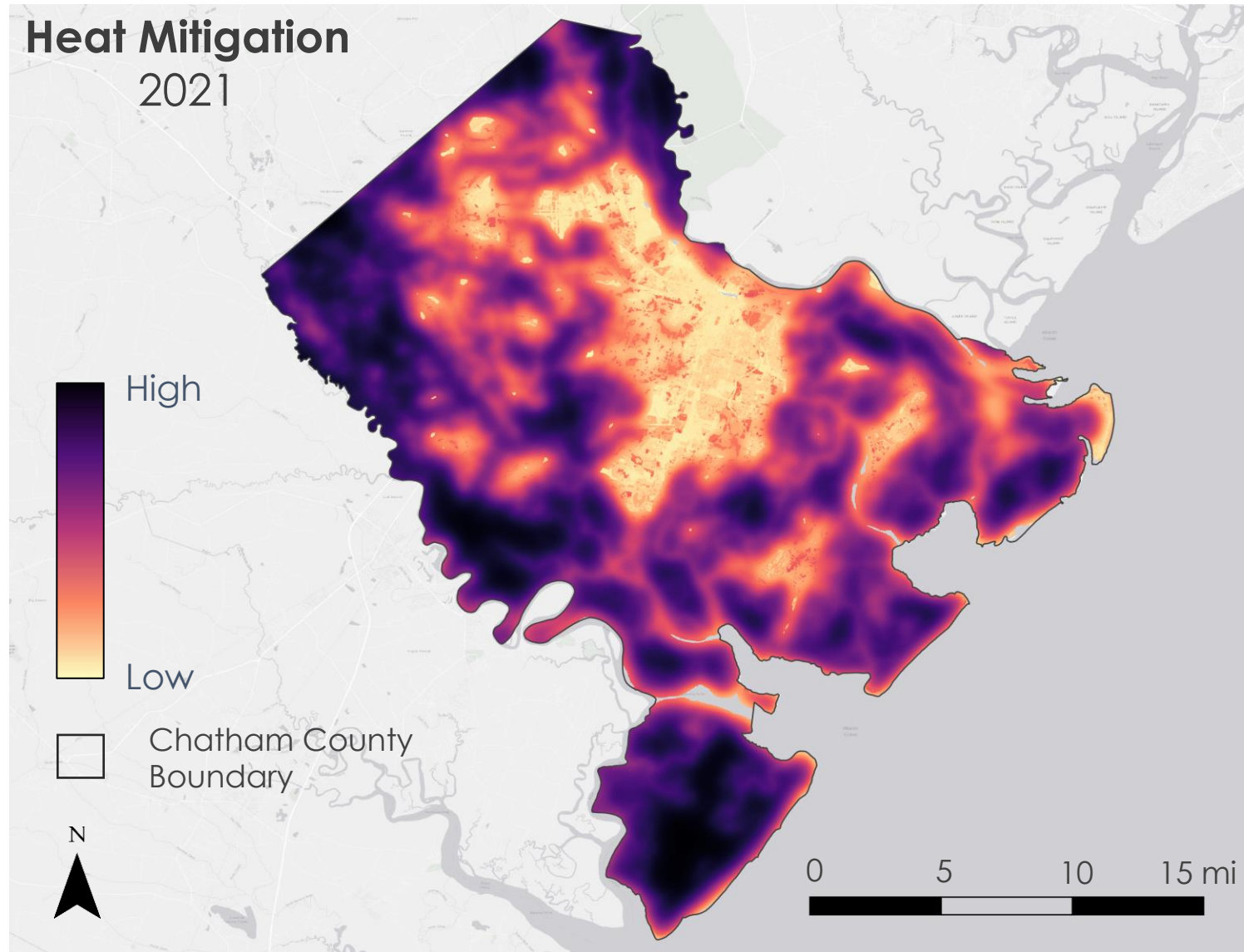


 Census Group Boundaries

Methodology: Mitigation – InVEST Urban Cooling Model



Results: Heat Mitigation Index



Heat Mitigation Index represents the ability of an area to cool itself

- Low heat mitigation indicates an ***inability*** for an area to cool itself
- High heat mitigation indicates that an area is ***effectively*** able to cool itself

Errors & Uncertainties

Data Acquisition

- Varying number of images per month & year
- Inconsistent spatial and temporal resolutions across datasets

Data Processing

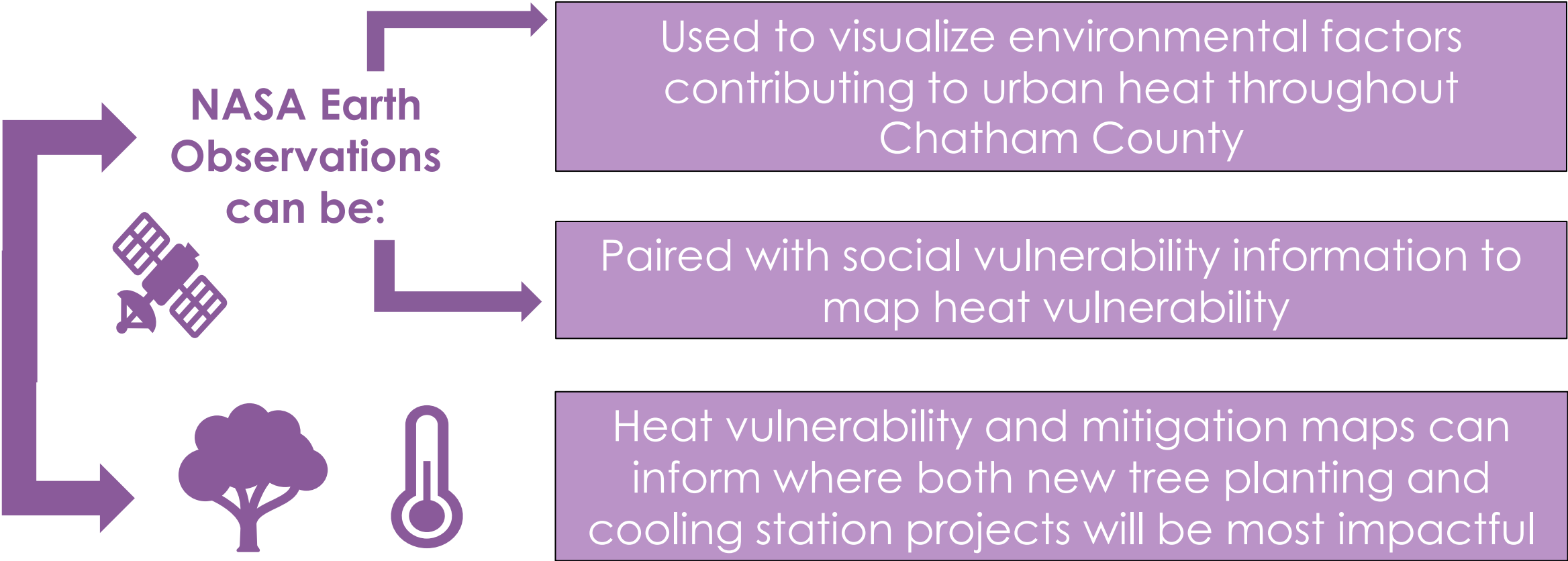
- Areas of null data due to cloud masking
- Remotely sensed data and models have inherent accuracy
- Marsh area NDVI results skewed by water amongst vegetation

Data Analysis

- Statistically insignificant number of images
- Comparing Urban Heat / NDVI at the beginning and end of period
- InVEST outputs rely on empirical weights of high uncertainty and do not consider meteorological effects



Feasibility & Partner Implementation



Conclusions

- Heat mitigation is lower in dense urban areas such as downtown Savannah
- Areas of low vegetation health/density and high urban heat expanded in the North-Western part of the county between 2014 and 2024
- Decreases in vegetation health are moderately correlated to increases in urban heat
- Canopy cover decreased by 17 percent between 2014 and 2024



Image and Background Credits: Chatham County



Acknowledgements

We would like to thank our Science Advisors and Center Leads for their continuous support and guidance throughout the term:

- **Dr. Xia Cai** (NASA Langley Research Center)
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- **Maya Hall** (California – Ames)
- **Caroline Baumann** (California – JPL)
- **Brent Bowler** (Virginia – Langley)

We would also like to thank our project partners and collaborators, your support helped make this project possible:

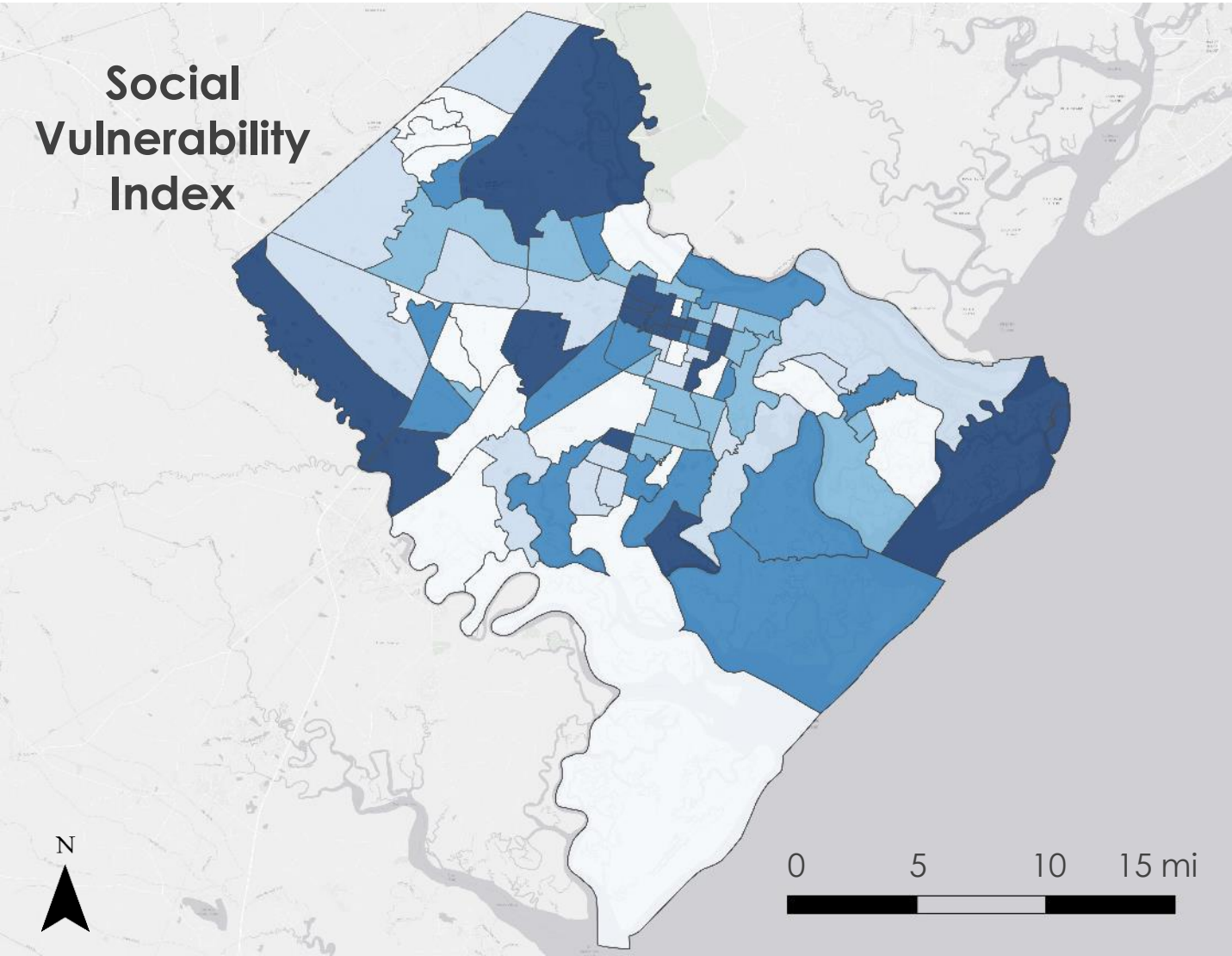
- **Jackie Jackson** (Chatham County)
- **Matt Gerig** (Chatham County)
- **Randal Mathews** (Chatham County)
- **Anthony Giarrusso** (Georgia Tech)
- **Zoe Rinker** (Savannah Tree Foundation)
- **Kait Morano** (Georgia Tech)
- **David Donnelly** (City of Savannah)
- **Chris Rustin** (State of Georgia)



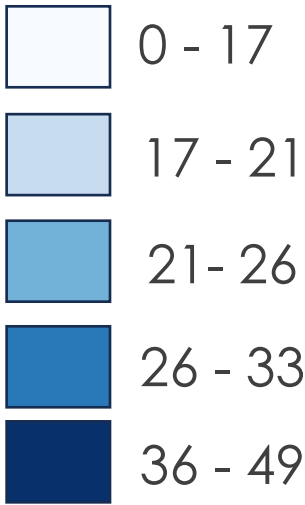
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Social Vulnerability Index



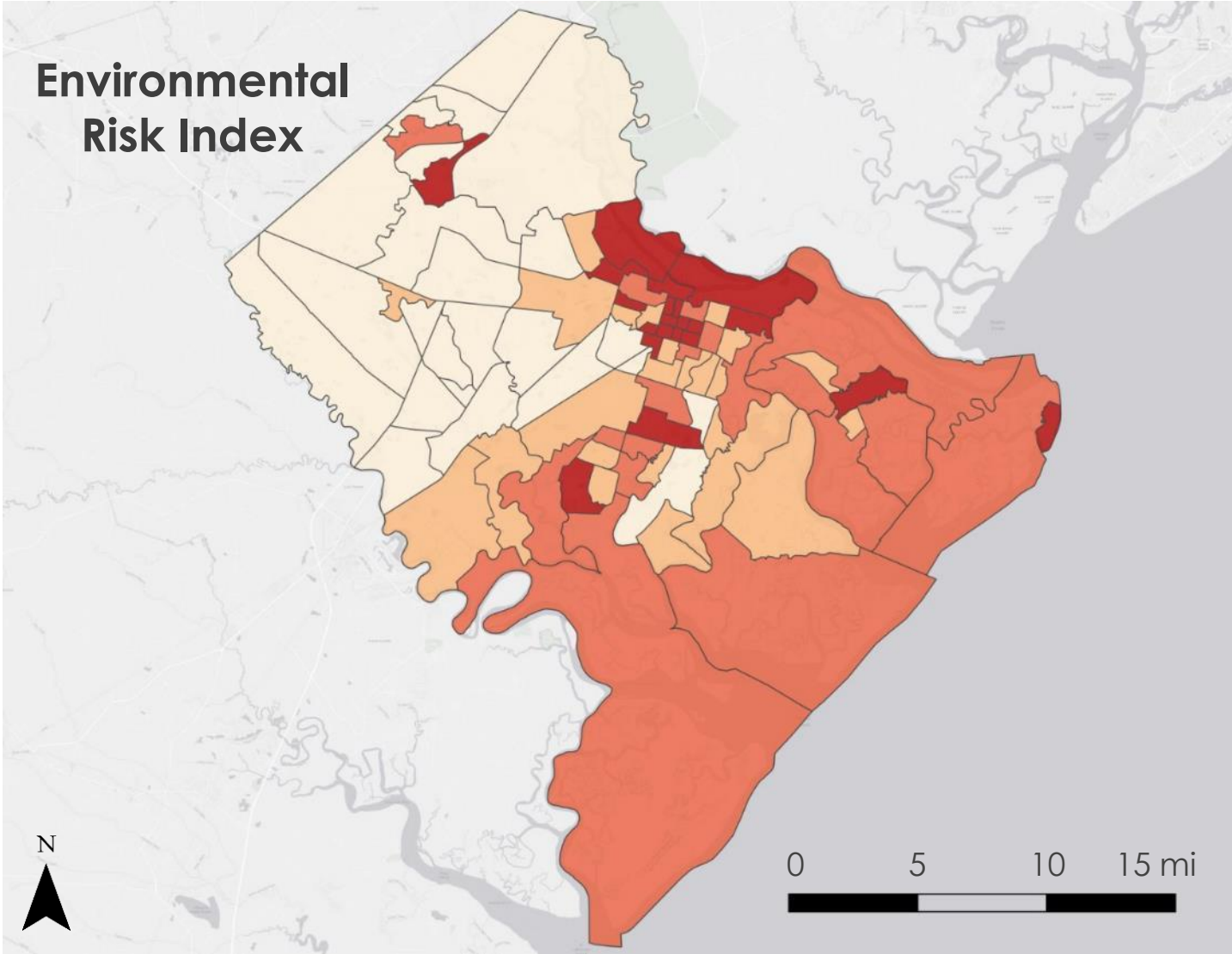
Social Vulnerability Index



Index composed of factors determined by the U.S. Census Bureau to be associated with vulnerability to heat events

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Environmental Risk Index



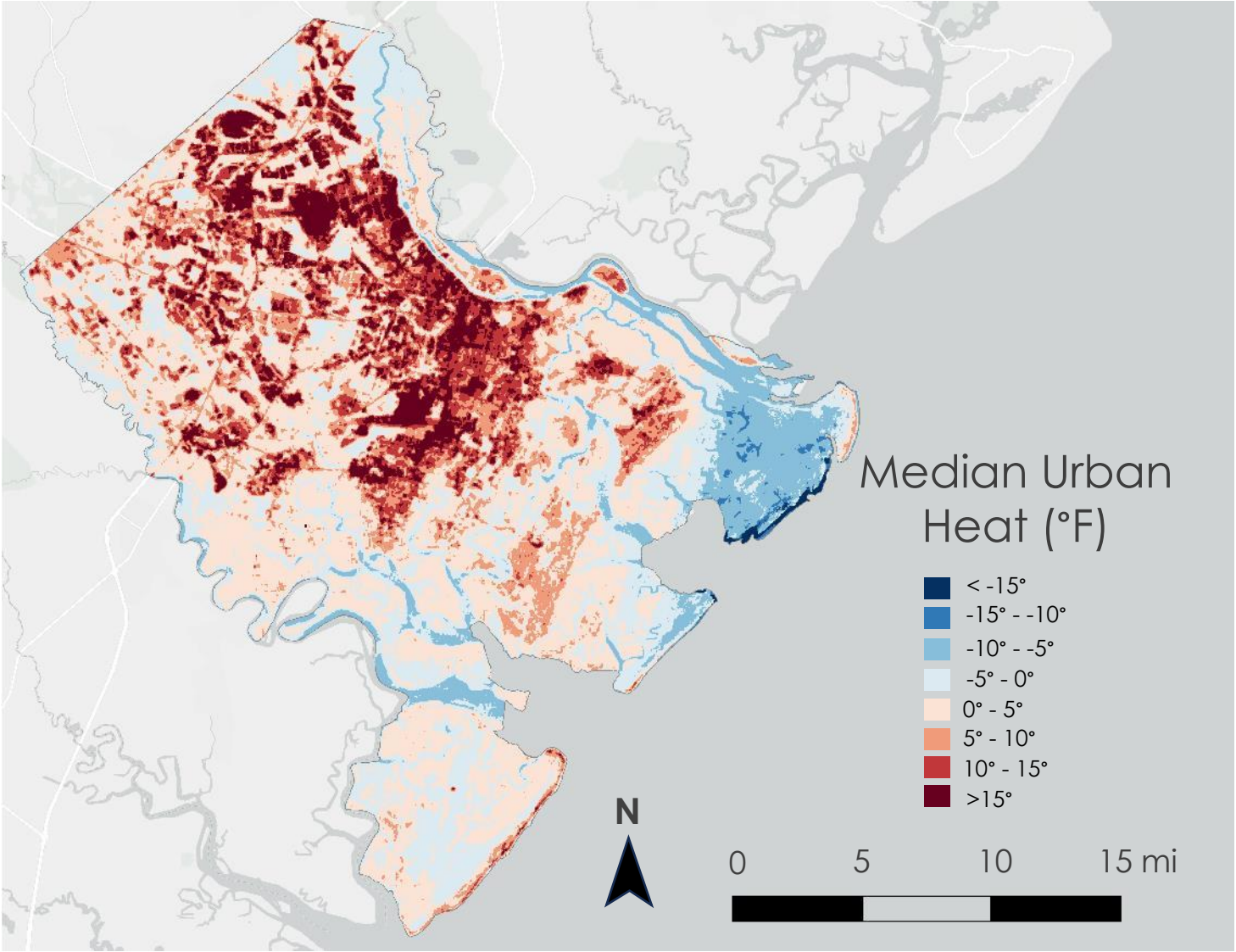
Environmental Risk Index



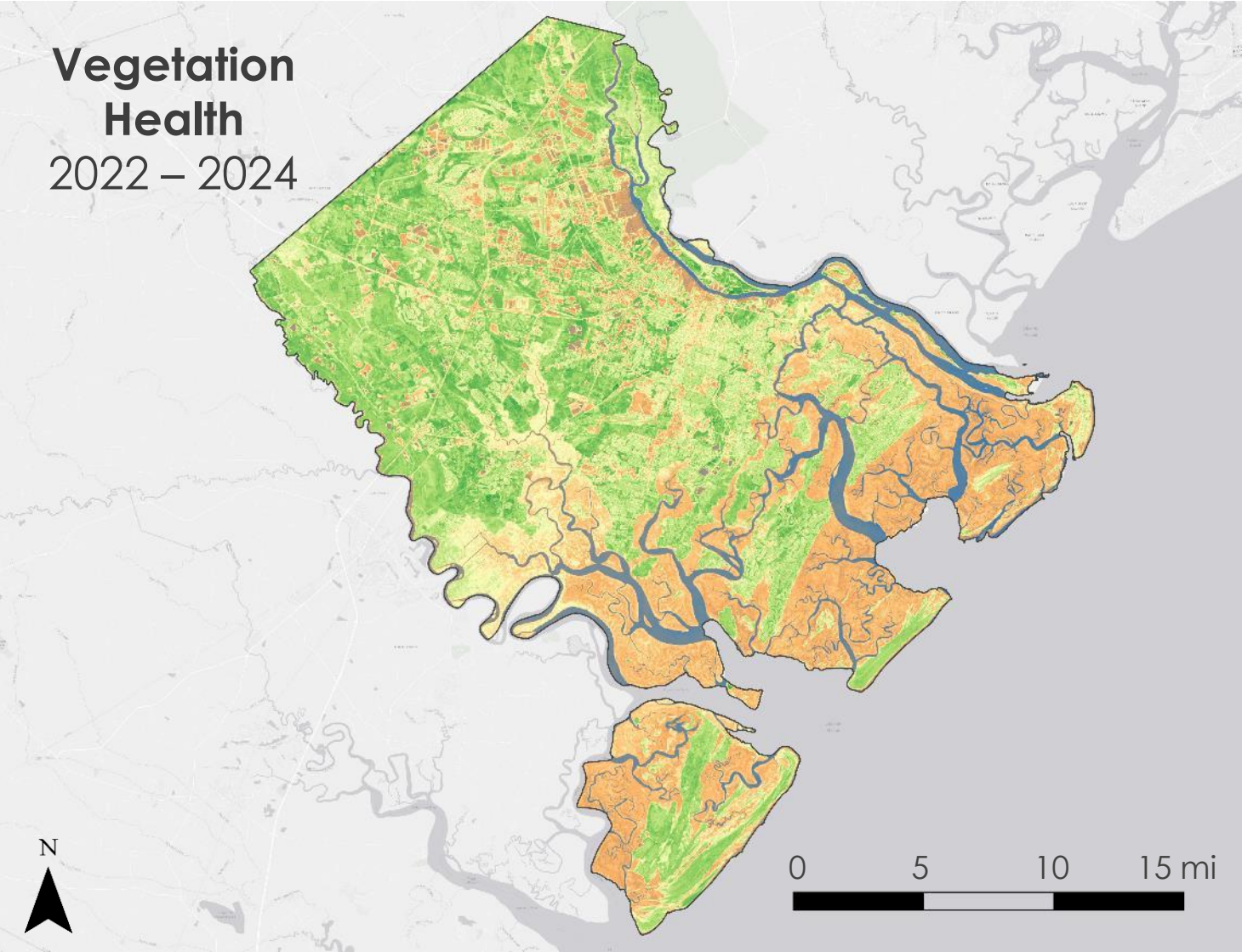
ERI Components
Canopy Cover
LST
NDVI

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Urban Heat: 2022 – 2024



Vegetation Health 2022 – 2024



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Results: 2014 – 2024 Canopy Cover Loss Map

