National Aeronautics and Space Administration

WICHITA Climate

Using Satellite Data to Identify Neighborhoods Vulnerable to Extreme Heat for Equitable Climate Mitigation and Planning

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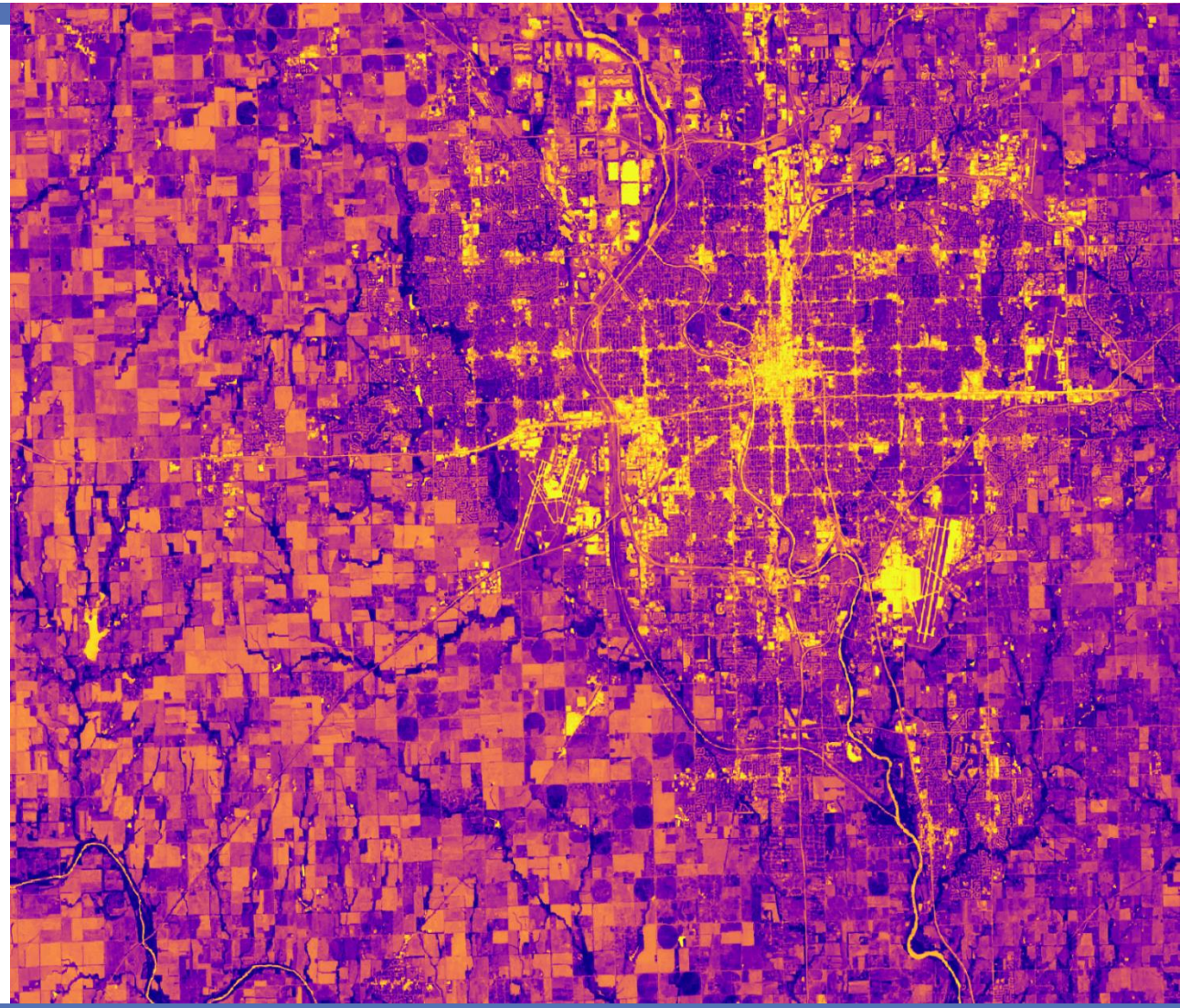

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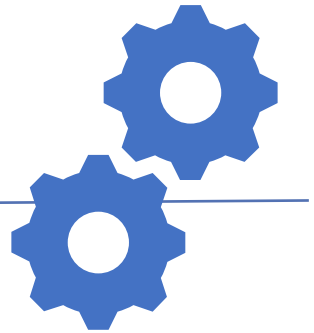
BACKGROUND

OUTLINE

Background

The Problem
What is Environmental Justice?
Project Objectives
Study Area & Period
Concerns & Goals



Methods

Results

Conclusions

Tract Snapshot
Errors and Uncertainties
Future Work
Acknowledgements

THE PROBLEM

- Rising temperatures are a climate, public health, and community concern
- Heat risk is an environmental justice issue
  - Marginalized communities suffer disproportionate impacts
  - Communities lack resources to respond

Impacts of Heat Exposure

- Health & Healthcare Burden
- Energy Burden
- Economic Vitality
- Quality of Life
- Infrastructure

Image Credit: City of Wichita

WHAT IS ENVIRONMENTAL JUSTICE?

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A **global movement** that recognizes that **spatial and environmental inequities** exist. These inequities are **driven by systemic barriers rooted in historical systems of oppression** and **continuing today**. Environmental justice calls for global transformation through **meaningful engagement of affected groups at the local scale**, including **equal partnership** in the development and implementation of laws, regulations, and policies that affect the environment and/or public health.

Image Credit: City of Wichita

PROJECT OBJECTIVES

MAP

Heat Exposure

Tree Canopy Coverage

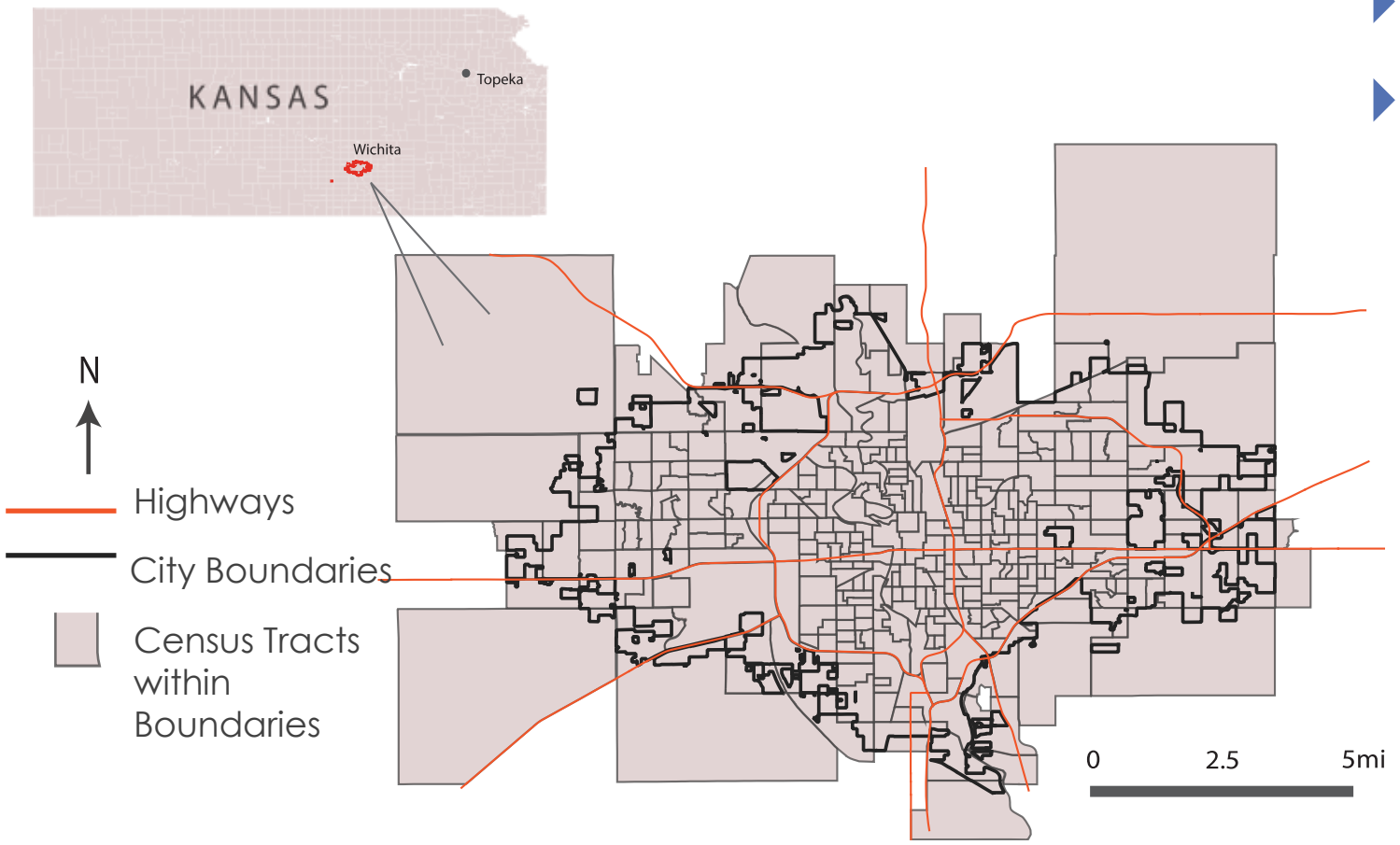
Heat Risk and Vulnerability

Produce an easily replicable workflow

Formulate clear and easily digestible deliverables

Establish a path for the City of Wichita to partner with the community

STUDY AREA & PERIOD



- Study Area: Wichita, KS
- Study Period:
  - **Heat Exposure**: May–Sep 2013-2021
  - **Tree Canopy**: May–Sep 2021
  - **Heat Risk**:
    - Heat data from May–Sep 2013-2021
    - Socioeconomic data from 2020

CONCERNS & GOALS

Community Concerns

- Balancing economic vitality and environmental quality
- Continuing tree loss
- More extreme weather events

Government Goals

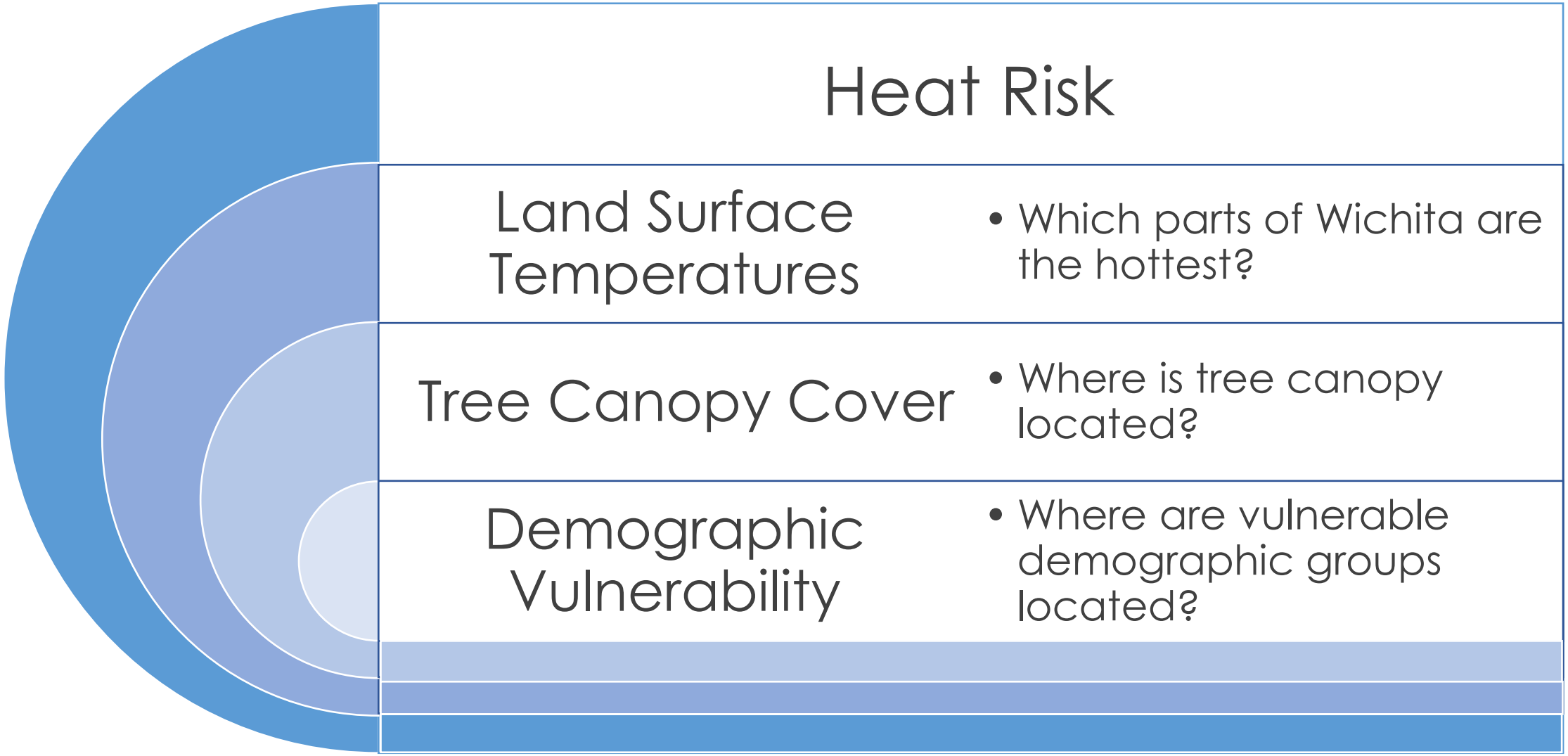
- Develop a Climate Adaptation and Mitigation Plan
- Explore using this research to support future grant applications

DEVELOP Team

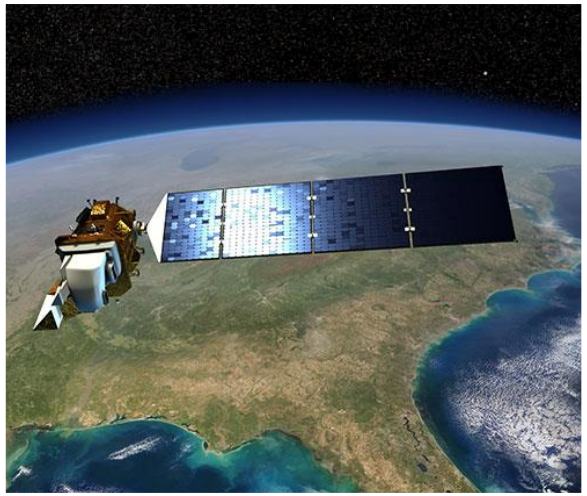
- Support our partner and community
- Recognize the limitations of the 10-week term working remotely from Wichita

METHODS

METHODS


Heat Risk
Land Surface Temperatures
• Which parts of Wichita are the hottest?
Tree Canopy Cover
• Where is tree canopy located?
Demographic Vulnerability
• Where are vulnerable demographic groups located?

SATELLITE DATA SOURCES



Landsat 8 OLI/TIRS
Surface Reflectance

Aqua MODIS

PlanetScope

Image Credit: NASA

HEAT EXPOSURE

- Study Area, Landsat 8, & MODIS Acquisition
- Calculation of Average LST per Block Group using UHEAT 1.0
- Join Average LST Data with the Study Area Shapefile
- Heat Exposure Map

TREE CANOPY

- Planet Imagery Acquisition
- Supervised Landcover Classification
- Removal of Non-tree Classes
- Accuracy Assessment
- High Resolution Tree Cover Map

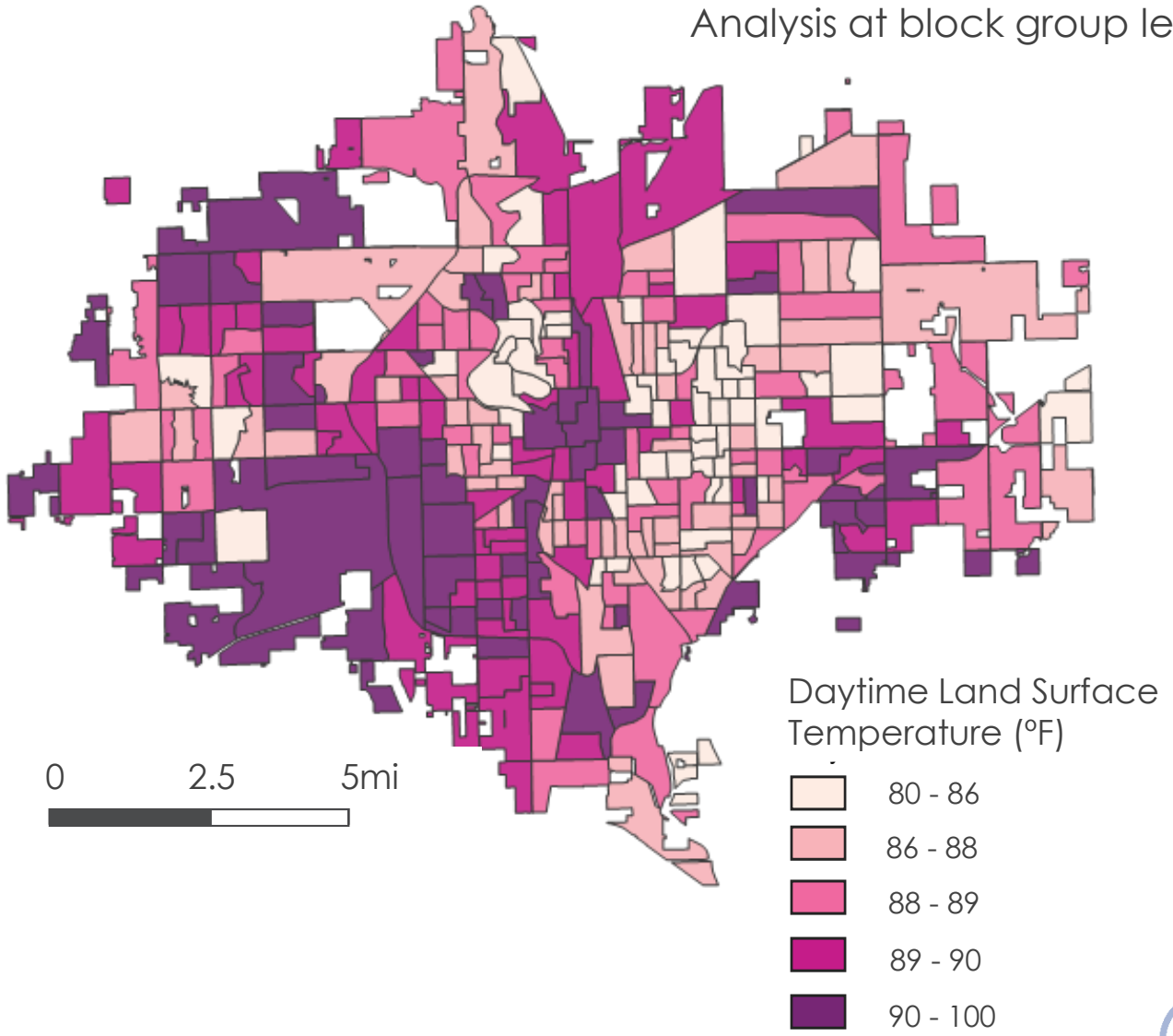
HEAT RISK

- Selection of Socioeconomic Variables
- Selection of Existing Vulnerability Indices
- Identification of Extreme Heat
- Classification of Risk
- Heat Risk Maps

RESULTS

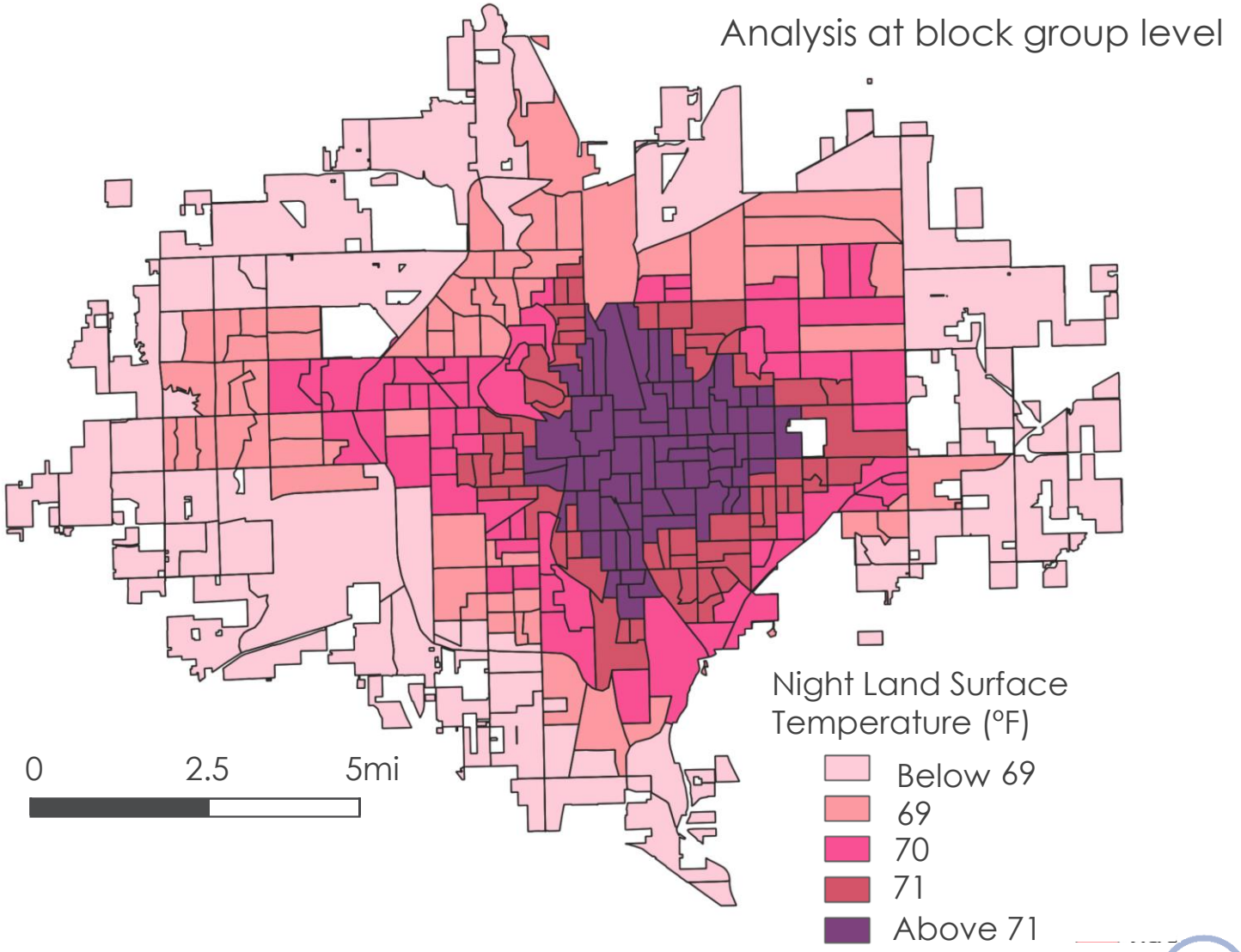
DAYTIME HEAT EXPOSURE

- High temperatures are concentrated in the city center and SE Wichita
- Heat exposure decreases as you move away from the city center



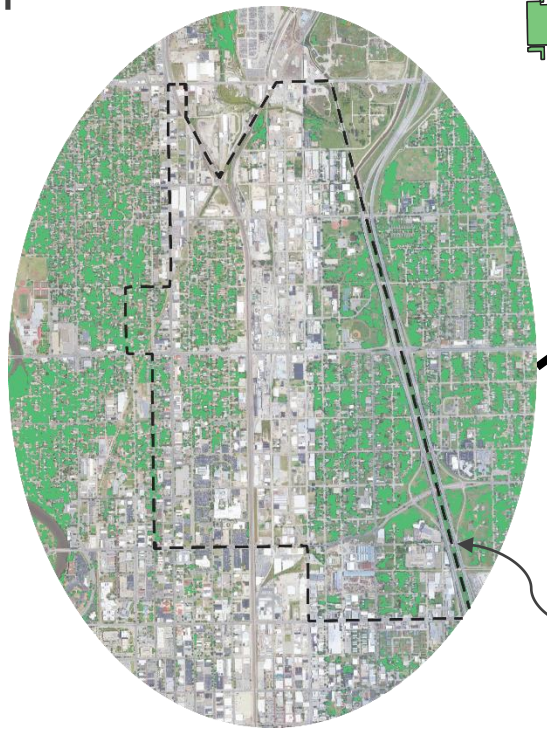
NIGHTTIME HEAT EXPOSURE

- Coarser spatial resolution
- Heat is most concentrated in the city center

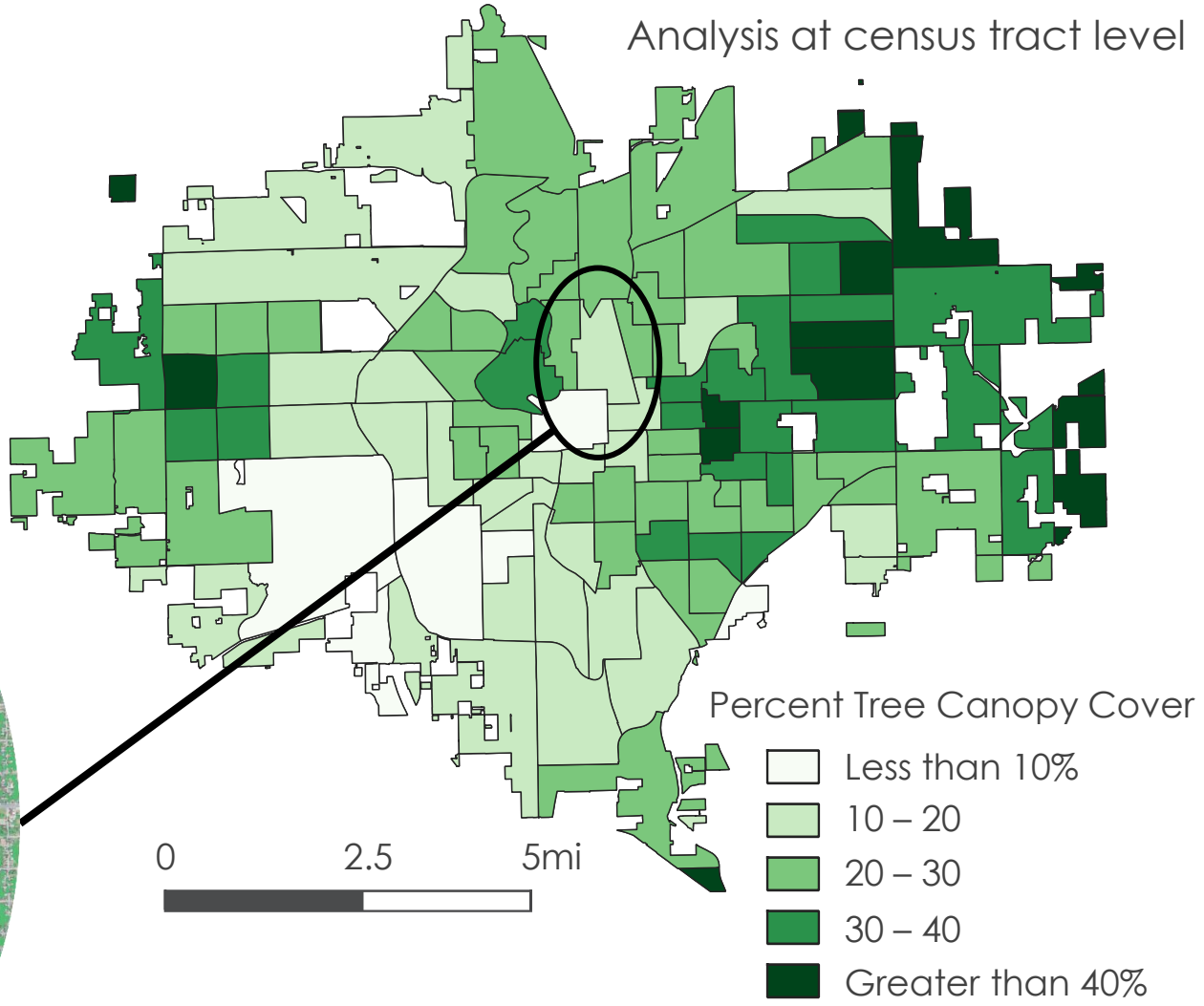


TREE CANOPY

- Unequal distribution of tree canopy
- Areas of highest heat exposure have the least canopy cover
- Classified 20% more trees than the NLCD



Green pixels = tree classification

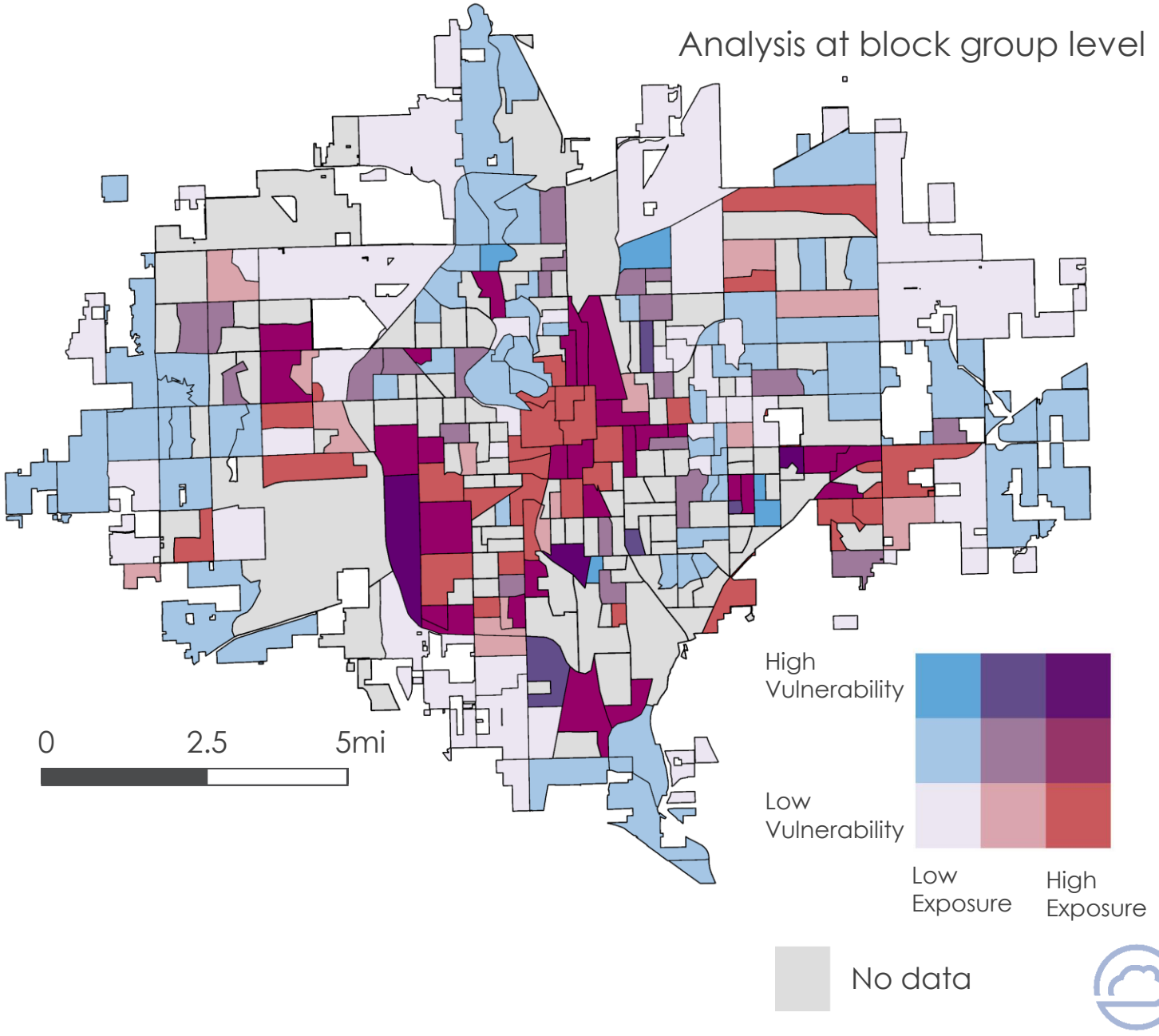


Google Earth Satellite base map with PlanetScope imagery for pixel classification courtesy of Planet Labs, Inc.

HEAT RISK

- Demographic variables
  - % low-income
  - % non-white
  - % age over 65

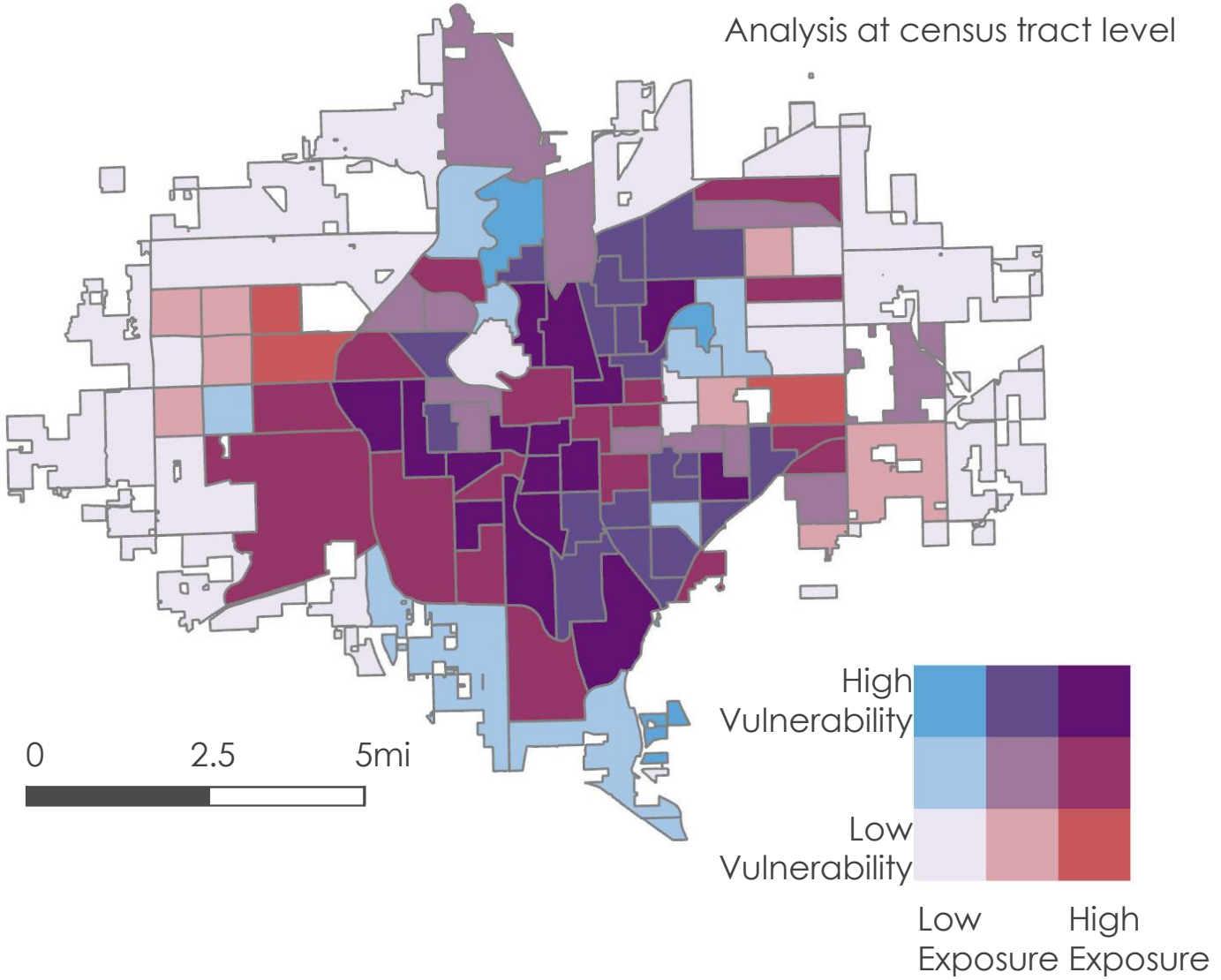
- Identified 3 high risk block groups



HEAT RISK INDICES

- We identified 17 high risk census tracts
  - 82% are also identified as disadvantaged by CEJST

- Spatial Trends
  - High risk tracts circle the city center
  - SW tracts have high exposure tracts with medium vulnerability
  - Eastern tracts have medium exposure and high vulnerability



CONCLUSIONS

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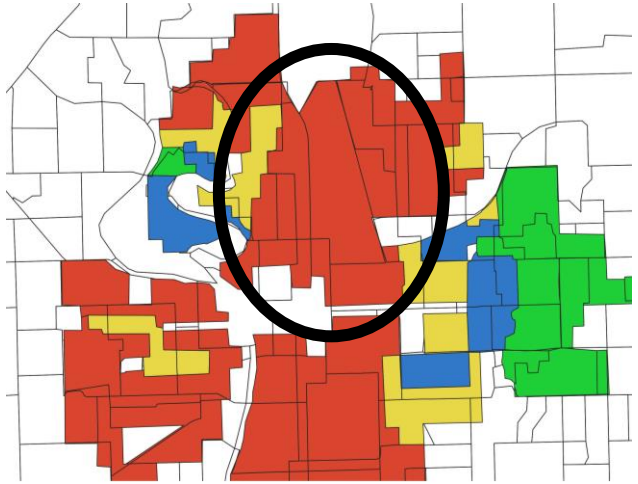
- Heat exposure is concentrated in the city center and SW Wichita
- Tree canopy coverage is low in the city center and SW Wichita
- Census blocks and tracts adjacent to the city center have the highest heat risk
- We identified 3 census block groups and 17 census tracts which the City of Wichita can focus on in heat mitigation efforts

Image Credit: City of Wichita

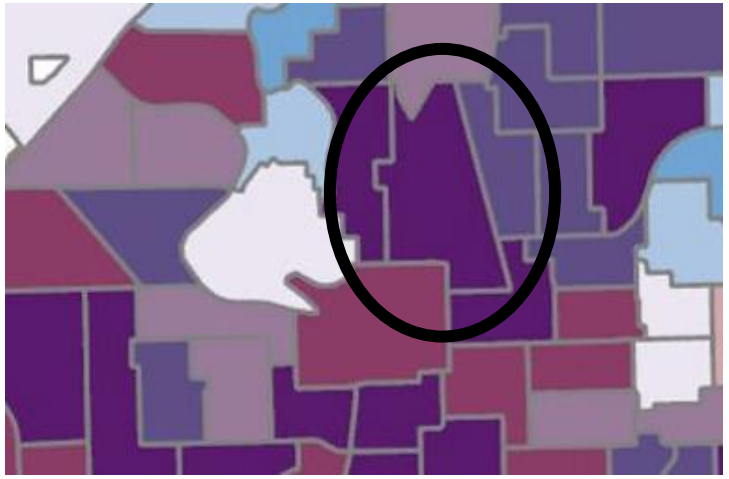
SNAPSHOT OF A HIGH-RISK AREA

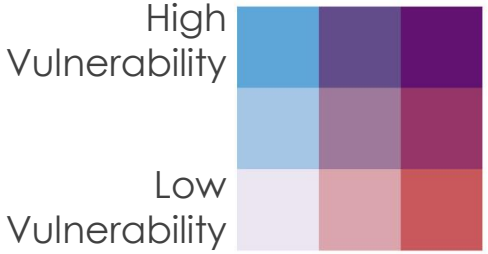
Examining the Relationship Between Redlining, Heat Vulnerability, and Tree Canopy

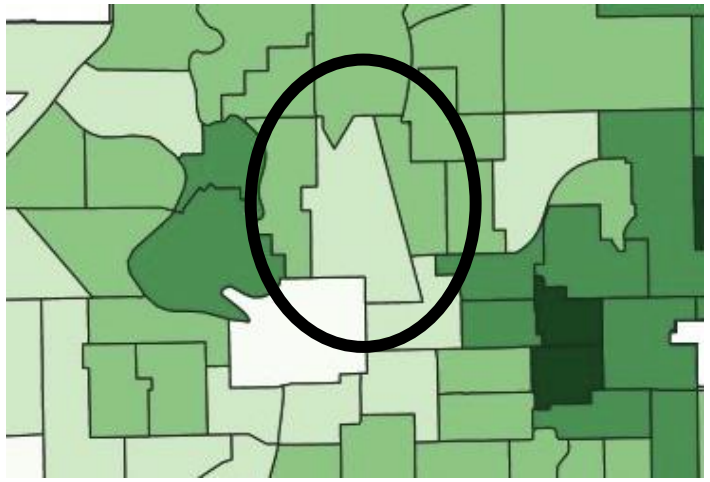


Home Owner Loan Corporation Grades

- A "Best"
- B "Still Desirable"
- C "Definitely Declining"
- D "Hazardous"







Percent Tree Canopy Cover

- Less than 10%
- 10 – 20
- 20 – 30
- 30 – 40
- Greater than 40%

WHAT DO DIFFERENCES IN TREE CANOPY COVER LOOK LIKE?

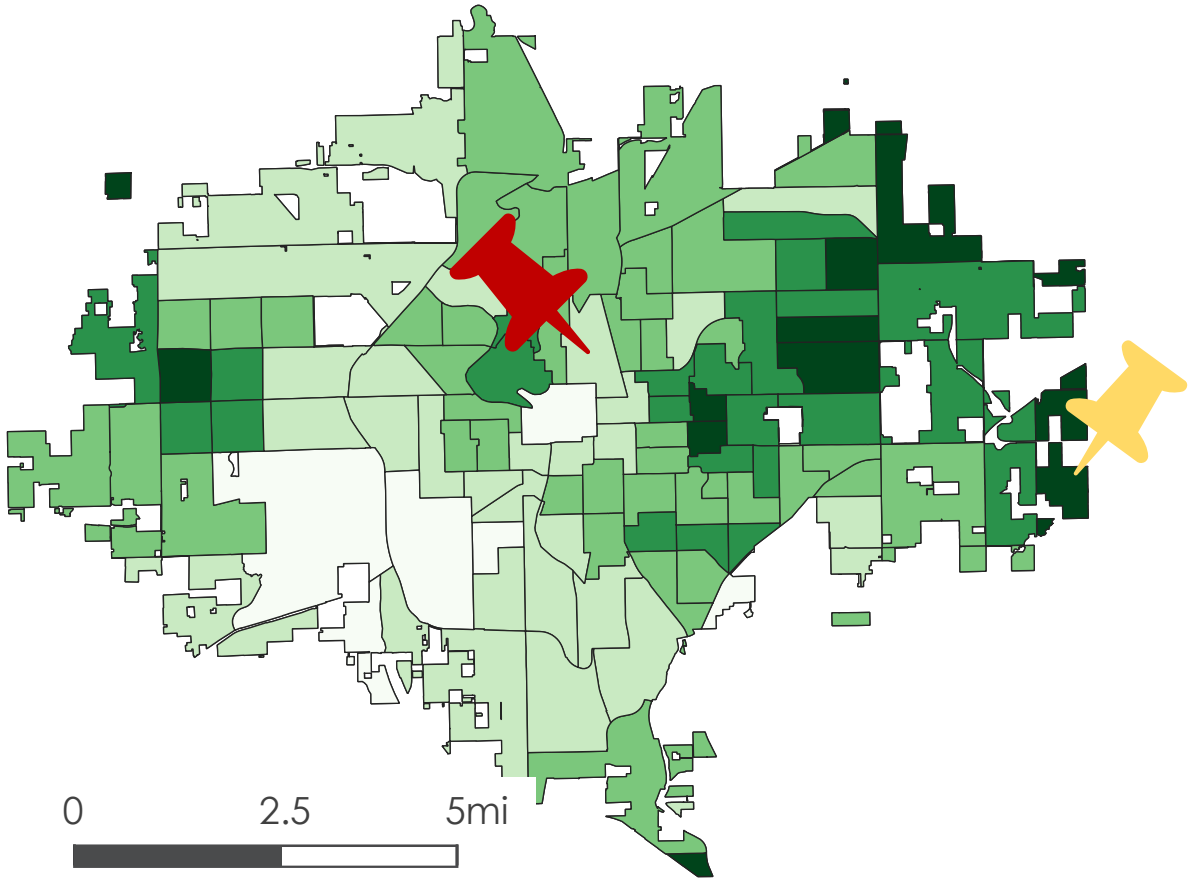
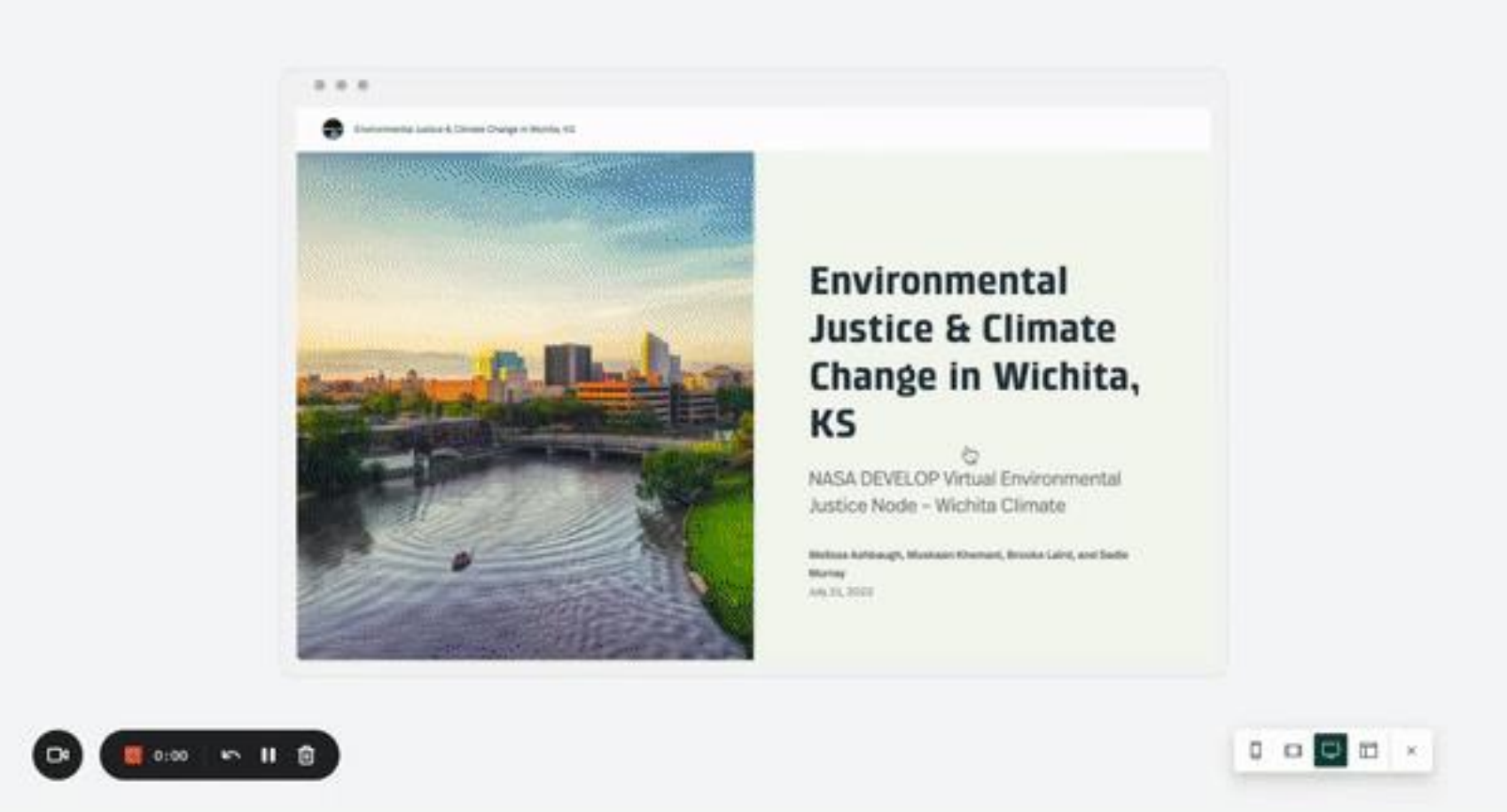


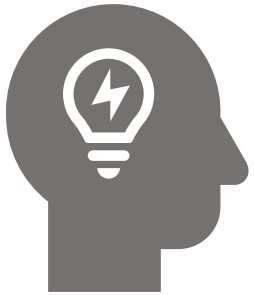
Image Credit: Google Maps

STORY MAP


Environmental Justice & Climate Change in Wichita, KS
NASA DEVELOP Virtual Environmental Justice Node – Wichita Climate
0:00

ERRORS & UNCERTAINTIES

- Lack of localized data
- LST is a proxy
- EJ is more than a correlation
- Unhoused populations not accounted for
- Constructed vulnerability indices
- Community engagement limited by short term



FUTURE WORK

- **Focus** on community engagement
  - Solicit community feedback
  - Align with local EJ organizations
  - Provide residents with tools to address environmental injustice in their community
- **Model** cooling impacts
  - of actions such as increasing tree canopy

Image Credit: City of Wichita

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