CRITICAL INFRASTRUCTURE AND LAND USE CLIMATE VULNERABILITY ANALYSIS
Project Update

— In Association with —

May 23, 2023

JonesEdmunds

BRIZAGA
Collective Water Resources
GSE
Wetland Solutions Inc
NEMAC+FernLeaf
BEBR BUREAU OF ECONOMIC AND BUSINESS RESEARCH
eda consultants · inc.
CRC Climate Resilience Consulting

Project Overview
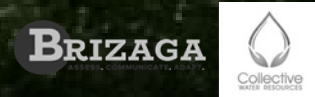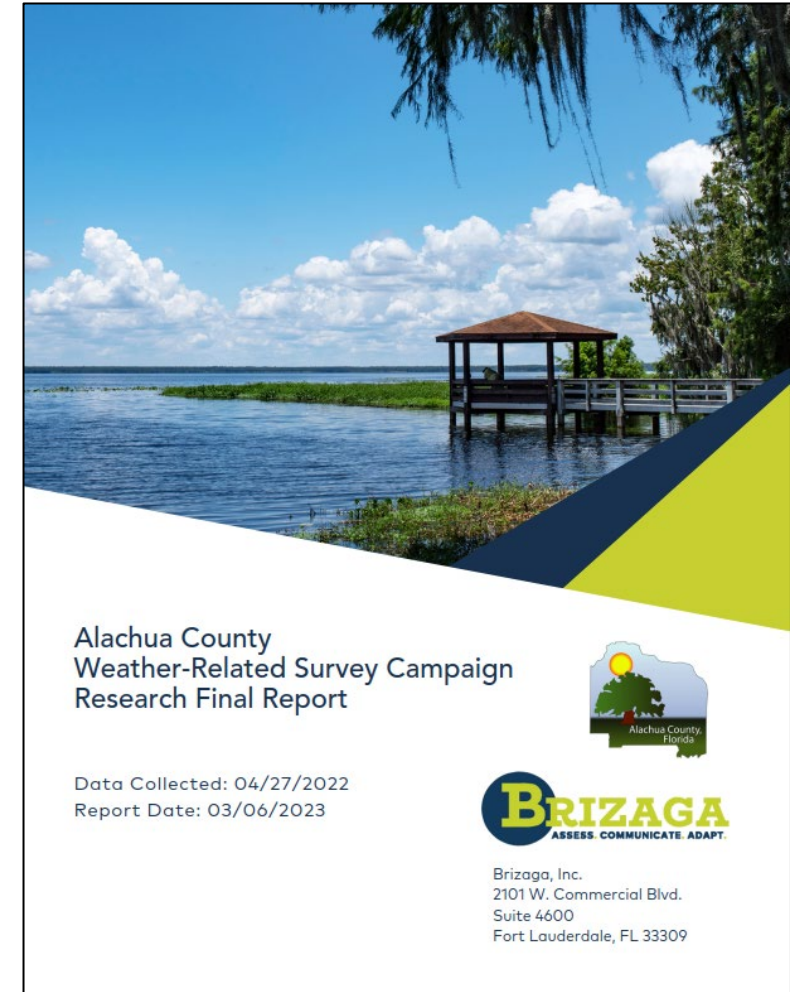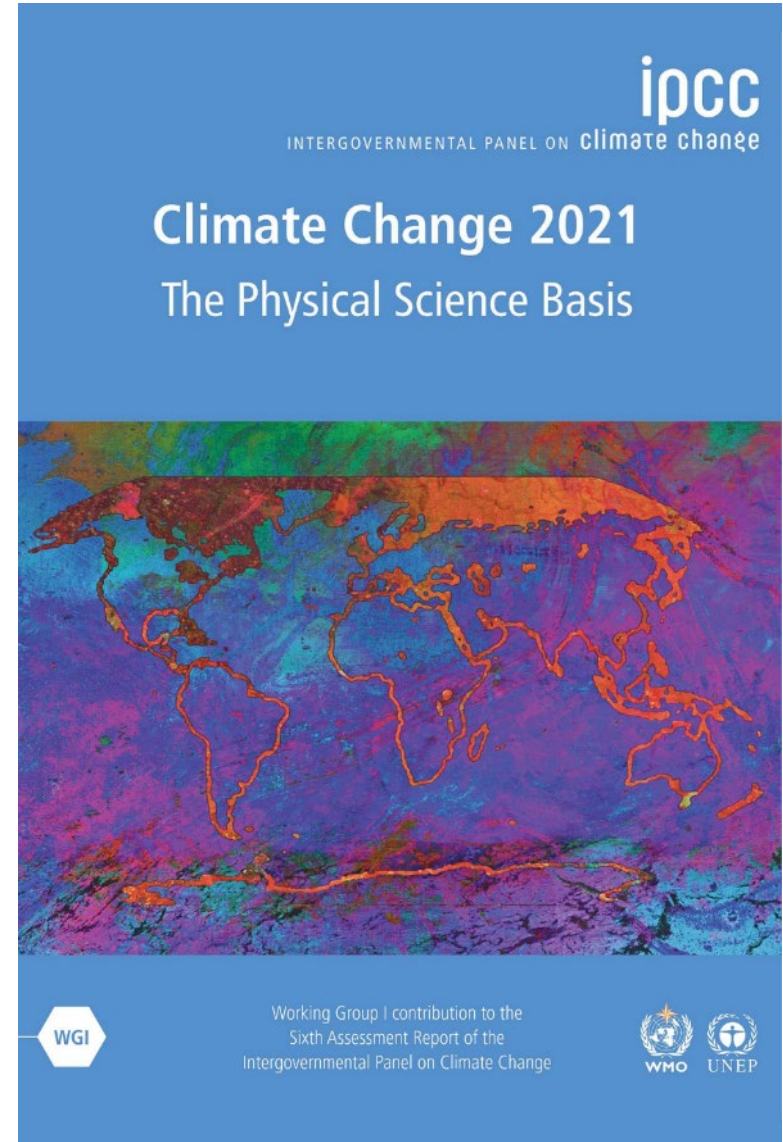
- Task 1 - Future Climate Change Impact Analysis & Stakeholder Engagement

- Task 2 – Location of Critical Infrastructure Vulnerable to Flooding

- Task 3 – Assessment of Increased Climate Change Related Vulnerability to Neighborhoods and Cultural Resources
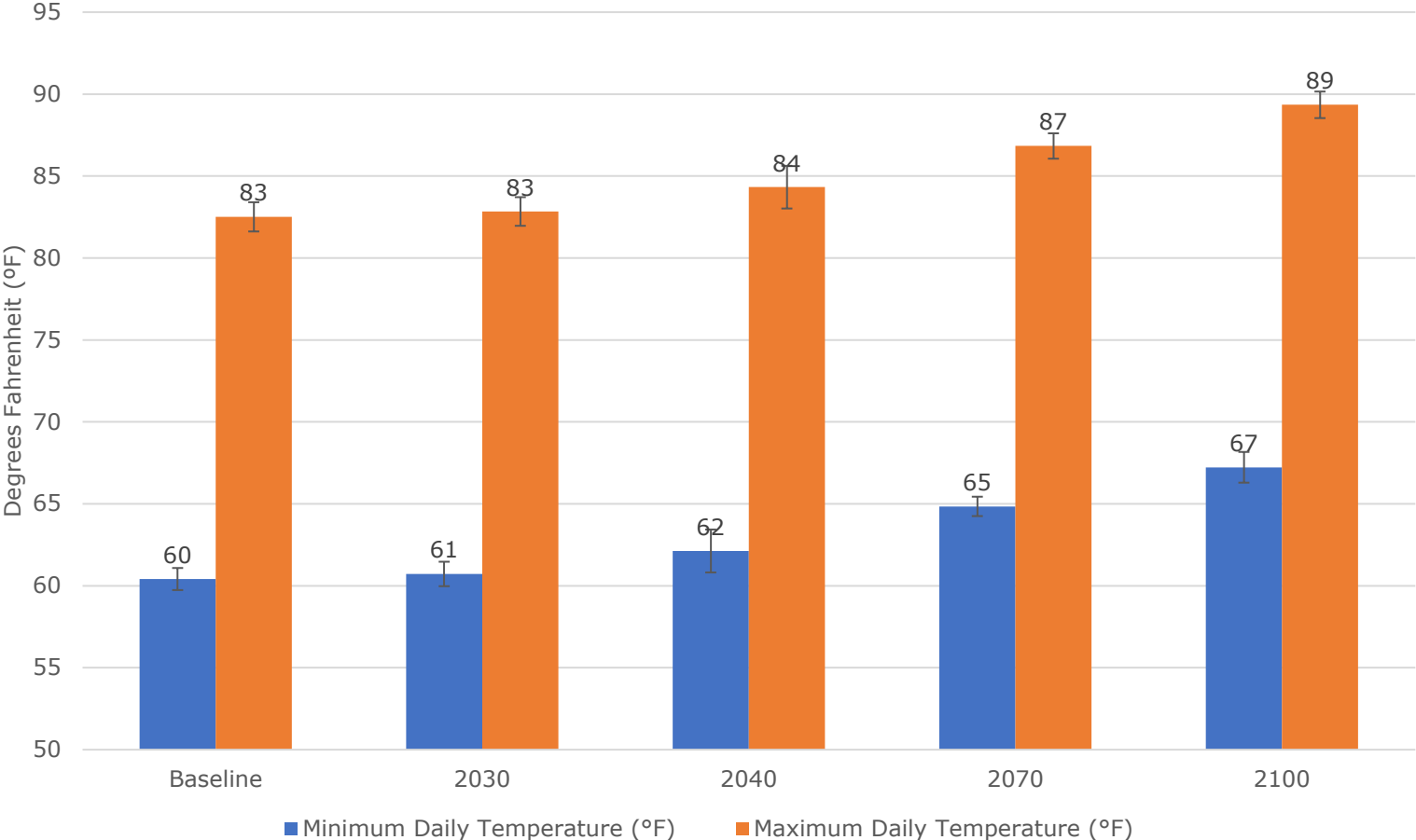
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- **Survey Results**
  - **601 total responses**
  - **Target was 400 responses**
  - **Summary report and results provided to staff**

Alachua County
Weather-Related Survey Campaign
Research Final Report

Data Collected: 04/27/2022
Report Date: 03/06/2023

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ASSESS. COMMUNICATE. ADAPT.

Brizaga, Inc.
2101 W. Commercial Blvd.
Suite 4600
Fort Lauderdale, FL 33309
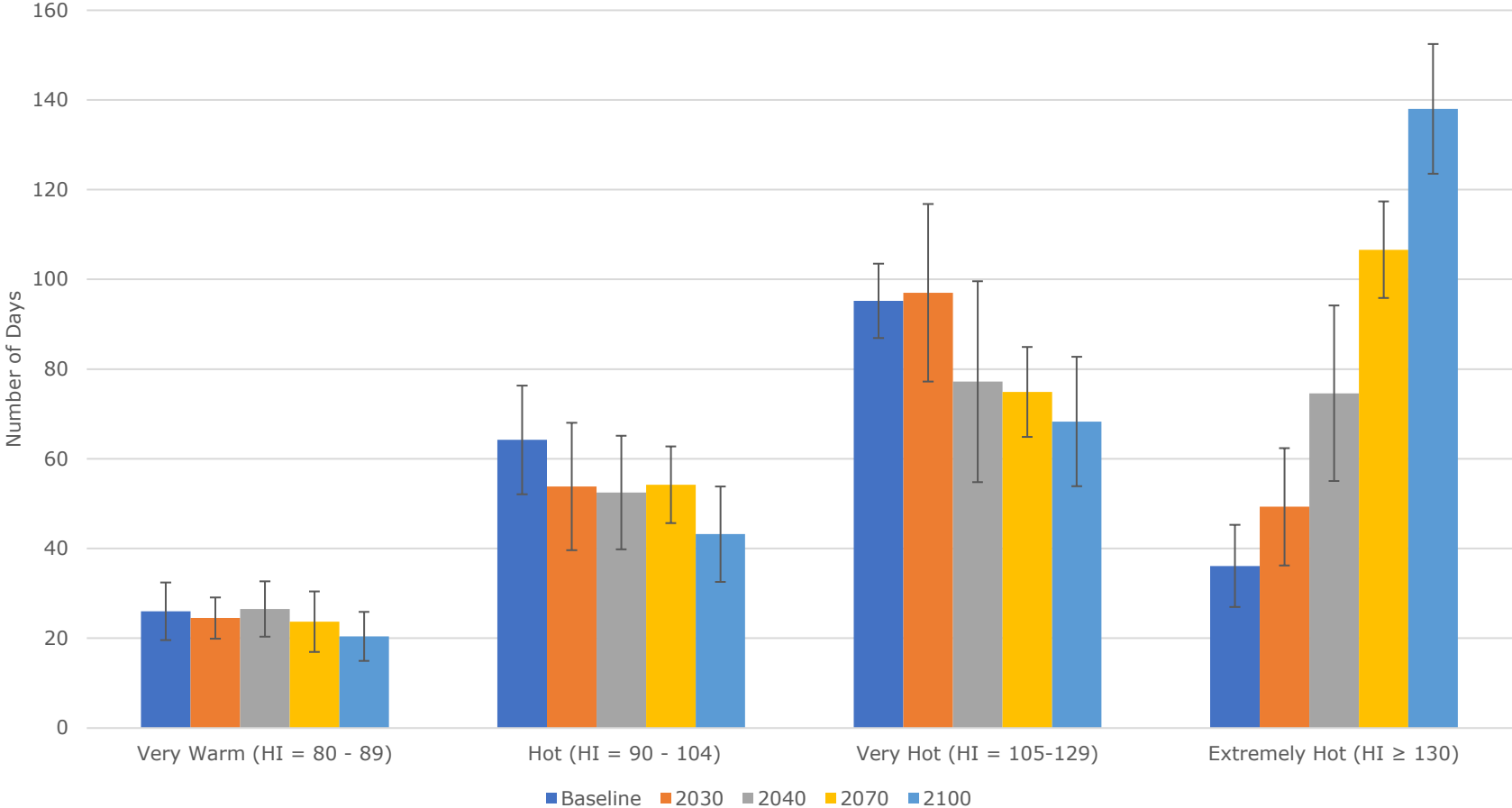
Selected Climate Change Scenario

- **Coupled Model Intercomparison Project (CMIP)**
    - **CMIP 5 (published 2014)**
    - **CMIP 6 (published 2021)**
- **Multiple Climate Change Scenarios**
- **Five Shared Socio-Economic Pathways**
    - **SSP1 - high level of mitigation & adaption ~ 1.5°C rise by 2100**
    - **SSP5 – low mitigation & adaptation ~ 5°C rise by 2100**
        - **More likely to show trends**
        - **Highlights planning needs**

ipcc
INTERGOVERNMENTAL PANEL ON climate change

Climate Change 2021
The Physical Science Basis

WGI

Working Group I contribution to the
Sixth Assessment Report of the
Intergovernmental Panel on Climate Change

WMO UNEP

Extreme Temperatures

Average Annual Daily Minimum and Maximum Temperatures

Legend: ■ Minimum Daily Temperature (°F)　■ Maximum Daily Temperature (°F)

X-axis: Baseline, 2030, 2040, 2070, 2100
Y-axis: Degrees Fahrenheit (°F)

Baseline — Minimum: 60, Maximum: 83
2030 — Minimum: 61, Maximum: 83
2040 — Minimum: 62, Maximum: 84
2070 — Minimum: 65, Maximum: 87
2100 — Minimum: 67, Maximum: 89

Heat Index

Average Number of Days Maximum Heat Index Exceeds Thresholds

Extreme Heat Vulnerability Assessment Ruleset

| Exposure		Adaptive Capacity	
H	>75th percentile developed land cover	**L**	<25th percentile tree canopy coverage AND/OR <25th percentile median income
M	25th-75th percentile developed land cover	**M**	25th-75th percentile tree canopy coverage AND/OR 25th-75th percentile Median Income
L	<25th percentile Developed Land Cover	**H**	>75th percentile tree canopy coverage AND/OR >75th percentile Median Income

VULNERABILITY
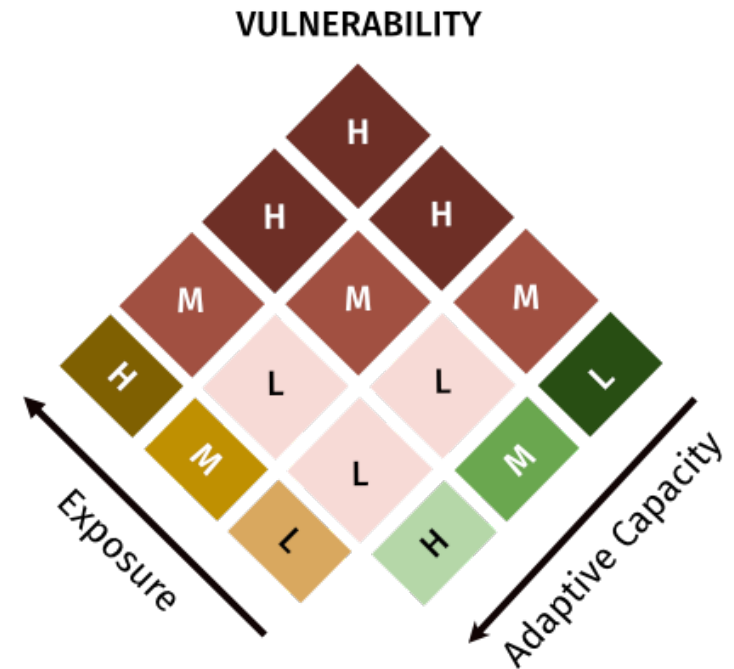
People living in mobile homes are likely to be more exposed to extreme heat due to lack of air conditioning prevalence, insulation and energy usage.

Hatched block groups have greater than >19% mobile home residences
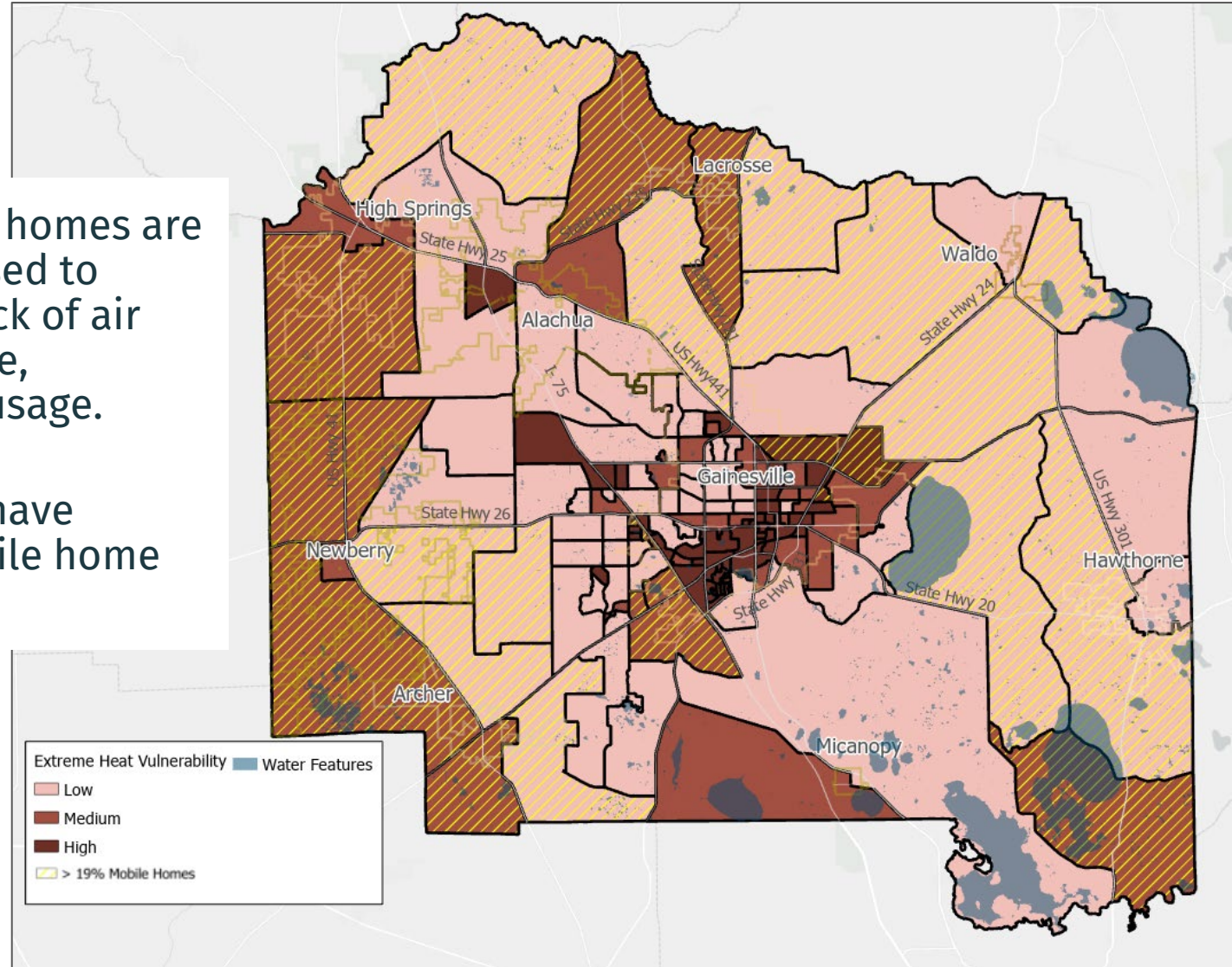
Individuals aged 65 or older are more prone to heat-related illness.

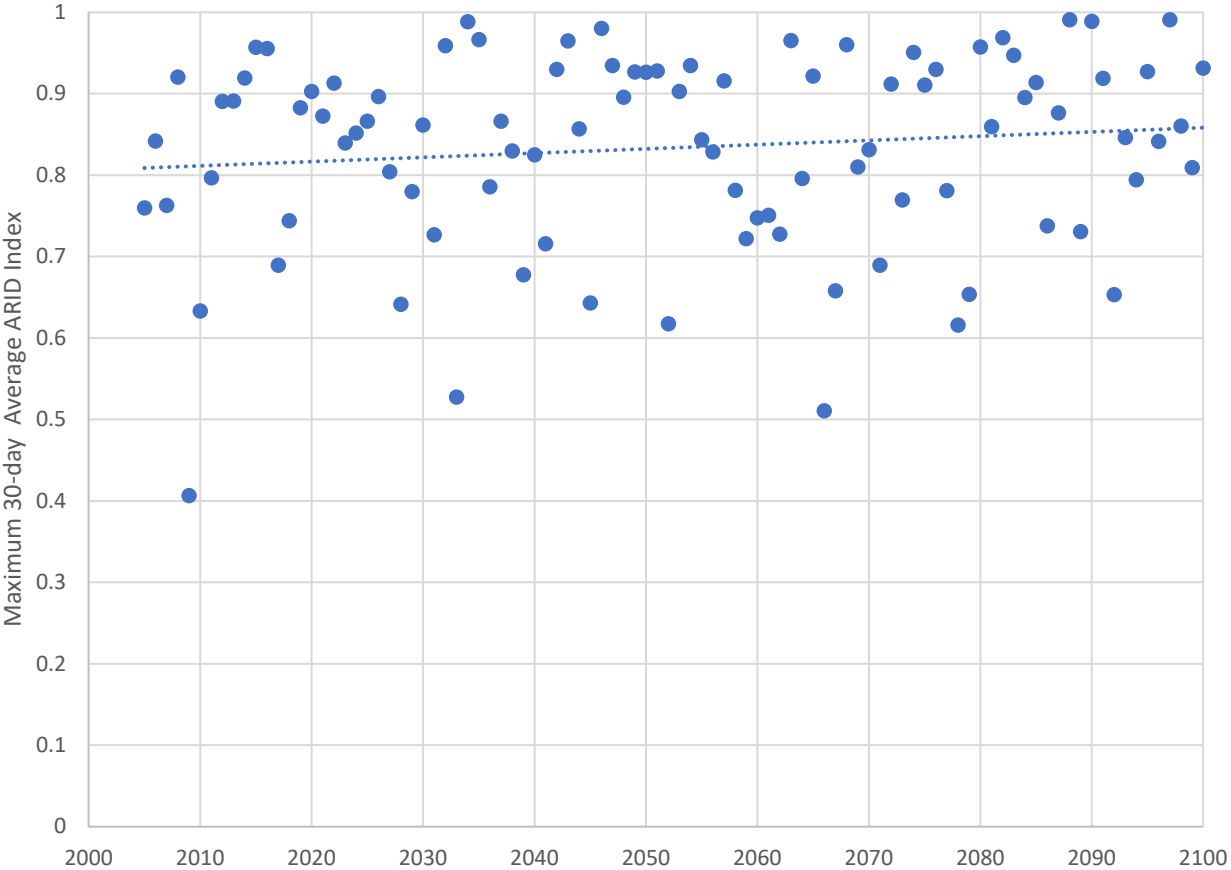Hatched block groups have >36% individuals over 65 years of age
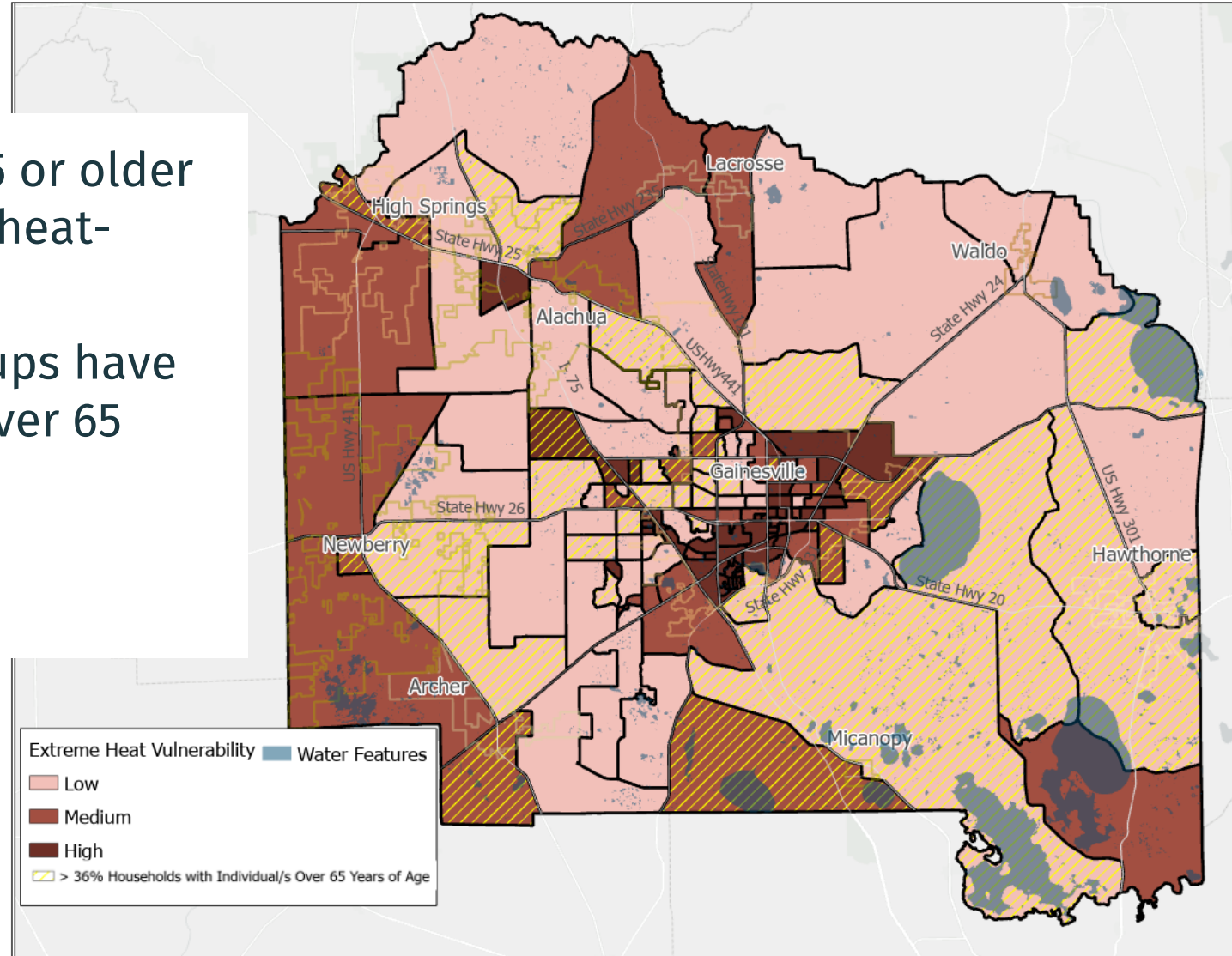
About a quarter of public and private school properties and day cares are located in highly heat vulnerable areas.

Student athletes are susceptible to dehydration and heat-related illness from exposure during outdoor practice.

Infants and young children are more susceptible due to less efficient thermoregulation and may lack of resources/knowledge to protect themselves

Food Systems and Agricultural Production
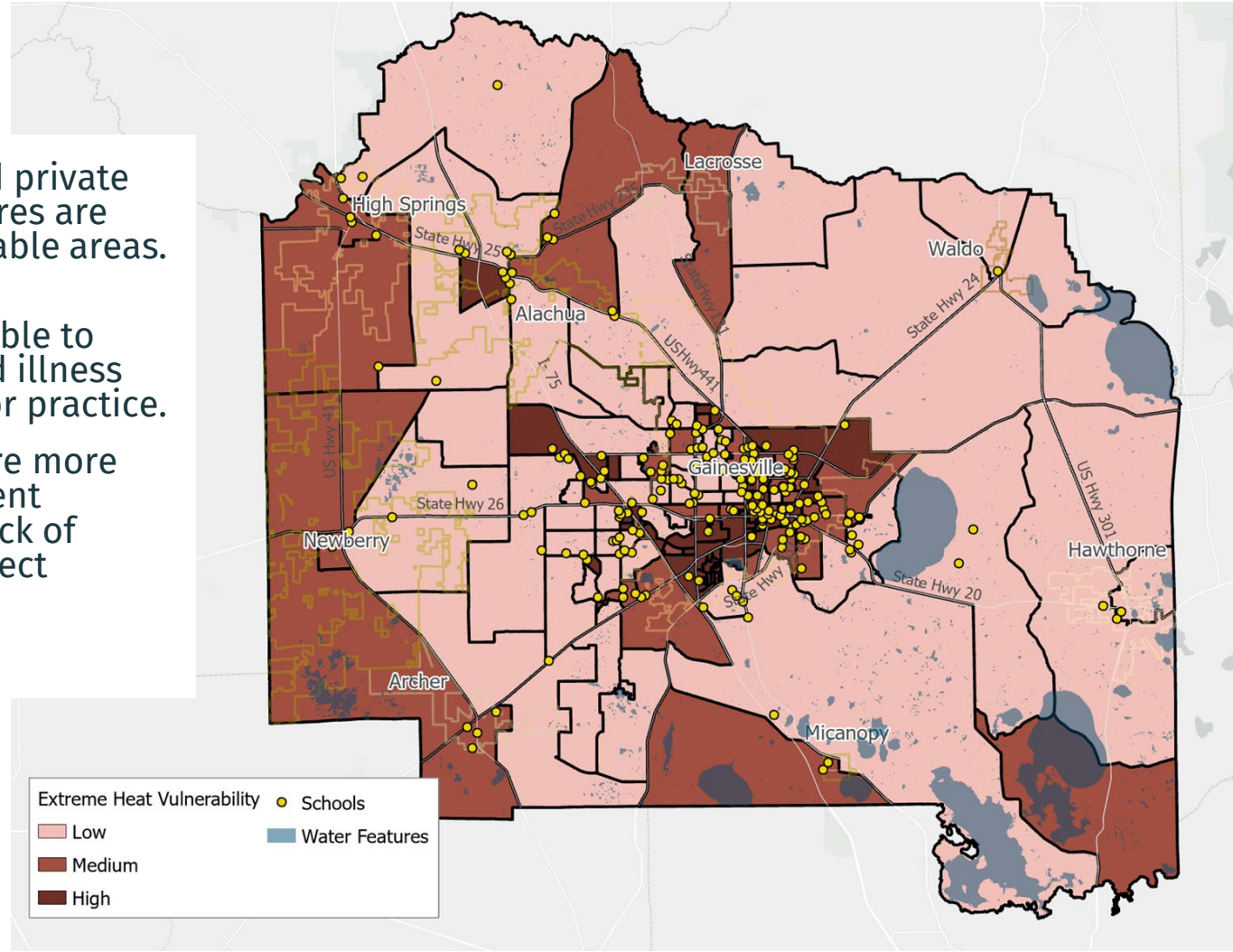
- **Agricultural Reference Index for Drought (ARID)**
  - **Used to quantify drought in the SE**
  - **Focused on agricultural drought**
  - **Developed at UF**

Food Systems and Agricultural Production

- **Three Crop Models**
  - **Field Crop (corn)**
  - **Forage Crop (Bahia)**
  - **Vegetable Crop (snap bean)**

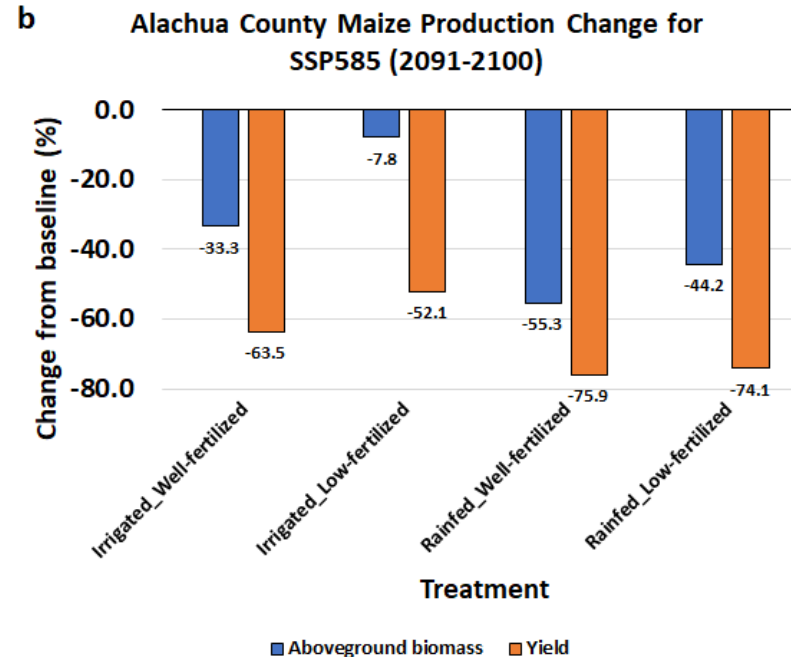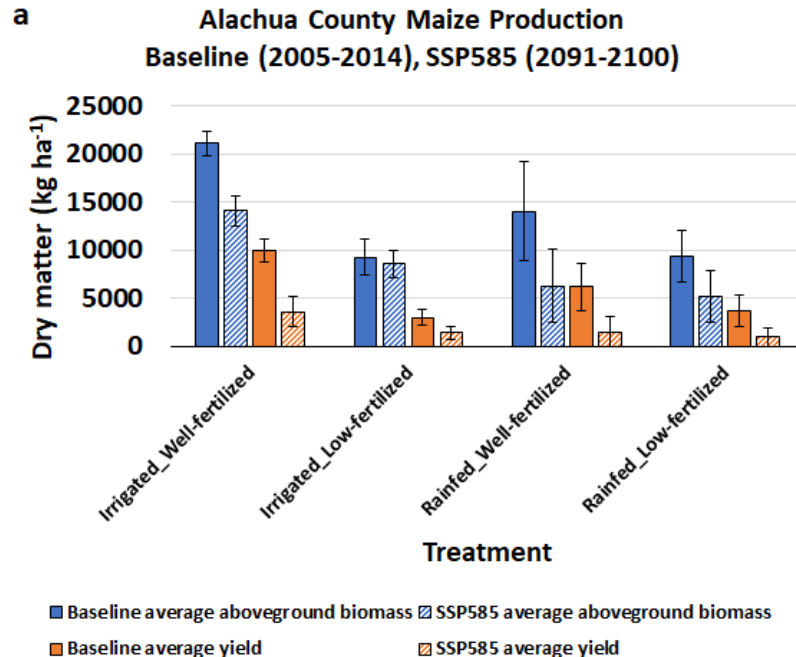# Food Systems and Agricultural Production

- **Three Crop Models**
  - **Field Crop (corn)**
  - **Forage Crop (Bahia)**
  - **Vegetable Crop (snap bean)**
- **Irrigated & non-irrigated**
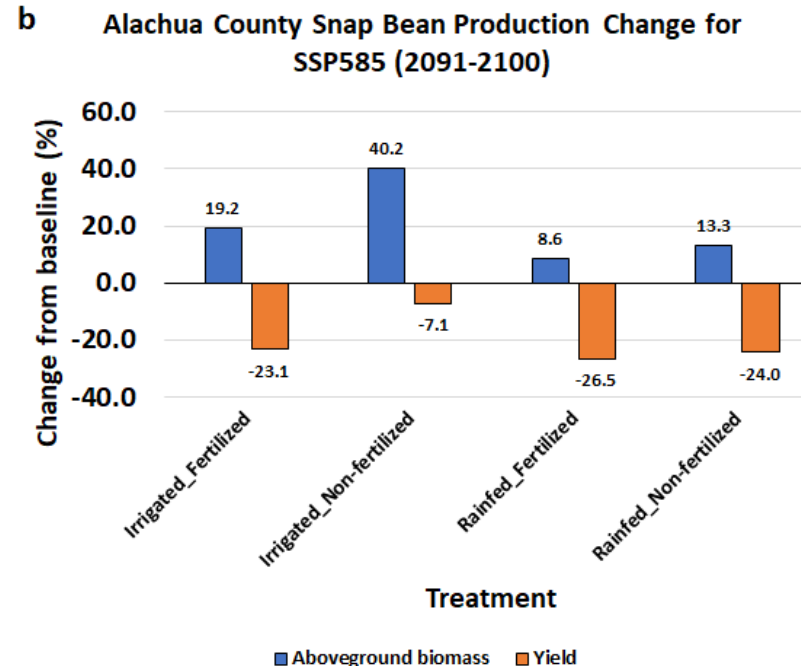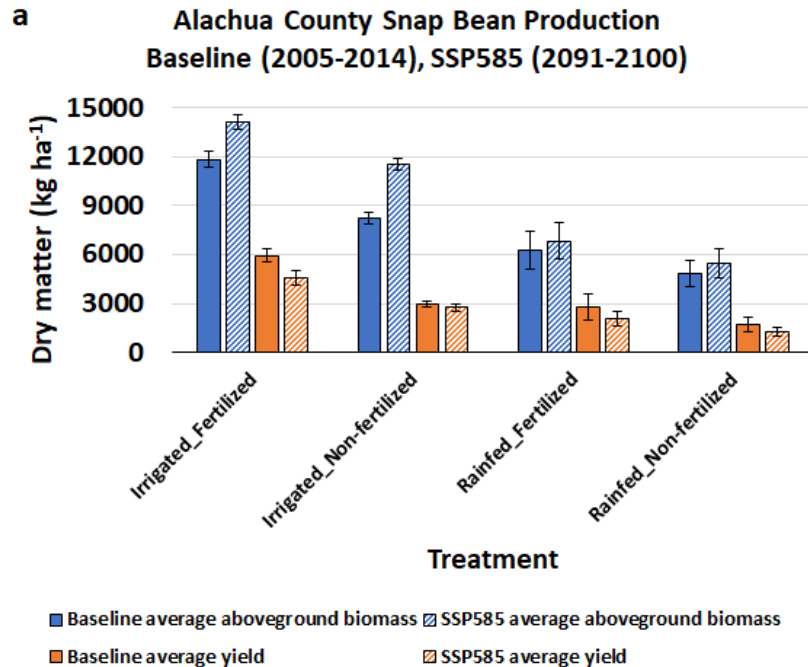- **Fertilized & non-fertilized**

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- **Evaluated yields, biomass, fertilizer & irrigation demand:**
  - 2030
  - 2040
  - 2070
  - 2100

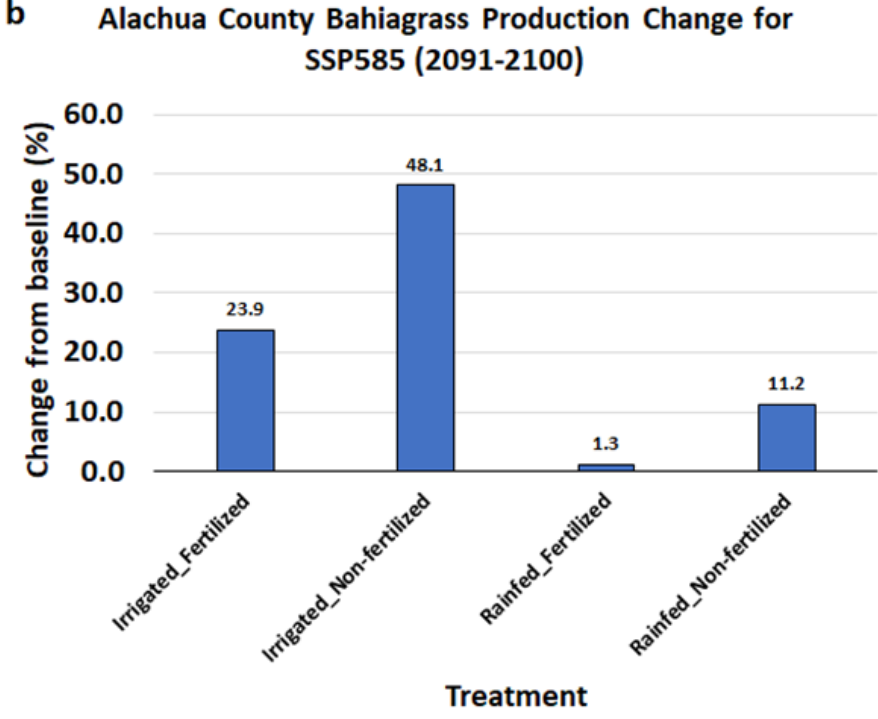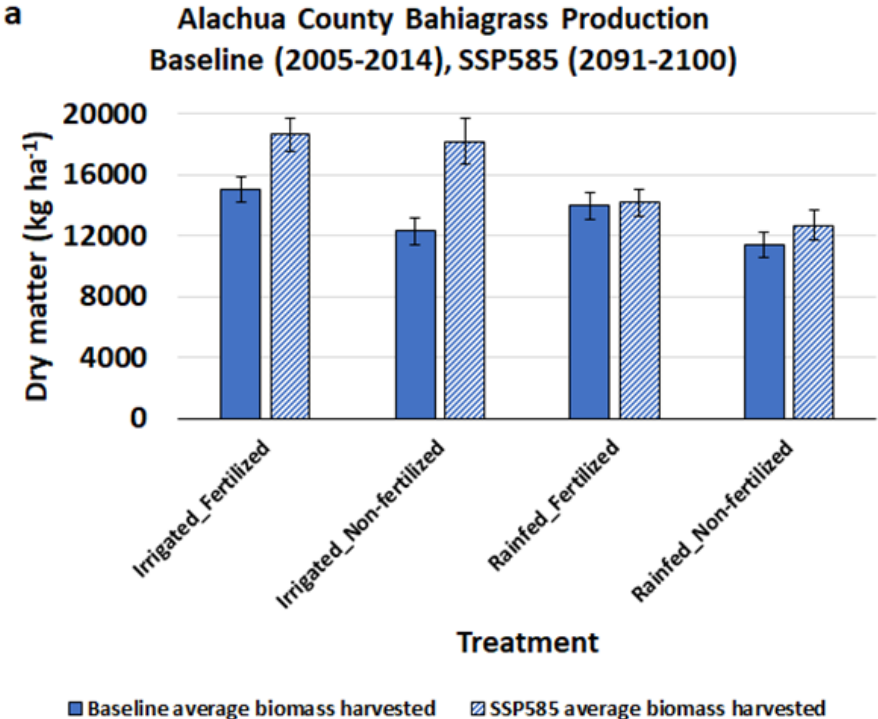# Food Systems and Agricultural Production

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- **Corn**
    - **Significant reduction in yield**
    - **Heat and water deficit stress**
    - **Increased irrigation and fertilizer need**

a — Alachua County Maize Production Baseline (2005-2014), SSP585 (2091-2100)

b — Alachua County Maize Production Change for SSP585 (2091-2100)

- **Snap Beans**
  - **Initial increase in yield (increased CO_2)**
  - **Eventual reduction (heat and water deficit stress)**
  - **Increased irrigation and fertilizer need**

a Alachua County Snap Bean Production Baseline (2005-2014), SSP585 (2091-2100)

b Alachua County Snap Bean Production Change for SSP585 (2091-2100)

Legend for a:
- Baseline average aboveground biomass
- SSP585 average aboveground biomass
- Baseline average yield
- SSP585 average yield

Legend for b:
- Aboveground biomass
- Yield

Food Systems and Agricultural Production

- **Bahia Grass**
  - **Increase in yield (increased CO$_2$)**

a Alachua County Bahiagrass Production Baseline (2005-2014), SSP585 (2091-2100)

b Alachua County Bahiagrass Production Change for SSP585 (2091-2100)

■ Baseline average biomass harvested   ☑ SSP585 average biomass harvested

Food Systems and Agricultural Production
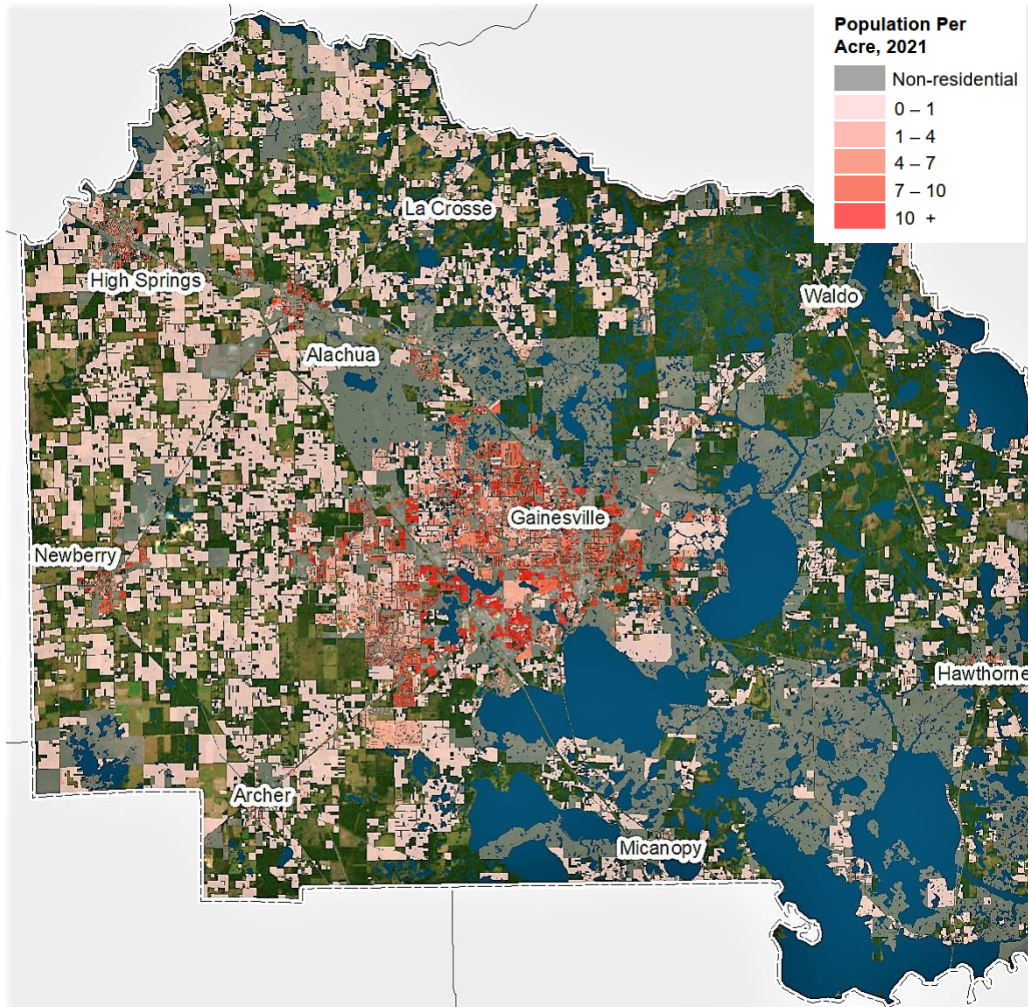
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Livestock Heat Stress
- **Temperature-Humidity Index**
- **Correlated with Stress in Livestock**
- **Dairy cow production impacted THI > 68**
- **Dry cow stress THI > 77**
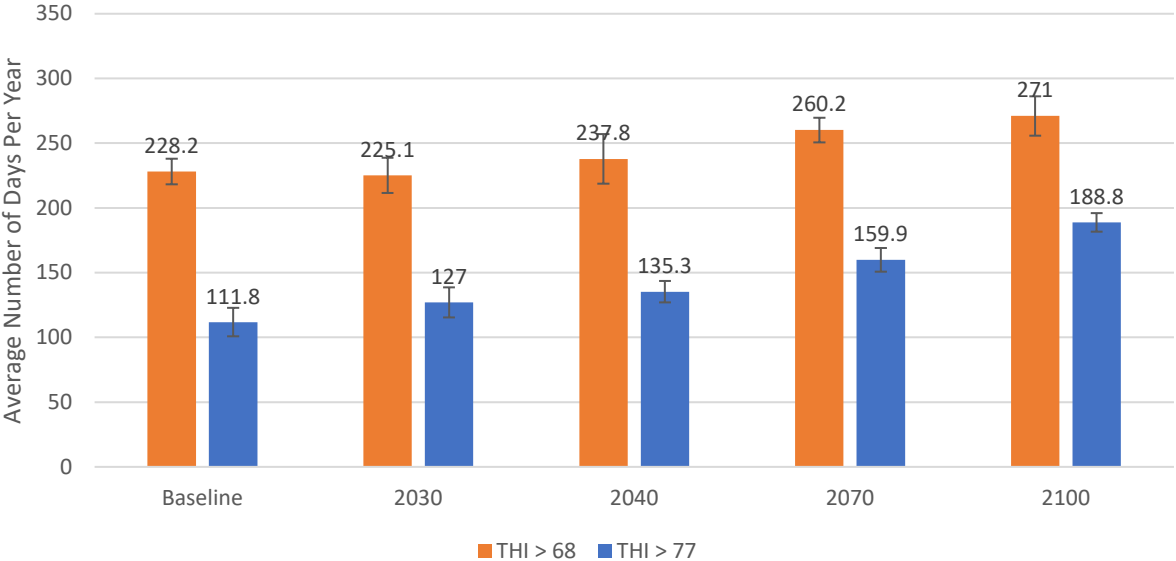
Bar chart — Average Number of Days Per Year

Period	THI > 68	THI > 77
Baseline	228.2	111.8
2030	225.1	127
2040	237.8	135.3
2070	260.2	159.9
2100	271	188.8

Effects Of Climate Migration On Population Projections

Population Per Acre, 2021
- Non-residential
- 0 – 1
- 1 – 4
- 4 – 7
- 7 – 10
- 10 +

- **Extended State Population Projections**
- **Adjusted Projections Based on Climate Migrants (sea-level rise)**
- **Modeled spatial distribution of population change**

2021 Population Density with Climate Migration

Effects Of Climate Migration On Population Projections

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Population Per Acre, 2100

- Non-residential
- 0 – 1
- 1 – 4
- 4 – 7
- 7 – 10
- 10 +

- **Extended State Population Projections**
- **Adjusted Projections Based on Climate Migrants (sea-level rise)**
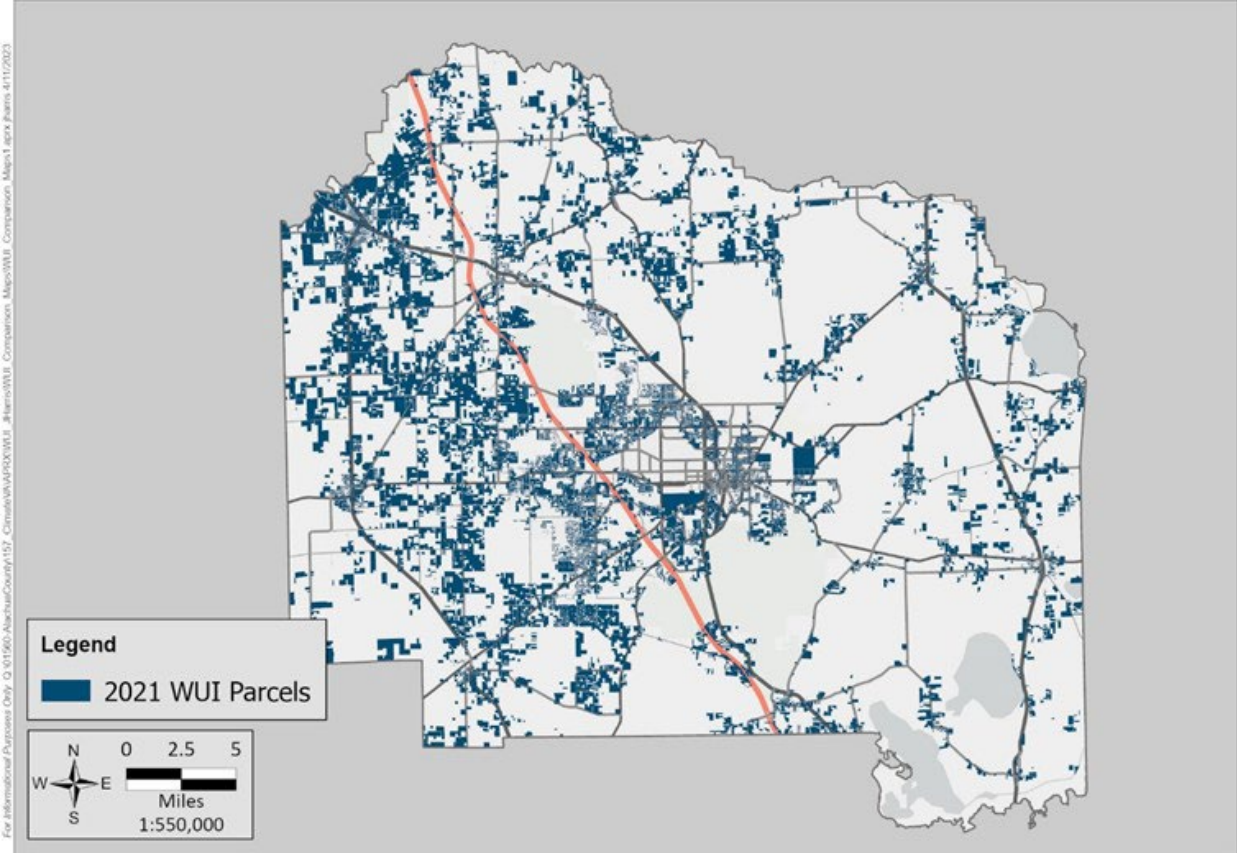- **Modeled spatial distribution of population change**

2100 Population Density

Wildfire Risk
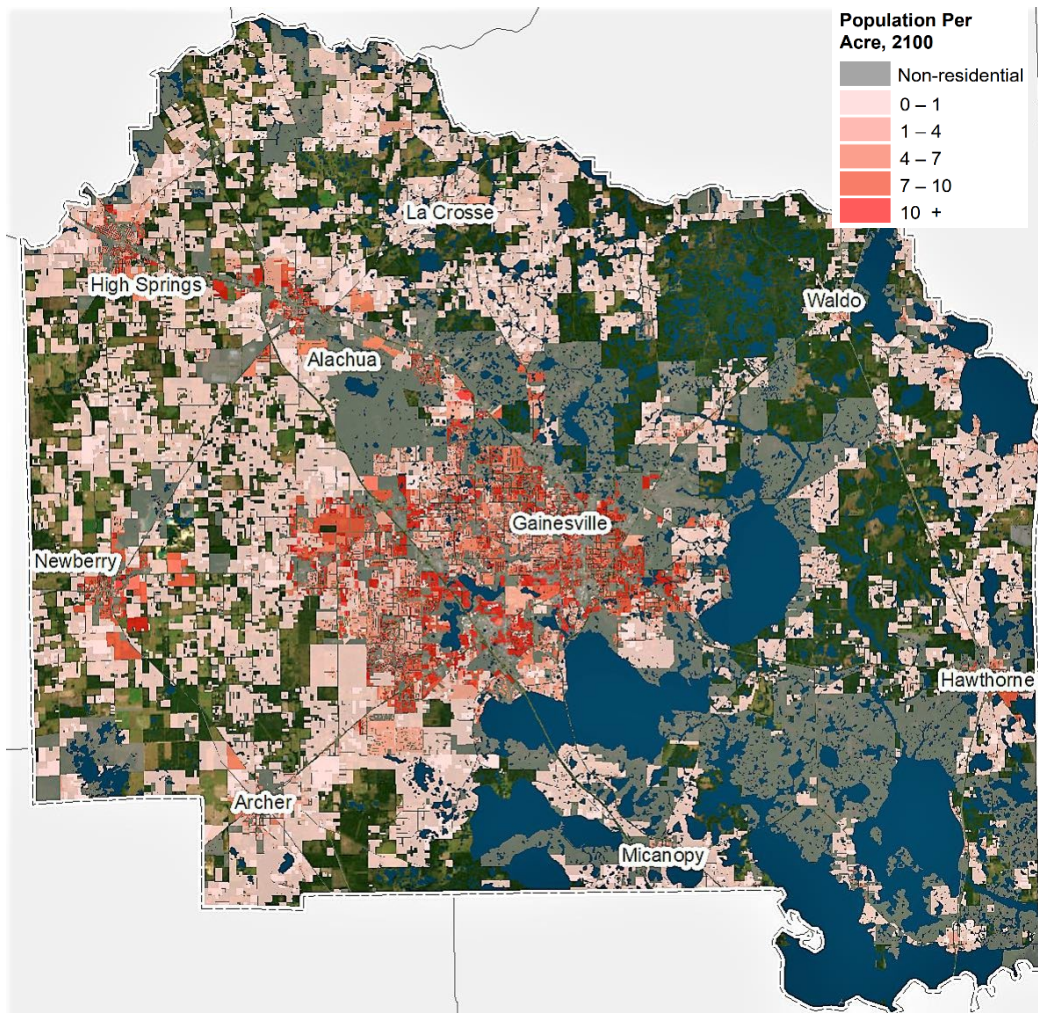
- **Keetch-Bryam Drought Index**
- **Annual Maximum 30-Day KBDI**

Annual Average of the Maximum 30-Day KBDI
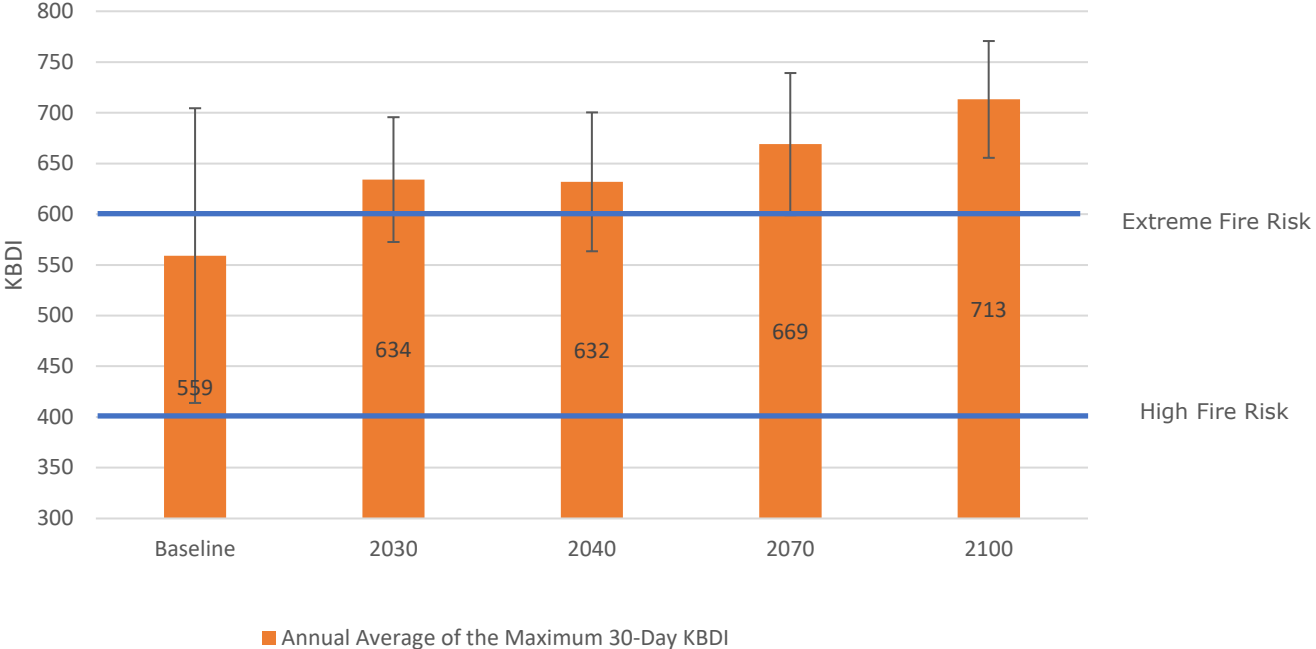
Wildfire Risk

- **Average Annual Count of High and Extreme Risk Wildfire Days**

Wildfire Risk
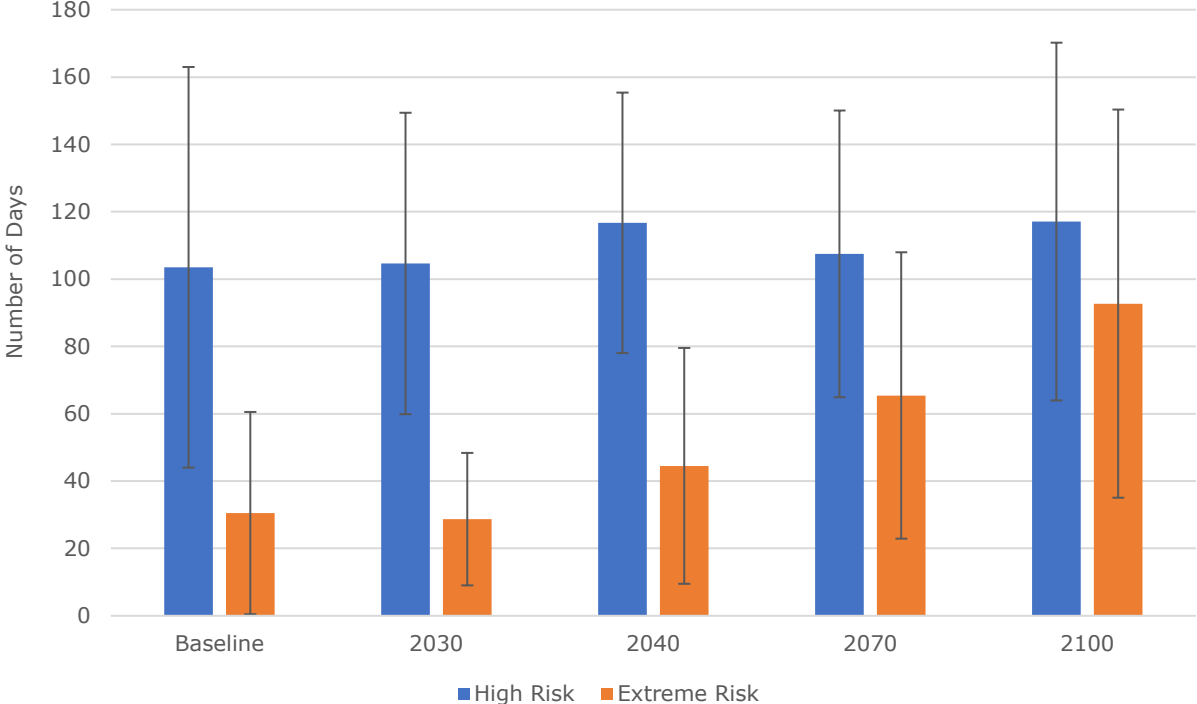
- **Wildland Urban Interface**
- **Projected 2040, 2070, 2100**

1990-2010: 30% Increase

2021 ~ 316 sq miles

Wildfire Risk

- **Wildland Urban Interface**
- **Projected 2040, 2070, 2100**
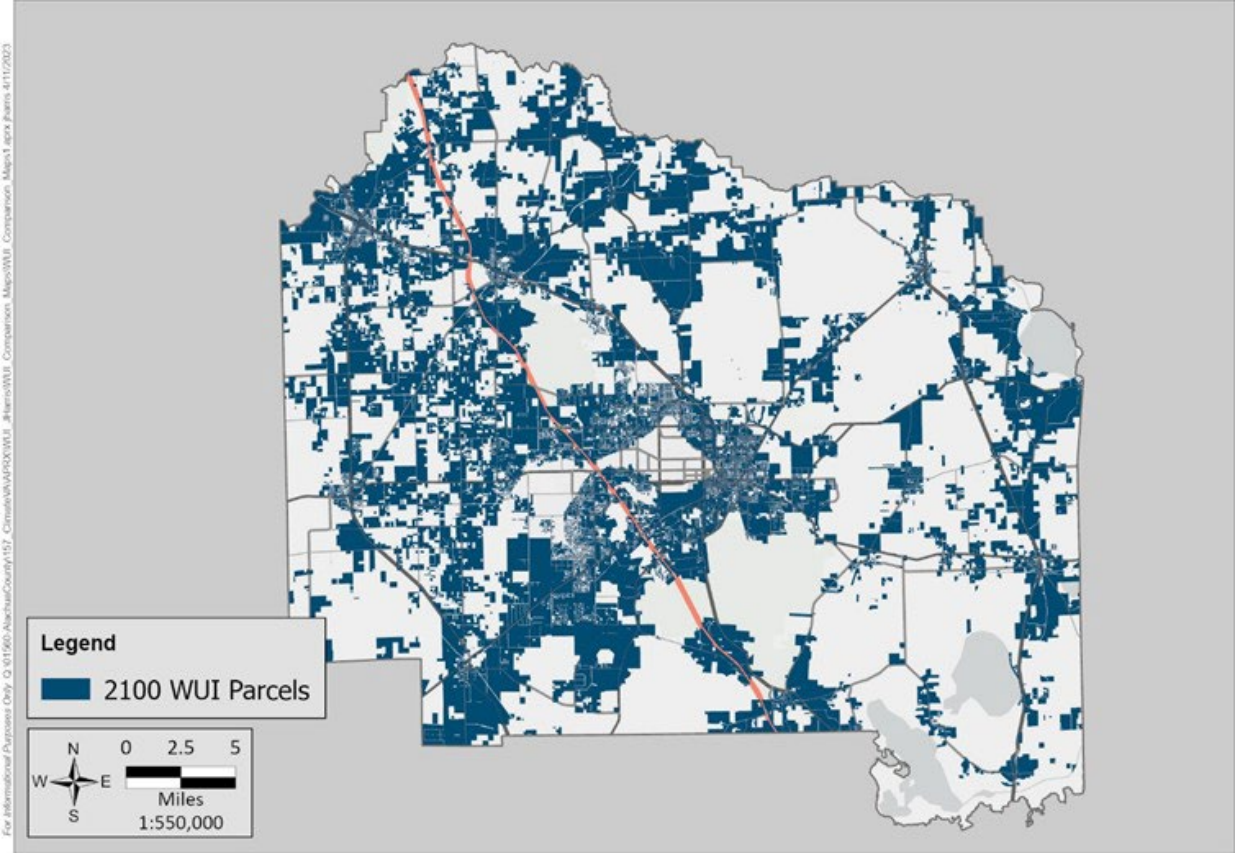
2021-2040: 33% increase
2021-2070: 67% increase
2021-2100: 97% increase

Legend

■ 2100 WUI Parcels

N 0 2.5 5
W E
S Miles
1:550,000

Wildfire Risk

- **Other risk factors:**
  - **Changes in tropical storms**
  - **Changes in tropical low systems**
  - **Changing species composition**
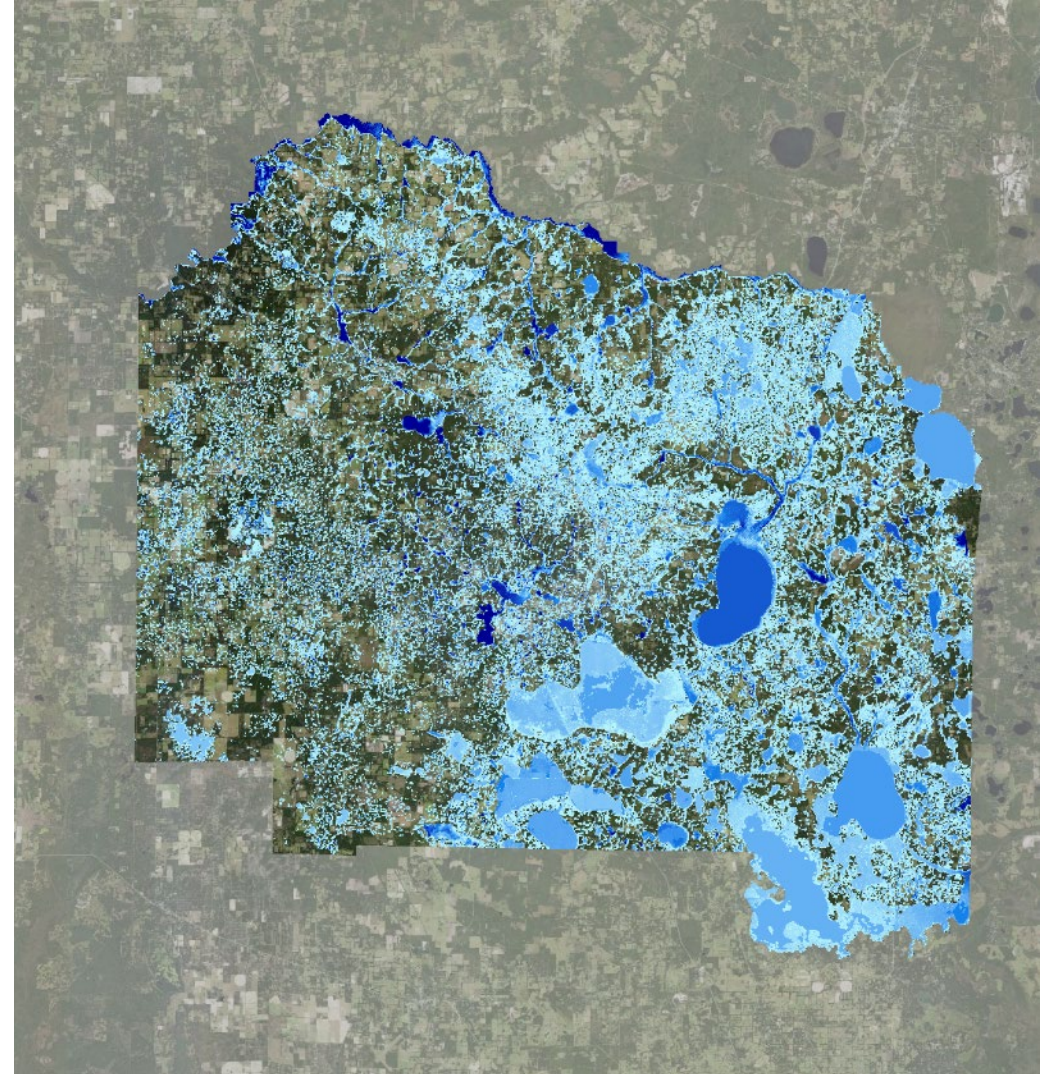 - **Changing soil water tables**

Location of Critical Infrastructure Vulnerable to Flooding

- **Effective FEMA Mapping**
  - **Limited extents**
  - **Generally outdated**
- **Recent preliminary study Santa Fe Basin**

Location of Critical Infrastructure Vulnerable to Flooding

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- **New countywide flood model**
- **2019 LiDAR (2.5 ft)**
- **14,300 stormwater structures**
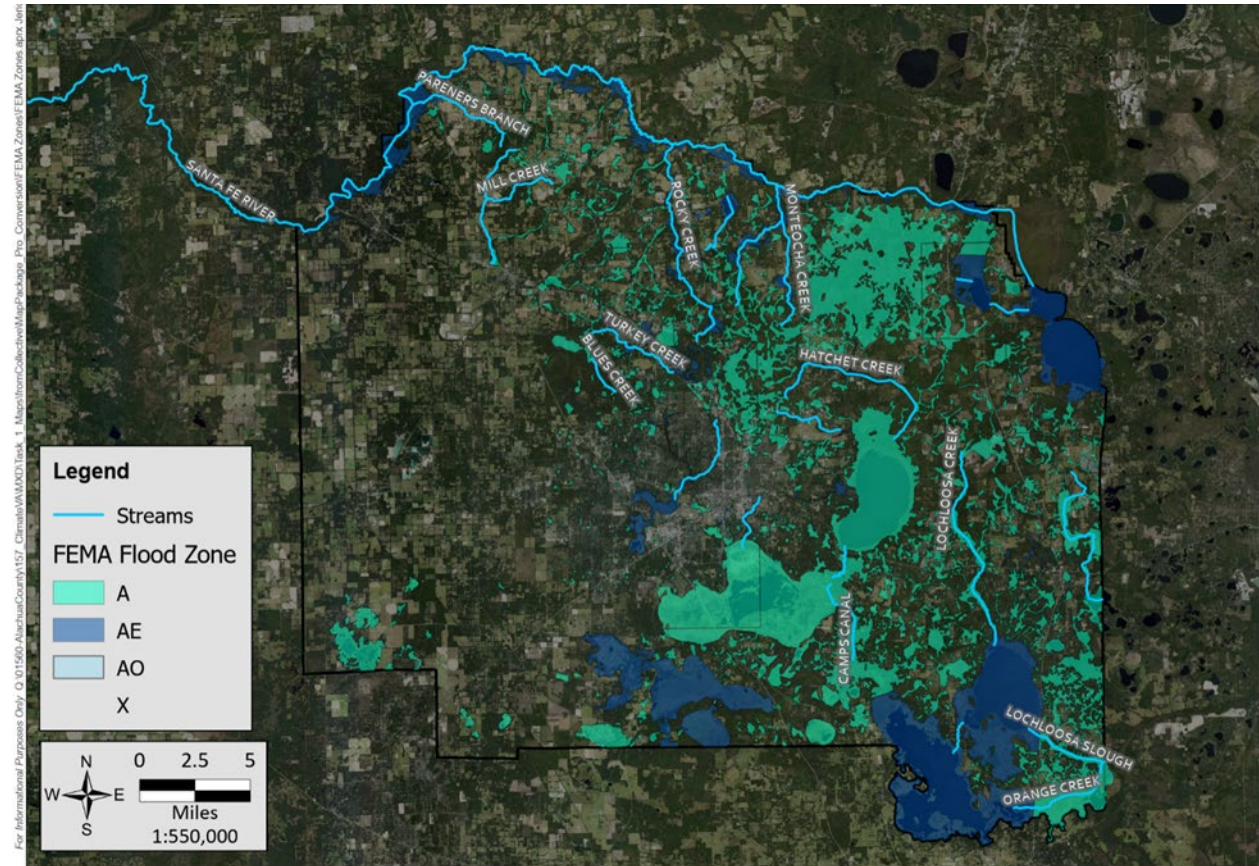
Location of Critical Infrastructure Vulnerable to Flooding

- **New countywide flood model**
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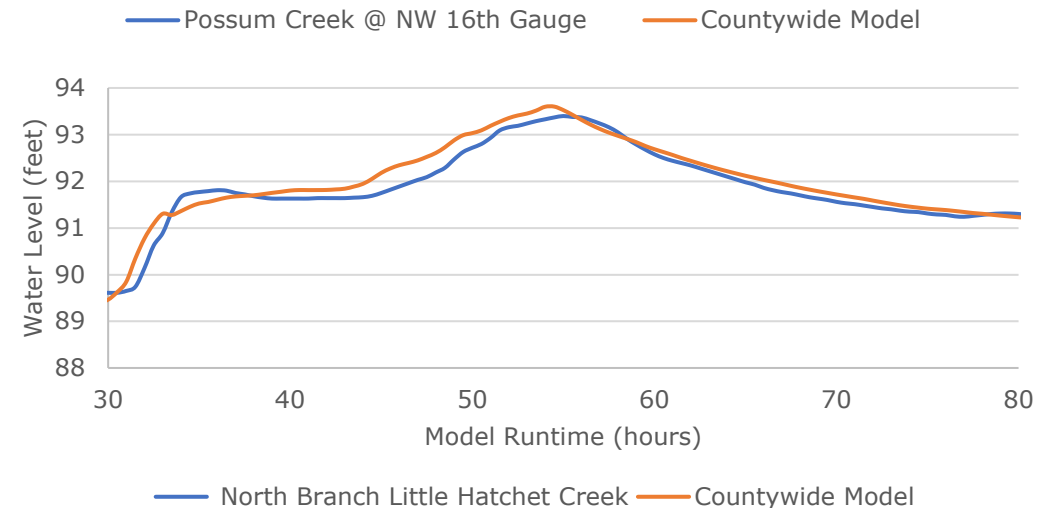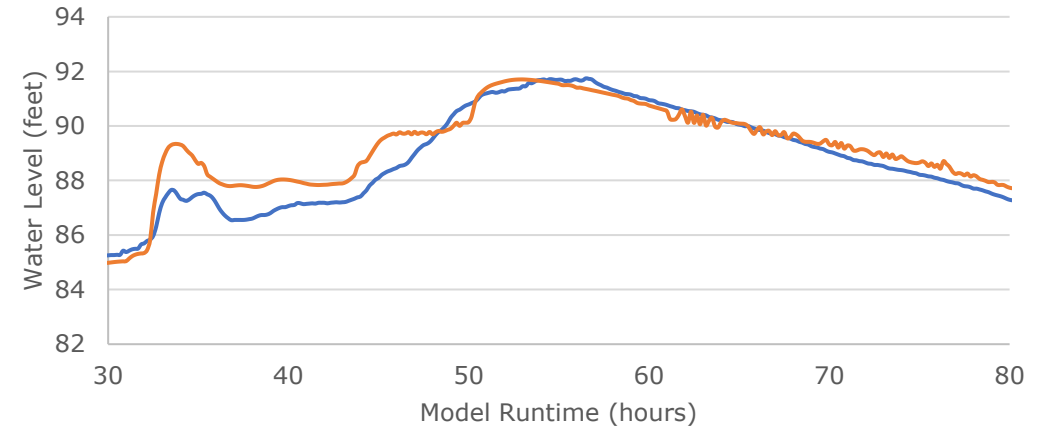- **14,300 stormwater structures**
- **High resolution (80 ft/40 ft/20 ft)**

Location of Critical Infrastructure Vulnerable to Flooding

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- **Model calibration – Hurricane Irma**
- **Model verification – Tropical Storm Elsa**
- **11 Gauges & 80 High Water Marks**
- **MAE = 1.3 feet**

Possum Creek @ NW 16th Gauge — Countywide Model

North Branch Little Hatchet Creek — Countywide Model

Future Flood Risk – Extreme Rainfall
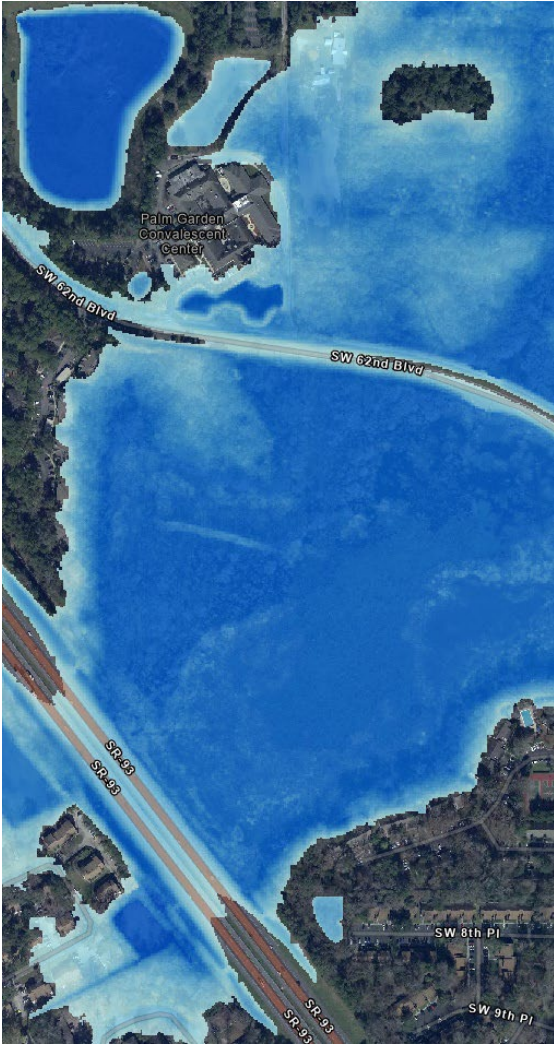
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- **Rainfall Change Factors**
  - **Change in Extreme Rainfall <u>Depth</u>**
  - **Change in Extreme Rainfall <u>Frequency</u>**

- **2040**
  - **100-year/1-Day Storm – 1.35**
  - **100-year/10-Day Storm - 1.21**
- **2070**
  - **100-year/1-Day Storm – 1.47**
  - **100-year/10-Day Storm - 1.38**
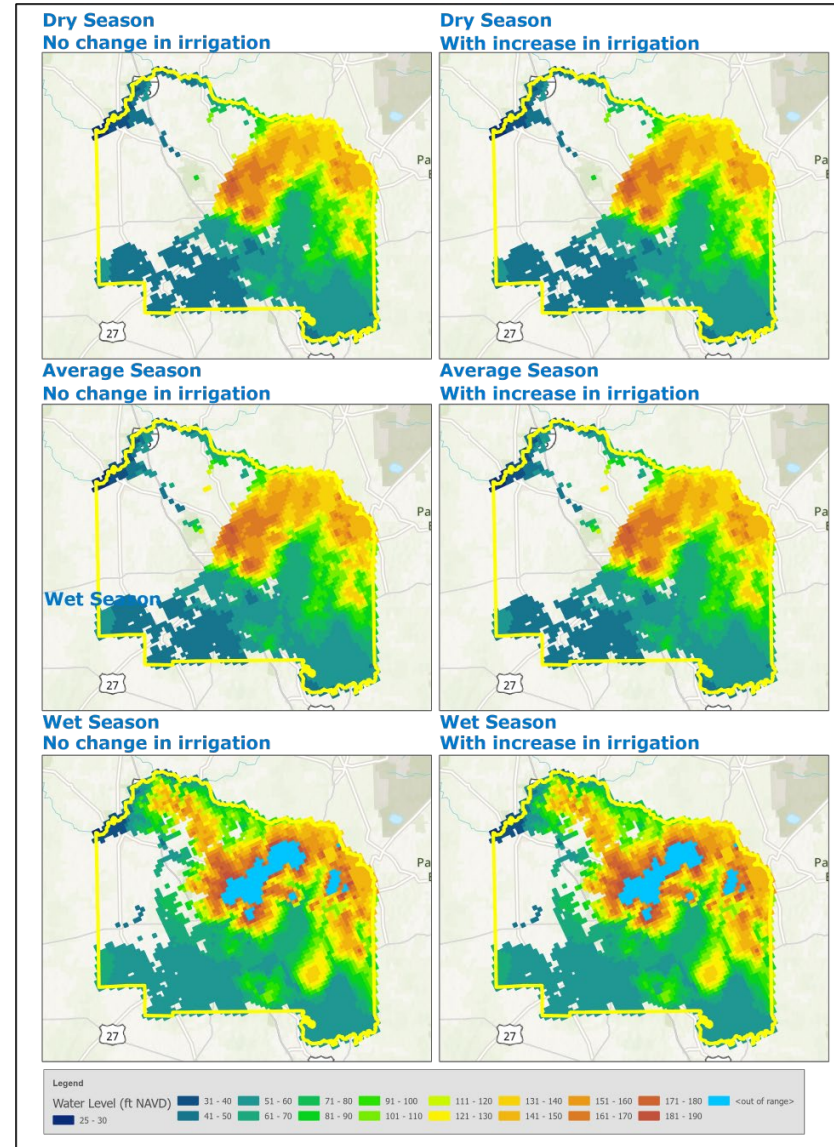
Future Flood Risk – Extreme Rainfall

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Hurricane Irma

Current -100-Year Max (10-day)
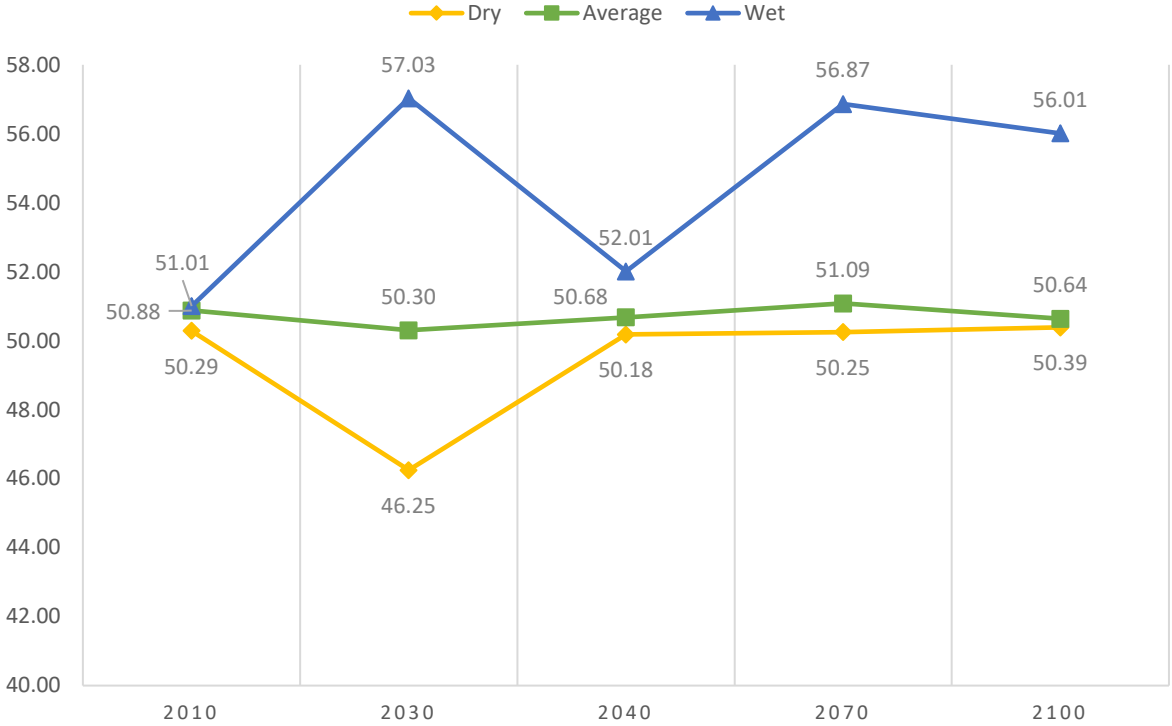
2070 -100-Year Max (10-day)
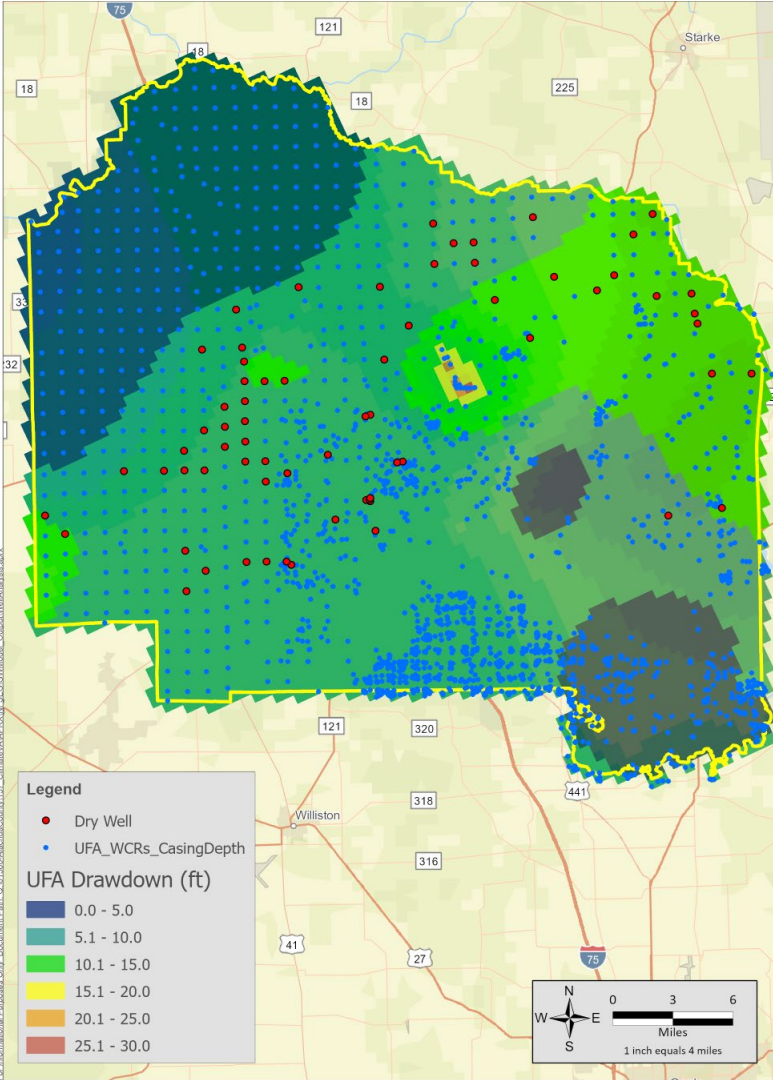
Groundwater Model

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- **NFSEG Groundwater Model**
  - **Updated to account for projected changes in recharge & ET**
  - **Changes in pumping**
  - **Steady state model**

Groundwater Model

- **More variation in groundwater levels**

Groundwater Model

- **More variation in groundwater levels**
- **Potential impacts to domestic wells**

Summary

- Task 1 – Weather Related Survey Complete

- Task 2 – New Countywide Flood Model (Existing conditions)

- Task 3 –

  - Population projections

  - Food Systems & Agricultural Production Vulnerability

  - Wildfire Risks & Vulnerability

  - Groundwater Changes

Alachua County, Florida

Next Steps

- Task 2 – Critical Infrastructure Vulnerability Analysis

- Task 3 – Assessment of Increased Climate Change Related Vulnerability to Neighborhoods and Cultural Resources

  - Surface water

  - Water supply

  - Extreme temperature

  - Flooding

Alachua County, Florida

QUESTIONS

— In Association with —

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WATER RESOURCES

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