



January 23, 2023 Meeting Backup Materials

Contents:

- Presentation: *Urban Heat Islands* {Stefan Perritano, Sustainability Coordinator}

The City of
Fort Lauderdale



Urban Heat Island Report

City Staff Report to the
Sustainability Advisory Board

Stefan Perritano | Sustainability Coordinator
January 2023





Contents

- 01** Introduction

- 02** What is an Urban Heat Island (UHI)

- 03** Effects of UHI on Residents

- 04** Fort Lauderdale's UHI Mitigation Efforts

- 05** Ways to Mitigate the UHI

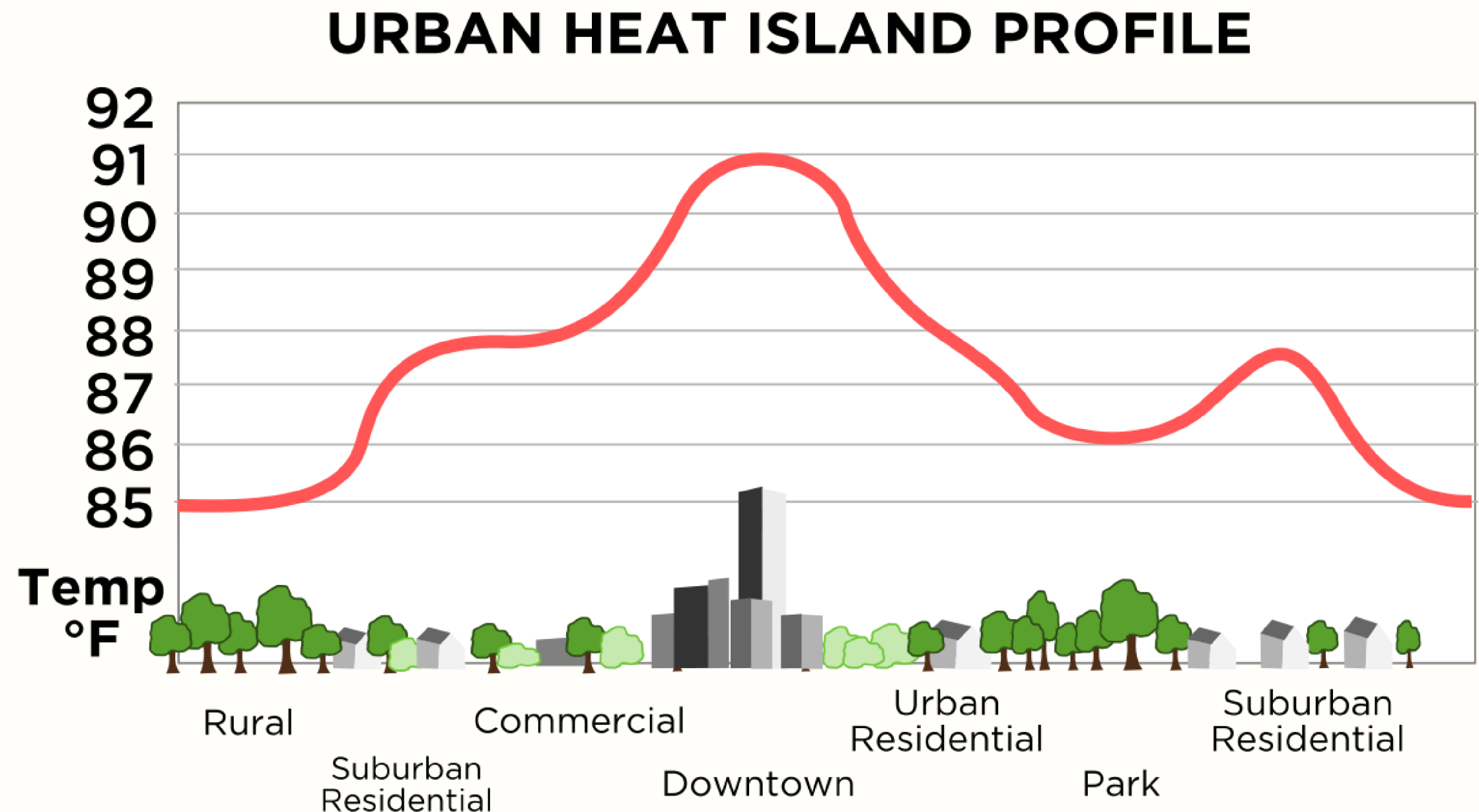


What is an Urban Heat Island

"Urban heat islands" occur when cities replace natural land cover with dense concentrations of pavement, buildings, and other surfaces that absorb and retain heat.

Causes of UHI

- Low Albedo Materials, Dark Surfaces
- Paved and Impermeable Surfaces
- Increased Use of Air Conditioner
- Combustion Engines and Industrial Processes
- Thermal Mass of Buildings





South Florida's Climate is Changing

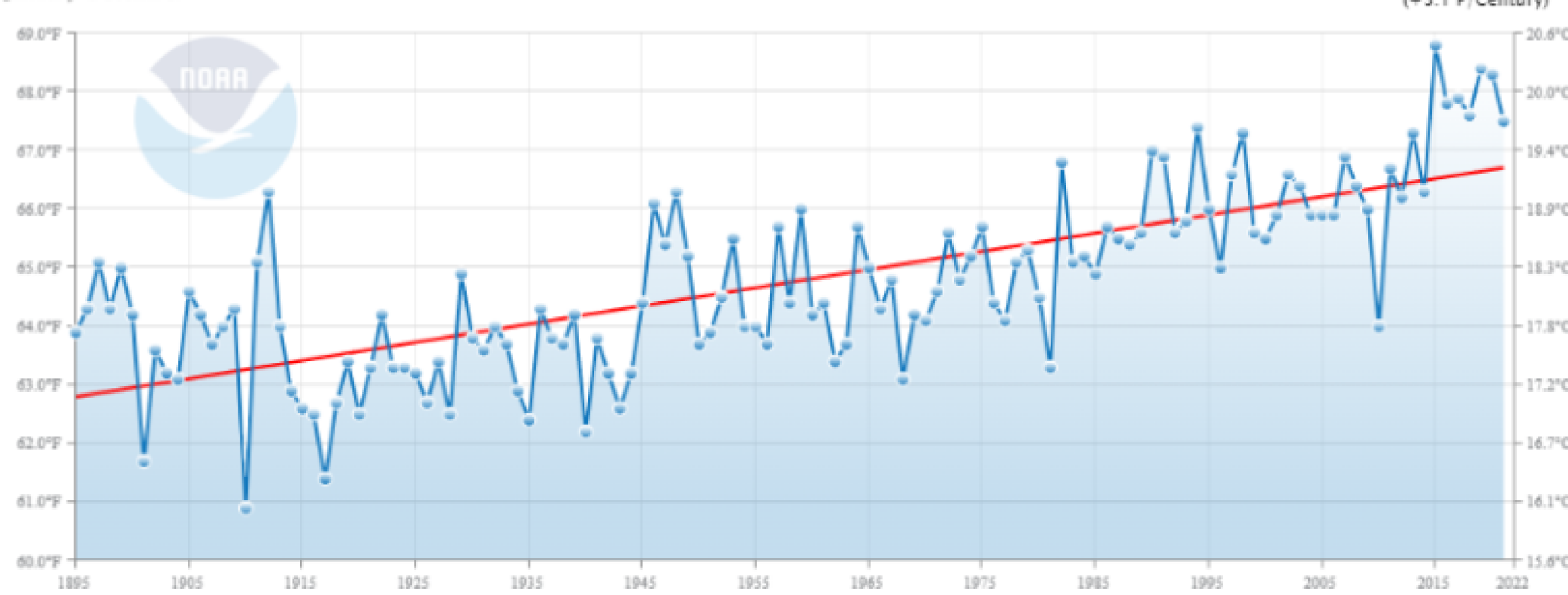


Average Daily Minimum Temperatures Up **3.1°F**

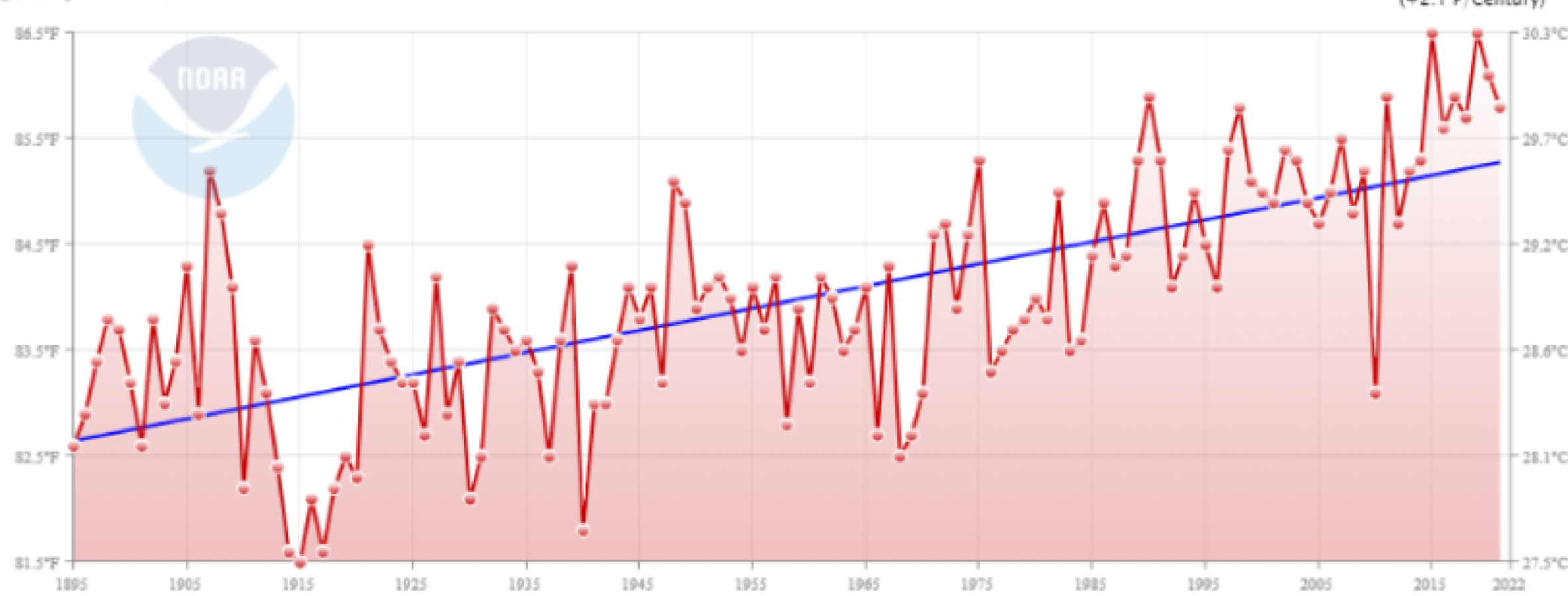
Average Daily Maximum Temperatures Up **2.1°F**



Broward County, Florida Minimum Temperature January-December



Broward County, Florida Maximum Temperature January-December





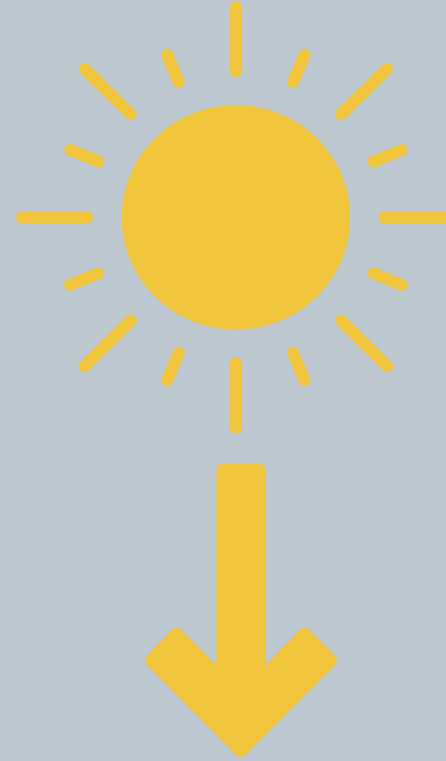
Cost of Cooling Urban Heat Islands

Roofing Type	Reduction in Peak Load	Annual Savings
Dark gray asphalt shingle (control)	—	—
White asphalt shingle	4%	17%
Terra-cotta tile	3%	13%
White S-tile	20%	32%
White flat tile	17%	34%
White galvanized steel	23%	28%

*Based on an average-sized south Florida home with R-19 ceiling insulation and cooling ducts located in the attic.

SOURCE: Adapted from the FSEC report *Comparative Evaluation of the Impact on Roofing Systems on Residential Cooling Energy Demand in Florida, 2000*, by Danny Parker, Jeffrey Sonne, John Sherwin, and Neil Moyer. Courtesy of Florida

BLACK ROOF



Air = 90°F

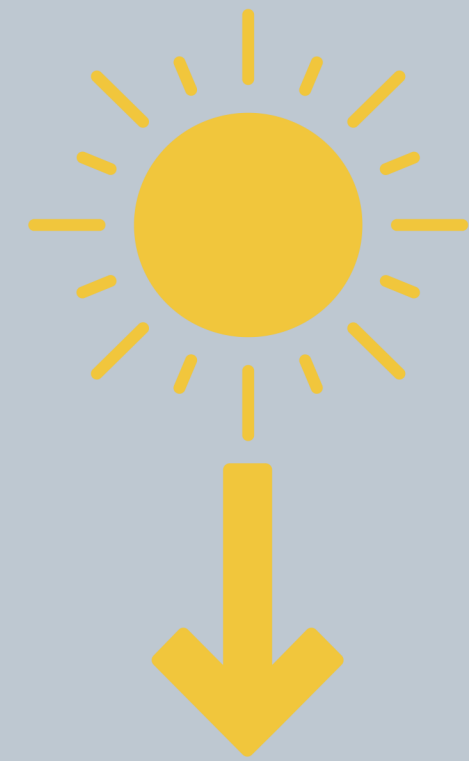
ROOF TEMP
179°F



INSIDE
115°F

REFLECTS
20%
SUNLIGHT

WHITE ROOF



Air = 90°F

ROOF TEMP
99.8°F



INSIDE
79.8°F

REFLECTS
85%
SUNLIGHT



Effects of UHI



Air Pollution



Ambient Temperature



Energy Consumption



Urban Heat Island



Hospital Admittance



Roof Life Expectancy



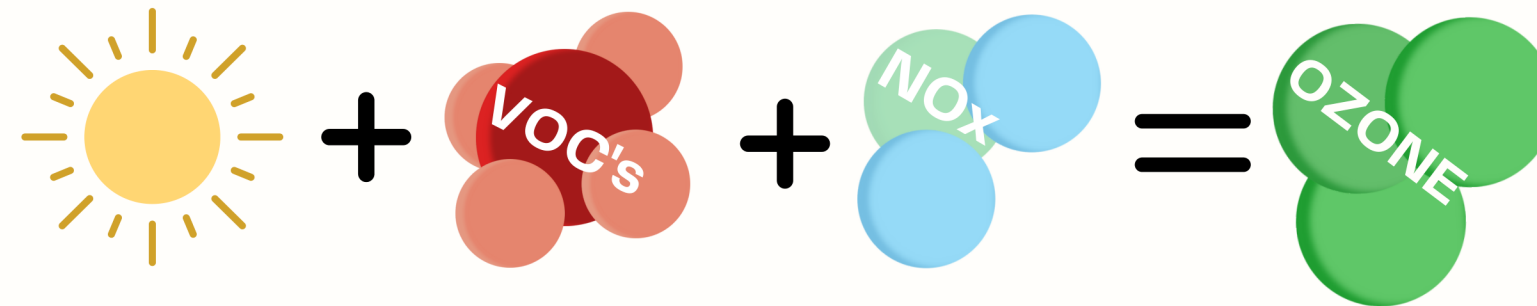
Water Quality

Urban Heat Islands increase the ambient temperature of a city, thus causing increases in air pollution, energy consumption and heat related illnesses while decreasing life expectancy for infrastructure structures and the quality of water bodies.



Environmental Impacts of UHI

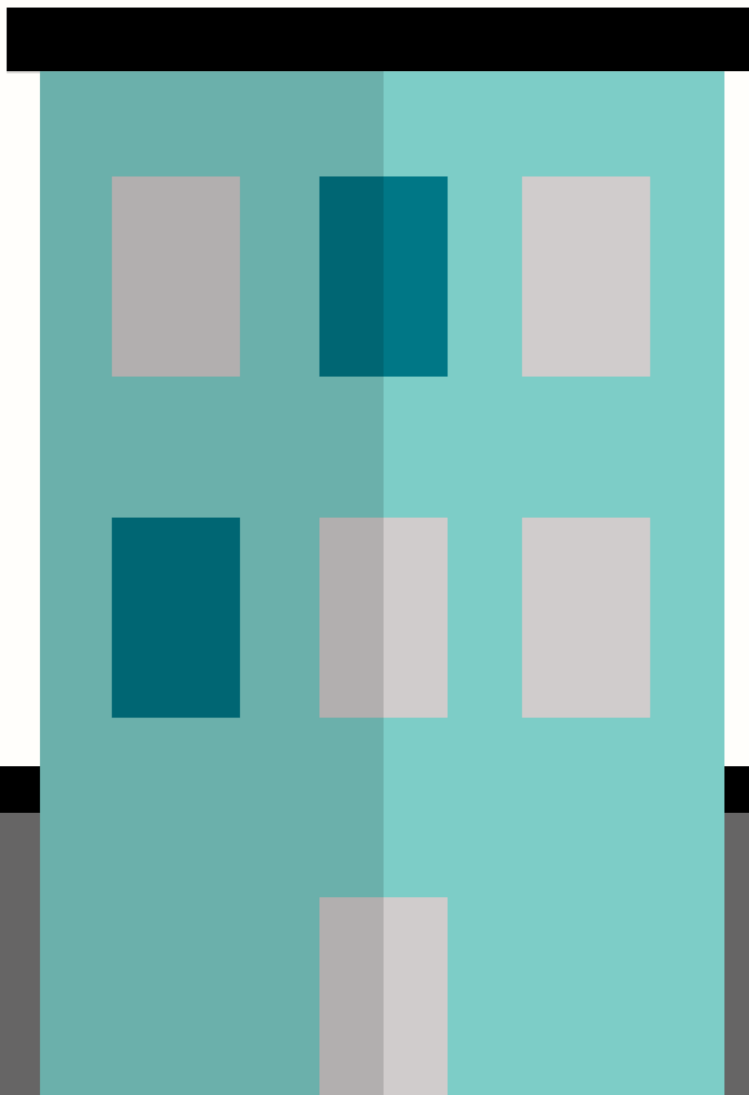
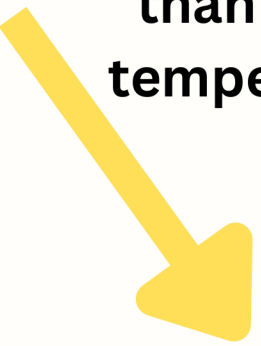
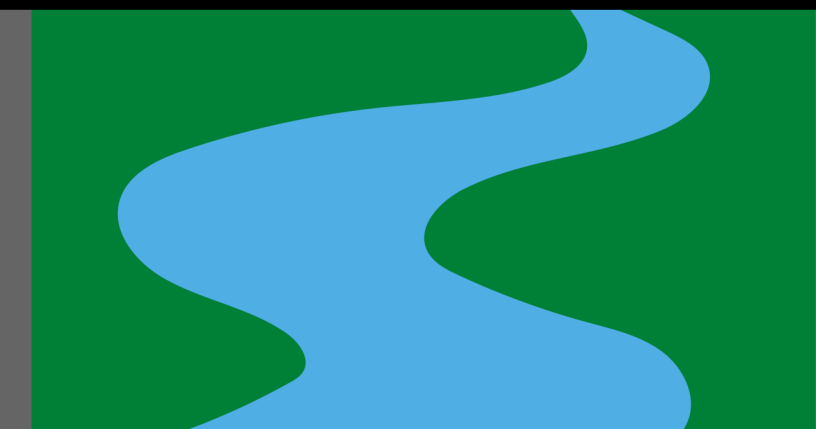
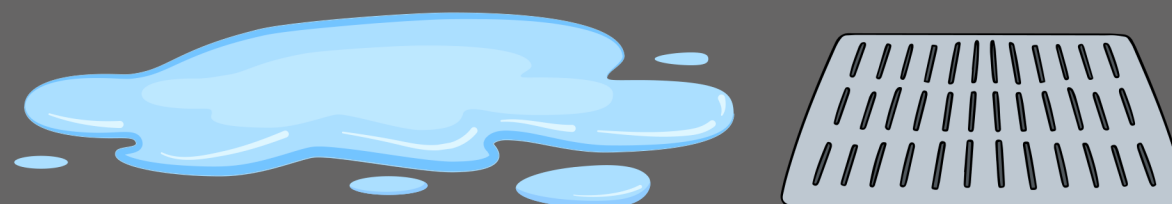
Dark surfaces absorb 225% more energy than light colored surfaces. The ambient temperature rises as the amount of energy absorbed increases.



Elevated temperatures directly increase the rate of ground-level ozone formation, a serious air pollutant.

Waterways heat up from stormwater, promoting algae blooms and stressing aquatic life to the point of mass die outs.

Rainwaters that collect on the built environment turns into stormwater and can no longer enter the subsurface to help cool the environment. This water absorbs bacteria and heat as it moves towards drainage systems and can often reach temperatures of up to 95°F.

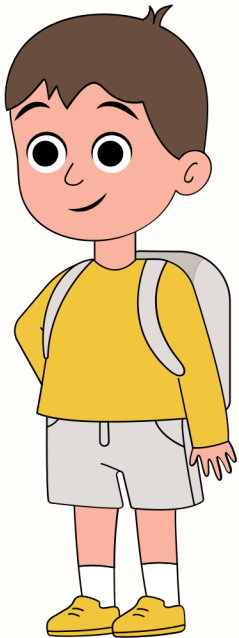




Health Related Illness of UHI

"The widespread prevalence of exposure to hot temperatures, in conjunction with an increase in the proportion of older people in the population, might result in a rise in poor cardiovascular disease health outcomes associated with a warming climate."

Vulnerable Populations



Young Children



Elderly



Low Income Individuals

Table 3. Health Impacts of Urban Heat Island (UHI) on Outdoor Workers.

Health Impacts	Author & Year
Heat exposure	
• Heat Stress/Stroke	Leal Filho et al. [48]
• Fatigue	Ward et al. [43]
• Dehydration and Kidney Disease	Kjellstrom et al. [40]
• Cardiovascular Disease	Heaviside et al. [31]
• Respiratory Distress	Hanna et al. [42]
• Death	Tan et al. [57]
• Increase morbidity and fatality	Kovats and Hajat, [56]
Air Pollution	
• Respiratory Distress	Kjellstrom et al. [40]
• Respiratory Track Irritation	Ward et al. [43]
• Asthma Attack	Kjellstrom et al. [52]
• Increased Respiration due to Heat exposure	
• Exposure to carcinogens	



Fort Lauderdale's Urban Heat Island

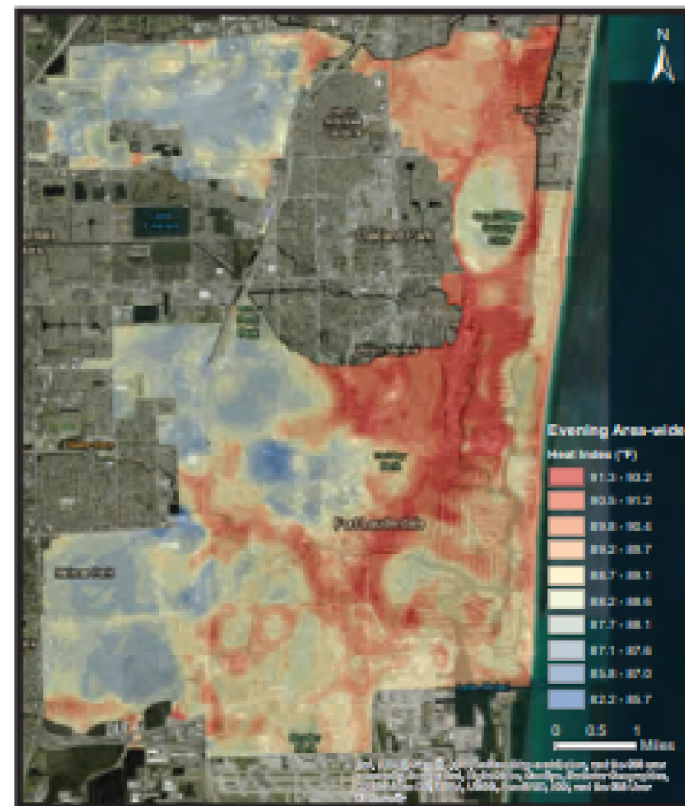
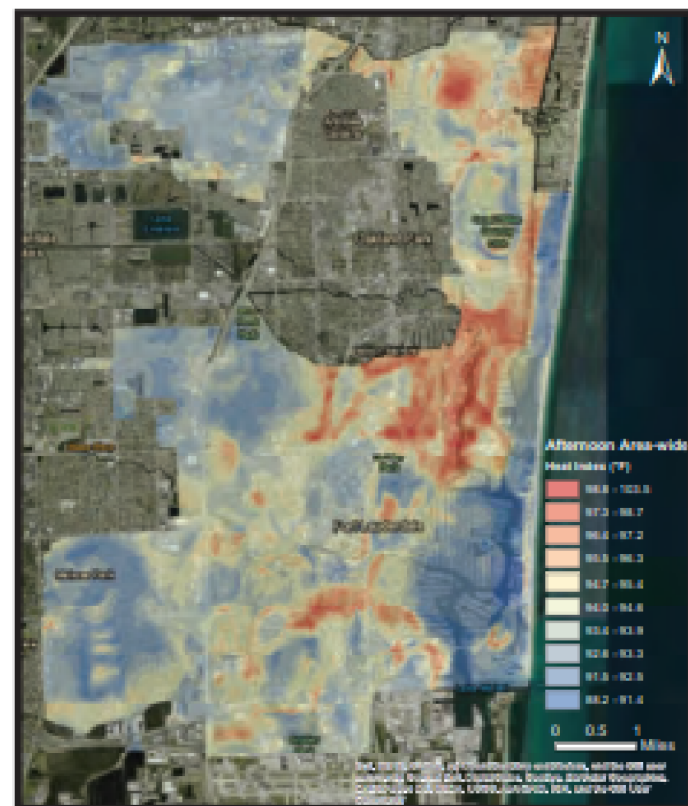
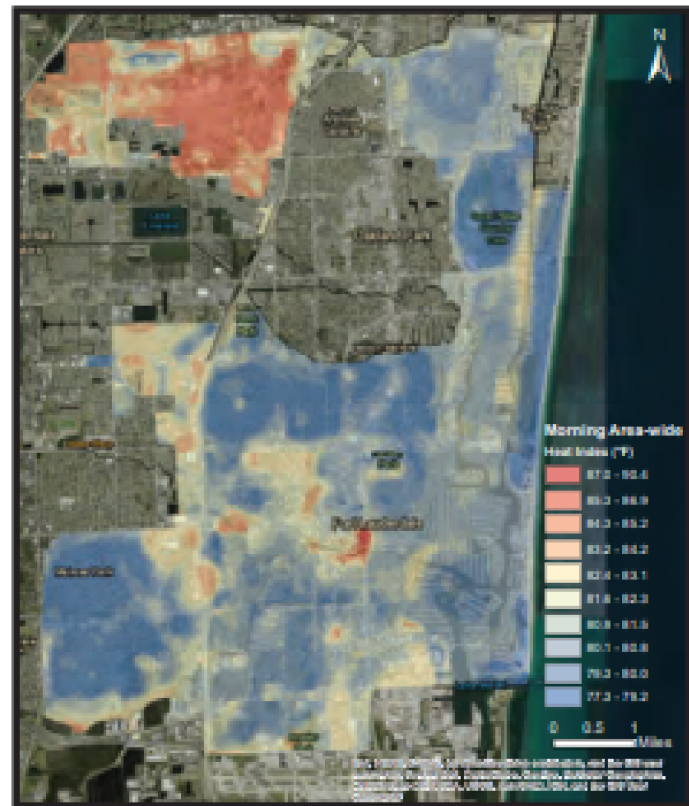
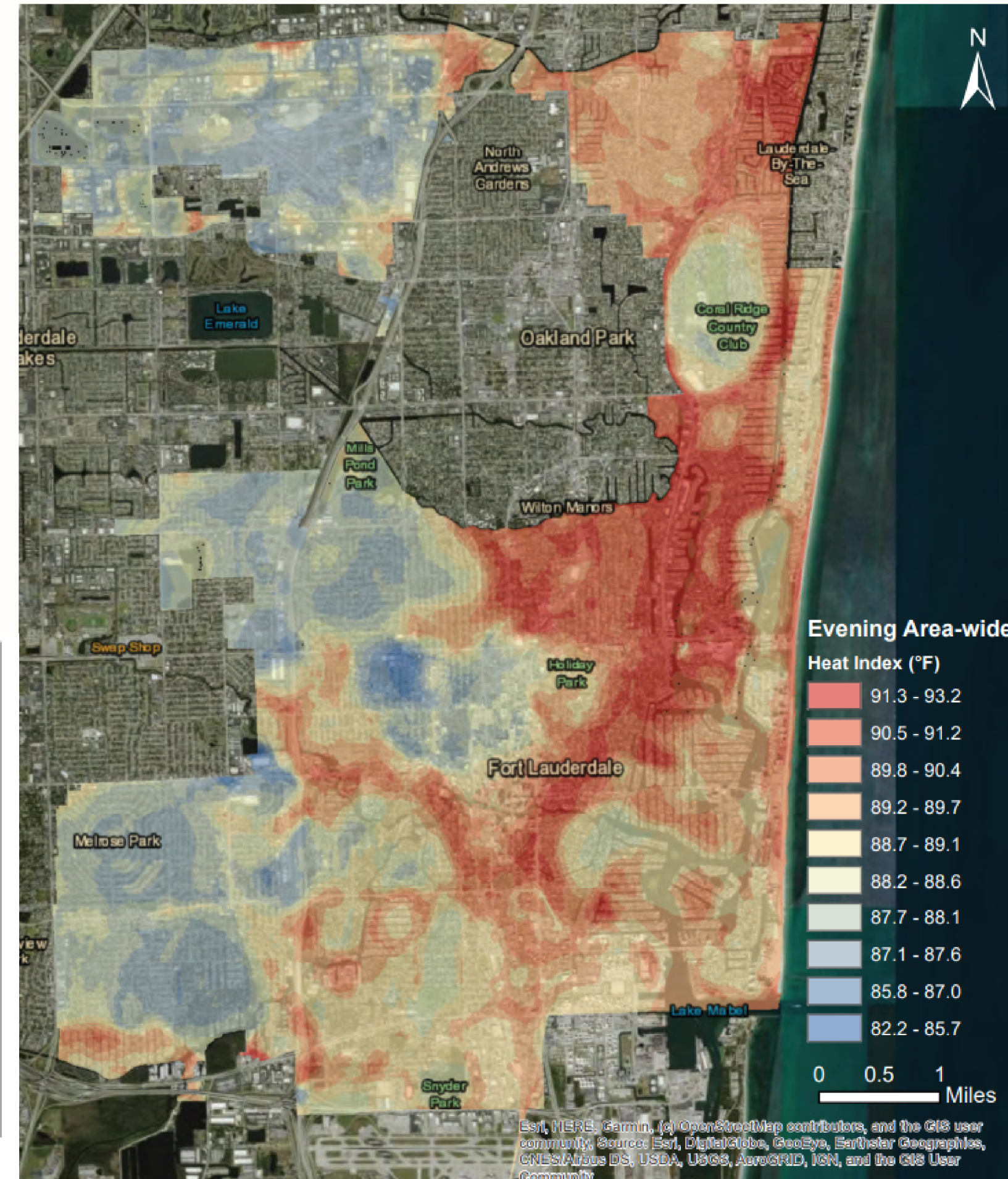
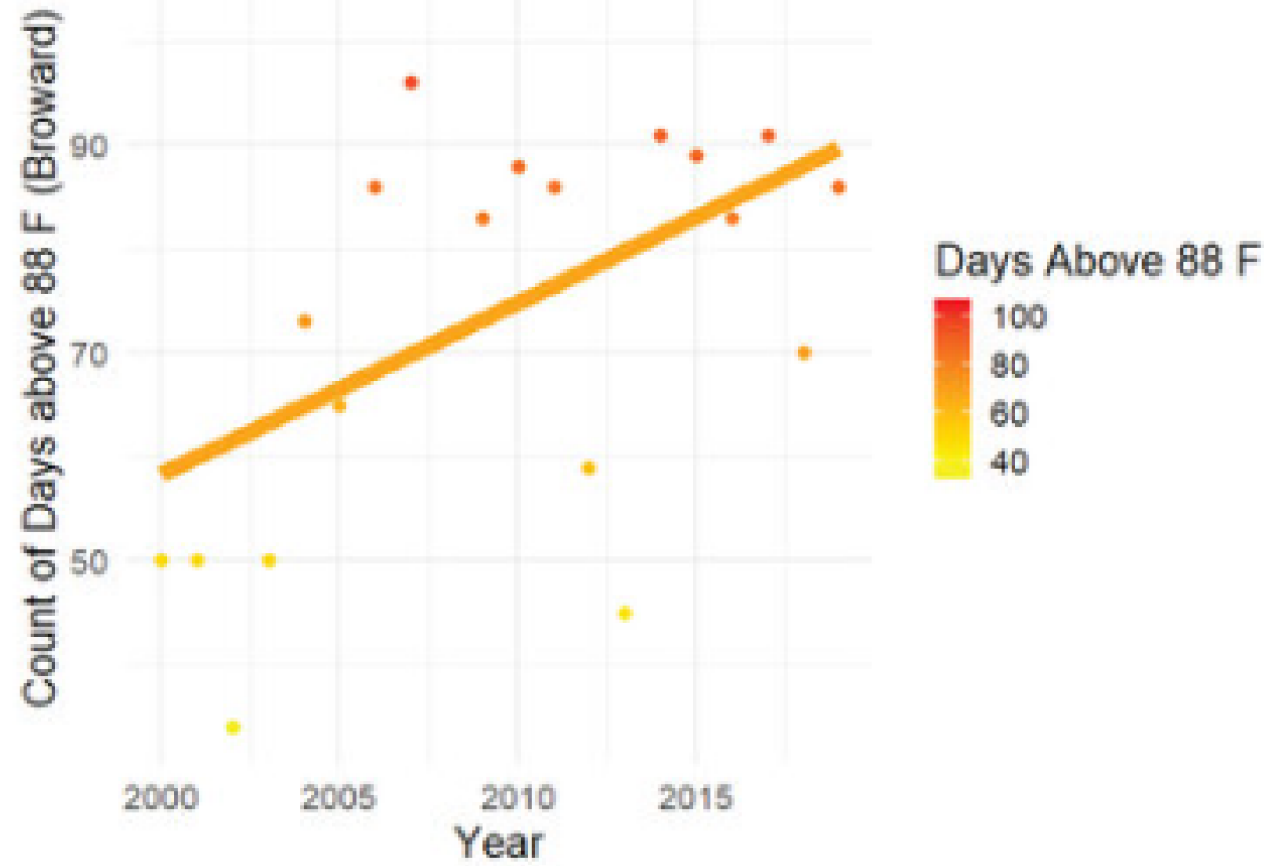


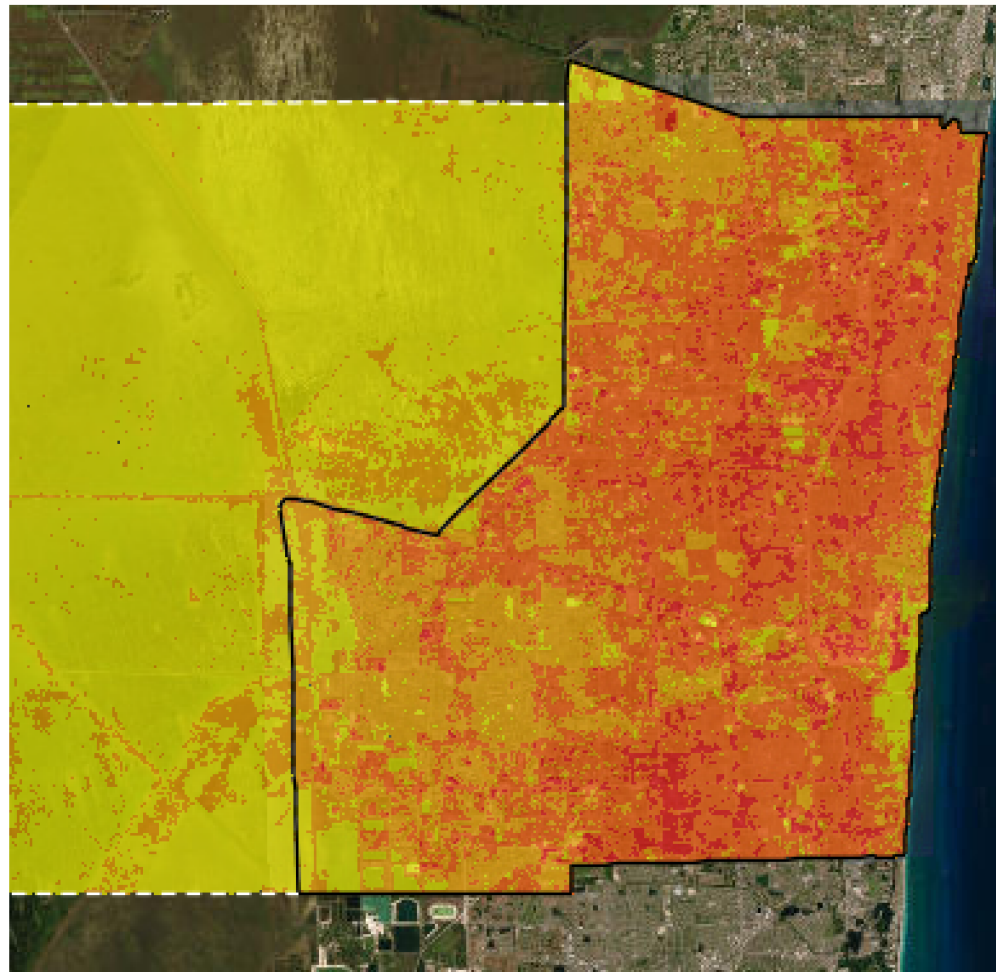
Figure 2a-c: Area-wide heat index during morning (left), afternoon (center), and evening (right).*

TABLE 2 Number of Days Above 88°F

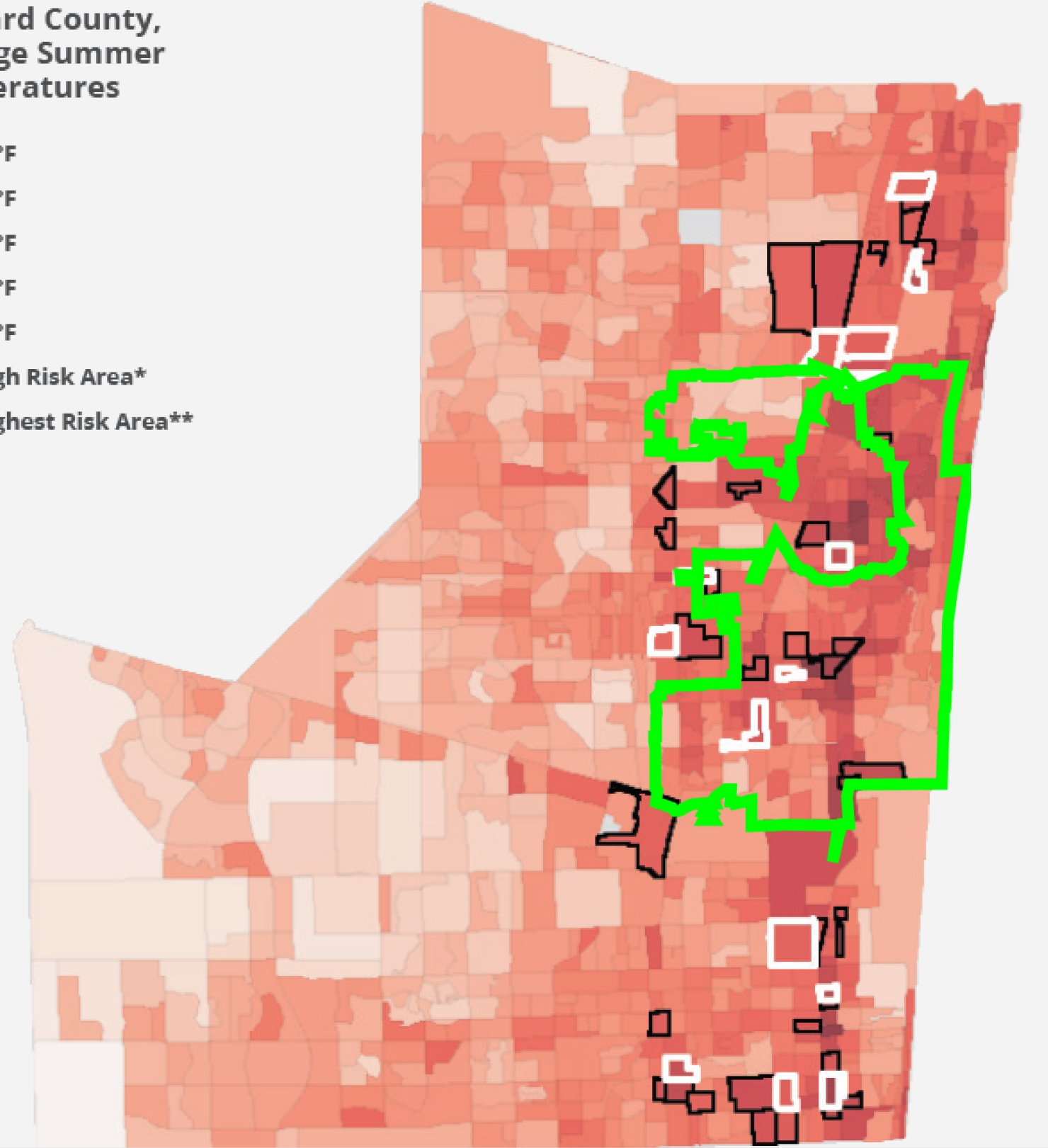
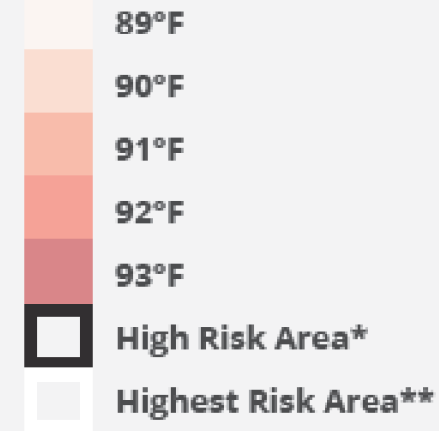


Oct 17th 2014

Surface Temperature (°C)

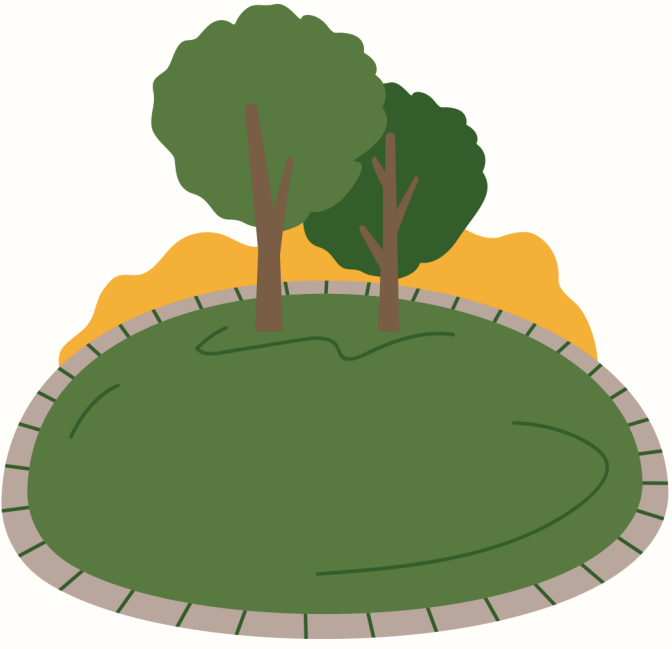


Broward County, Average Summer Temperatures

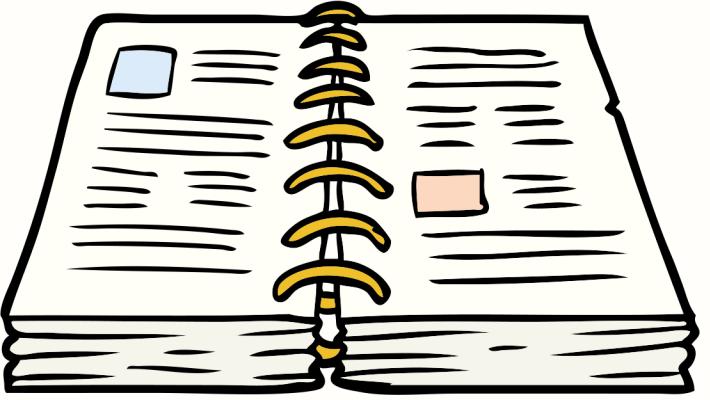




Fort Lauderdale's Current UHI Mitigation Efforts



The Parks and Recreation Department prioritizes the inclusion of a diverse and abundant tree canopy within all parks to help reduce heat for residents. In addition, the department acquires new land to preserve existing green space within the City.



All new City construction projects follow the Design and Construction Manual (DCM). The manual gives guidance on how to reduce urban heat by incorporating both green and sustainable infrastructure.

The Transportation and Mobility Department is focusing on the development of "complete streets". Complete streets strive to incorporate multi-modal transportation into existing roadways. This includes planting greenery to increase shade, reduce stormwater flow, improve water quality, and reduce urban heating.



The Sustainability Division, under its urban forestry program, is responsible for the health of the City's urban canopy. The City's goal of having 30% canopy coverage by 2040 is on track, and when future funding is acquired an Urban Forestry Master Plan will be developed.





Increase Green Space

Buffalo

The city's Green Code requires that new developments incorporate green infrastructure as the first option for stormwater management. Developments may pursue other stormwater management strategies only if green infrastructure proves infeasible.



Austin

The city offers development bonuses for private development projects that incorporate green roofs into new projects or that permanently preserve open space. Austin also adopted the 2012 International Energy Conservation Code that requires cool roofs on buildings. Buildings with vegetative roofs, roof top pools, or permanently integrated solar panels on a roof surface are exempt.



Chula Vista

The city adopted a Shade Tree policy that includes a 50% tree coverage requirement for parking lots and 10% coverage for landscaped land. If a development project is not able to meet this requirement, it can install light colored surfaces as an alternative.



Increase Albedo of Hard Surfaces

Chicago

Chicago's sustainable development policy requires new construction projects to integrate low impact development measures or restore natural lands. The city's policy also provides expedited green permits for construction involving a green roof, rainwater harvesting, or a similar measure. The Chicago Energy Efficiency Conservation Code requires new roofs to have a minimum reflectance standards.



Miami

The city requires solar reflectance standards for new or repaired roofs. Commercial and noncommercial parking lots must be constructed with high albedo materials to reduce the urban heat island effect.



Questions?



Stefan Perritano
Sustainability Coordinator

Email | SPerritano@fortlauderdale.gov

Phone | (954) 828-5798

