



# Sample City Report: Fort Lauderdale

## Notre Dame Global Adaptation Initiative

### Urban Adaptation Assessment

April, 2019



This report reflects a vulnerability analysis for Fort Lauderdale, FL and is developed utilizing data from the Urban Adaptation Assessment (UAA) tool and an in-depth interview with Fort Lauderdale's sustainability officer. As such, this sample report serves as an example of how UAA data can help frame an evaluation of a city's climate vulnerability and coordinate with local, on the ground knowledge, to illuminate the stresses and strengths of a city to climate change.

### Overview

Fort Lauderdale is a city of 183,000 located on the southeastern coast of Florida. A popular tourist destination due to its beaches, attractions and sunny weather, it is known as the "Venice of America" due to the 165 miles of inland waterways that run throughout the city. Encompassing 36 square miles, the city is also a world-class international business center whose property is valued at over \$49 billion.

The City lies atop a porous limestone geological foundation, which allows water to easily permeate. The nature of this geological context, combined with the region's climate risks, means that the Fort Lauderdale faces significant risks from rising sea levels and inland flooding. At the same time, the City is taking far-reaching measures to prepare itself for the future and increase its climate resiliency. The Urban Adaptation Assessment tool places Fort Lauderdale in the High Risk and High Readiness quadrant.

### Fort Lauderdale, FL

Southeast, Broward County  
Median Household Income: \$50,778  
Population: 173,570

Risk score: 61.94  
Readiness score: 55.88  
[Comparable Cities?](#)

**HIGH  
RISK**  
**HIGH  
READINESS**

FLOOD

HEAT

COLD

SEA LEVEL RISE

DROUGHT

#### Potential Future Cost

Projected Sea Level Rise in 2040 for Intermediate Scenario: **1.0 FT** ?

Projected Cost of 1 ft SLR: **\$2,117,791,200** ?







## Fort Lauderdale's Climate Risks

Projections show that the most important climate impacts for the City are sea level rise, changes to rainfall patterns, intensity of storms, flooding and heat.

Fort Lauderdale already experiences periods of high heat: approximately 110 days per year are currently over 90°. But by 2040, the City will average around 145 days above 90° per year. These extended high heat periods will have a disproportionate impact on the poor, the young and the elderly. The UAA tool can help identify where elderly populations are located. The UAA sub-city tool shows that in one census tract near the coast, 45.4% of the population are elderly living alone, and the tree canopy, which can help mitigate the impacts of heat, is only 9%. Another census tract in the north central section of town may be more vulnerable: here, 27.5% of the population are elderly living alone, and the median income is only \$28,000. These two areas may indicate neighborhoods where the City may want to invest more resources to protect residents from extreme heat.

Fort Lauderdale is projected to experience dramatic increases in sea level rise in coming decades: 6-10 inches by 2030, and 14-26 inches by 2060. The Urban Adaptation Assessment (UAA) tool shows that the projected costs to the City of one foot of sea level rise will impact properties worth \$2.1B. The City's Sensitivity score is 56.3; contributing factors include a high percentage of impervious surfaces and buildings built before 1999. Their Exposure score is 98.4, reflecting a large percent of population living within a 3-foot sea level rise zone. The UAA calculates an overall sea level rise risk score of 79.8.

RISK		READINESS	
Indicator		Score	
<b>RISK</b> <i>Lower is better</i>		<b>77.9</b>	
<b>Adaptive Capacity</b> <i>Higher is better</i>		<b>34.0</b>	
Number of acute care hospital beds available per 1000 residents			
Percent of population with health insurance			
Water quality enforcement			
<b>Exposure</b> <i>Lower is better</i>		<b>94.7</b>	
Percent of buildings in high risk floodzone			
Percent of cars in high risk floodzone			
Percent of population living in high risk floodzone			
<b>Sensitivity</b> <i>Lower is better</i>		<b>56.3</b>	



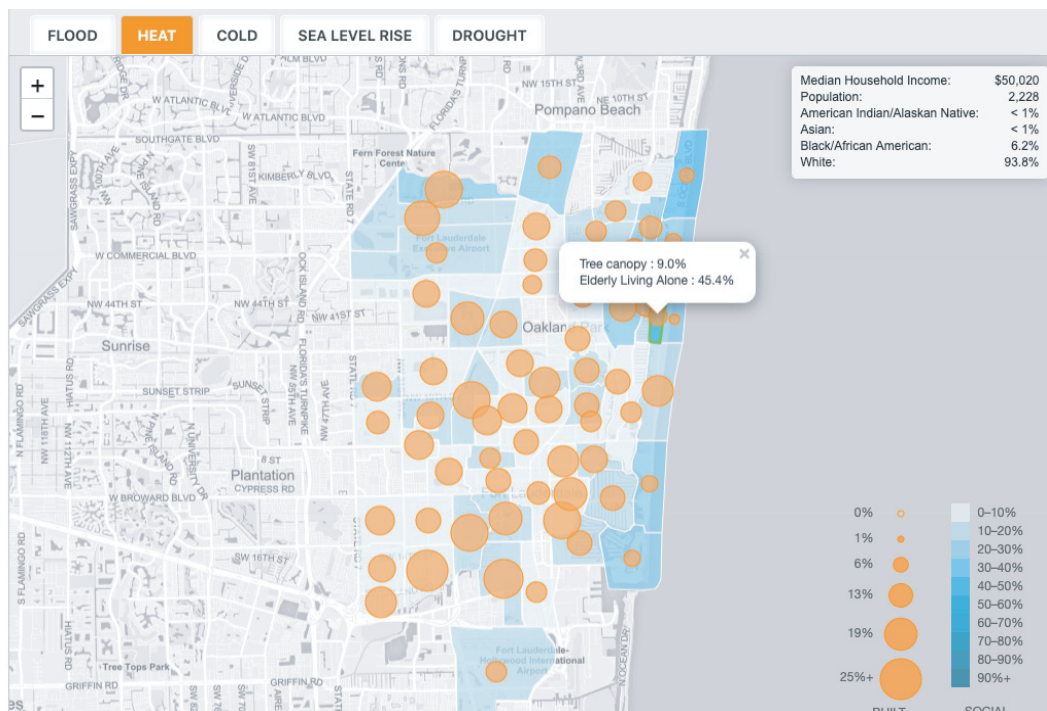
## Fort Lauderdale's Climate Risks (Continued)

The City's priority hazards all relate to flooding. In Fort Lauderdale, water is coming from four different directions: from the sky, from the sea, from groundwater, and from the regional drainage system to the west. More frequent extreme rainfall events and storms have led to increased flooding, as have tidal flooding, including King Tide events in the fall which can rise up to two feet higher than average high tide conditions. Another issue is excessive infiltration and inflow (I/I), where groundwater and/or precipitation enter the sanitary sewage system and cause risk of overflows. The limestone geology means that these intrusions of groundwater can happen easily, especially as the groundwater table rises during high tides.

The City has a high percentage of impervious surfaces in the forms of streets, sidewalks and buildings which increases the burden on stormwater infrastructure. During flooding events, some roads can become impassable and the ground floors of homes and businesses can experience water intrusion. Those living closest to tidal waterways are most at risk of flooding due to King Tide events, yet flooding can also occur elsewhere due to heavy precipitation. Street flooding is more common when rain events are coincident with high tides. Since most of the drainage is through gravity systems, higher tidal elevations block the outfalls and prevent stormwater from discharging.

Inland flooding in the City may impact more vulnerable populations than those on the coast. The UAA Sub-City Map provides valuable insight into the ways that climate hazards intersect with demographics. In the census tract that includes Sunland Park, 68% of the population lives in a high-risk flood zone, 91% of the population is African American, and the median income is \$18,000. These residents may have a more difficult time preparing for and recovering from floods. The surrounding neighborhoods show similar demographics. The City may want to look at increasing neighborhood resiliency efforts in these areas.

A comparison to other cities using the UAA tool can provide further insight. Located only a few miles south of Fort Lauderdale, the city of Miami Gardens has a lower risk score, partly influenced by its more inland location, but also has a lower readiness score, indicating they may have work to do to increase their resilience. Charleston, South Carolina is another city facing sea level rise issues, about the same size as Fort Lauderdale, but has a low risk and high readiness score. Their overall risk is lower due to lower heat projections than Fort Lauderdale, and their readiness is higher in the areas of adaptive capacity and sensitivity.



Select indicators below to pinpoint the locations of vulnerable populations overlaid with structural conditions that contribute to heightened climate risk.

### Built Environment

### Social Vulnerability

Social vulnerability refers to the inability of people, organizations, and societies to withstand adverse impacts from multiple stressors to which they are exposed. Indicators of social vulnerability were selected based on the following justifications:

- ☐ Single Mothers ?
- ☐ No Access To Vehicle ?
- ☐ Housing Instability ?
- ☐ Mobile Homes ?
- ☐ No Health Insurance ?
- ☒ Elderly Living Alone ?
- ☐ Linguistic Isolation ?
- ☐ People With Disabilities ?



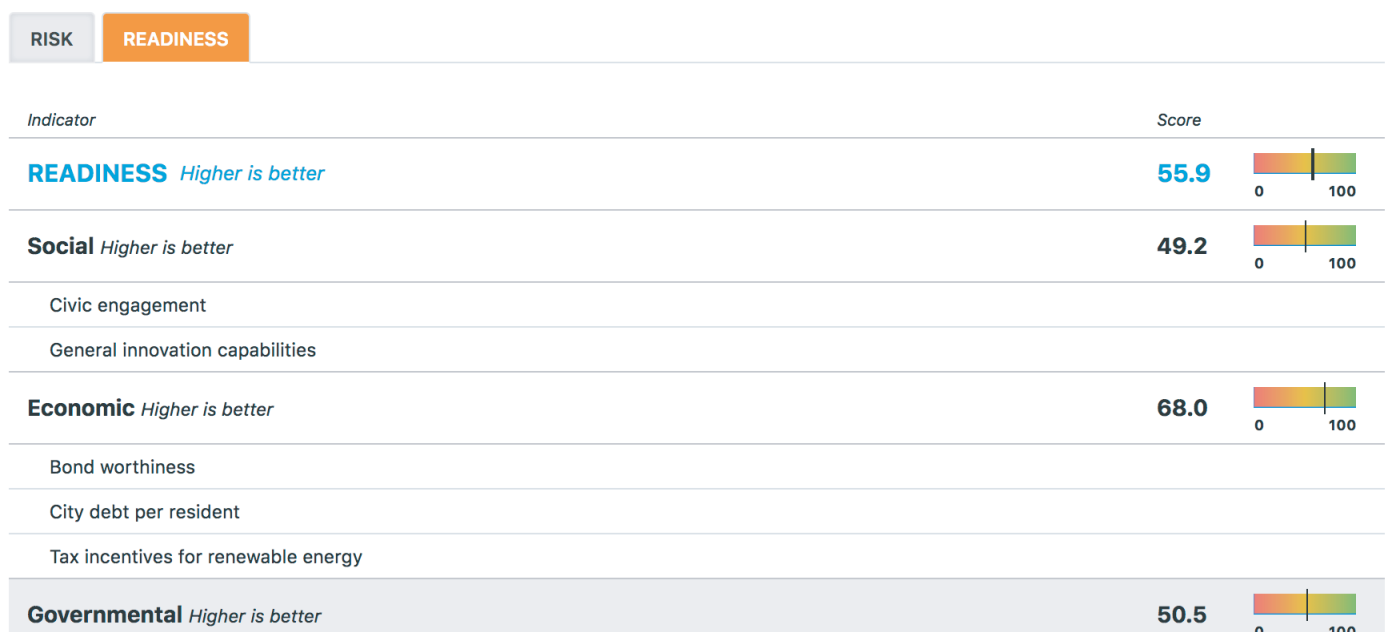
## Building Resiliency

Over the last ten years, Fort Lauderdale, together with its regional neighbors and partners, has been steadily working to build resiliency to its climate hazards. In 2010, Broward County (in which Fort Lauderdale is located) and three neighboring counties united to form the Southeast Florida Regional Climate Change Compact as a way to coordinate regional climate change adaptation initiatives. This regional climate compact has catalyzed resiliency efforts across southeastern Florida, allowing municipalities and counties to share resources, learn from each other, and engage in collective problem-solving. The Compact partnerships have expanded over the years and now includes federal, state, regional, municipal, nonprofit, academic, and private sector partners. This regional resource has been a great benefit to Fort Lauderdale.

The City currently has a staff of seven individuals dedicated full-time to sustainability and climate resiliency efforts, and all City departments approach their work through the lens of resiliency. Resilience is incorporated into all infrastructure master planning the City does. At the City's centennial in 2011 they began a two and a half-year visioning process to imagine the City in 2035. In 2013, a visioning report, *Fast Forward Fort Lauderdale*, and a strategic plan, *Press Play Fort Lauderdale*, were released. Strategies to build resiliency are woven throughout these planning documents. Planning for resiliency is also now incorporated into all planning the City undertakes, including for seawalls, stormwater systems, utilities, parks, community investments and the Comprehensive Plan.

Fort Lauderdale's resiliency goals, as stated in its *Press Play Strategic Plan*, are the following:

- Maintain water, wastewater, road and bridge infrastructure
- Reduce flooding and adapt to sea level rise
- Improve climate change resiliency by incorporating local, regional and mega-regional plans
- Reduce solid waste disposal and increase recycling
- Improve air and water quality and our natural environment
- Secure the community's water supply







## Building Resiliency (continued)

From a city planning and urban development standpoint, the City has undertaken numerous initiatives. Citywide asset management tools are being developed to map and proactively maintain community water, sewer and stormwater assets. Numerous stormwater capital improvement and operational projects have been undertaken. One example is the installment of tidal valves in stormwater drainage pipes, which prevent sea water from backfilling into roads and neighborhoods. A stormwater master plan was recently approved, and is now pending funding through a \$200M stormwater bond. The City is certified as a StormReady Community through the federal government, which demonstrates their readiness as a city to deal with stressors. In 2016, the City passed an ordinance requiring minimum seawall heights for impacted properties. The minimum elevation standard was set to address sea level rise through 2060. The City also participates in the National Flood Insurance Program's Community Rating System and currently has a Class 6 ratings which entitles property owners in Special Flood Hazard Areas to a 20% discount on flood insurance.

The City has made investments to address inflow/infiltration issues, using continuing funding through the Community Investment Plan and a separate \$200M water and sewer bond issued in February 2018. Resiliency is built into their construction methods and materials, their attention to critical structure evaluations and their approach to public seawall projects. Higher water levels are taken into account in considering how and where to build future development and drainage infrastructure. A recently revised County groundwater map changes how development must be designed to manage stormwater. In the near future, Broward County will be releasing updated flood plain maps, which will further shed light on how development needs to happen in coming decades.

A variety of local regulations have been passed to build resilience. These address floodplains, seawalls, landscaping, create local adaptation action areas, and more. Complete Streets projects have been undertaken as well, which place shade trees, pervious parking isles, LED lighting, green bike lanes and wider sidewalks on City streets to improve their ability to drain water, reduce urban heat island effects, reduce carbon dioxide (CO<sub>2</sub>) emissions and encourage residents to adopt more active transportation modes.

In terms of building codes, the City follows the Florida Building Code, which was strengthened and standardized following Hurricane Andrew in 1992, greatly increasing the resilience of new buildings to windstorms. Fort Lauderdale began development on a community-wide manual to address sustainability and resiliency for projects in the public realm. This Design and Construction Manual, which will be released in 2019, establishes a design framework that celebrates the City's unique sense of place, promotes healthy and active lifestyles, and designs for increased flooding and climate change adaptation.

The City realized the importance of public engagement early on. The UAA tool gives Fort Lauderdale a score of 49.2 in the Social category of Readiness, indicating an active level of civic engagement. The city is proactive about educating residents in the 90 established neighborhoods of Fort Lauderdale and letting them know the role they play in building a more resilient City. The City mails postcards to inform the public about hazards such as King Tides, and hosts open houses to educate the public. Three local newspaper editors have come together to create a year-long series called "The Invading Seas," which has significantly helped to bring public attention to the dangers of sea level rise.

Public safety is another area where Fort Lauderdale is building its climate resiliency. The Fort Lauderdale Fire Department has earned the highest accreditation in its class. A recently completed fire station has a finished floor elevation at seven feet, a wind design load of 140MPH or 180MPH for 3-second intervals, and includes sustainable design elements. In addition, the City is retrofitting electric panels for wastewater lift stations, which reduces the risk of failure during King Tide or heavy rainfall events.

The City has prioritized funding for resiliency initiatives. The UAA calculates an economic readiness score of 68, which takes into account bond worthiness, city debt per resident and tax incentives for renewable energy. The City has nearly tripled its annual budget for stormwater operations funding from 2012 levels. By 2023, this budget is expected to be nearly seven times 2012 levels. A \$200M water and sewer bond was recently issued. In addition, the City is looking at raising additional funds through utility fees, special revenue funds, impact fees, grant funding, energy service contracts, general obligation bonds, property tax, special assessments, private investments and public-private partnerships.



## What's Next for Fort Lauderdale

Fort Lauderdale has no plans to slow down their impressive pace at increasing climate resiliency. Proposed new city ordinances would encourage the adoption of cool roofs, increase the minimum freeboard requirement for new buildings, and incorporate pervious areas into the calculation of stormwater rates. A pending City project will study long term vulnerability and solutions to the risk of flooding from sea level rise, storm surge and other climate-related impacts. The study will consider factors including population groups, socioeconomic indicators, public investments, infrastructure and natural systems. The City is initiating efforts to incorporate a social equity lens in its sustainability and resiliency planning. The UAA Sub-City map provides valuable information to Fort Lauderdale planners by showing the population, median household income level and racial makeup of each census tract. This data will allow them to better understand where important social vulnerabilities lie within their city limits.

The City set new goals in the latest draft of the Climate Change Element of its Comprehensive Plan update which is currently being revised. Their ambitious goals include the following:

- Reduce greenhouse gas emissions from city operations by 80% by 2050
- Develop new green building standards ordinance
- Reduce fossil fuel use by 20% by 2025 in city fleet
- Encourage a mix of uses in development to reduce vehicle miles traveled
- Enhance pedestrian and bicycle infrastructure
- Expand tree canopy to 24% by 2025
- Utilize blue-green (waterways and open space) infrastructure in public right-of-way spaces

Fort Lauderdale has chosen to face a significant threat head-on, and because of their forward-looking perspective, can-do attitude, creative problem-solving, regional partnerships and prioritization of funding, they are working to ensure a great quality of life for their residents far into the future. Their climate resiliency planning is a model for other cities to follow.

This report demonstrates the value of localized data on climate hazard vulnerability in framing conversations around local sustainability and adaptation efforts. Putting the UAA data into the context of current initiatives and projections for future policy direction can illuminate the hazards, locations and social vulnerabilities that place various groups of people at risk.