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St. Augustine, Florida, USA

Future Flood Risk: Historic Sites of St. Augustine





INTRODUCTION

St. Augustine is the oldest continuously occupied settlement of European and African-American origin in the United States. Much of the city and its neighborhoods are situated at or just a few feet above sea level. Coastal flooding already poses risks to a number of historic, cultural, and recreational sites that are popular with locals and tourists. <u>Climate Central</u> used its public and proprietary tools to assess the current and future coastal flood risk of five historically significant sites in and around St. Augustine.



St. Augustine, Florida is shown with areas below a water level 4 feet above the local high tide line marked in red. This water level, which could occur through combinations of sea level rise, tide, and storm surge, has a 21% of taking place between today and 2050.

OUR FINDINGS

Using our <u>Portfolio Analysis Tool</u>, Climate Central assessed five historical sites throughout St. Augustine for coastal flood risk now and in the future. All five sites are projected to experience chronic flood risk, defined as experiencing least annual flood risk events, by the end of the century, if not much sooner. A flood risk event occurs when nearby coastal water levels exceed the elevation of a location and there is an unobstructed pathway for the water to reach that site. Additionally, the analysis found that several of these historically and environmentally significant locations in the St. Augustine area are already facing substantial threats from sea level rise and climate change.

The findings presented in this report assume heat trapping emissions continue unchecked (the RCP 8.5 scenario). Results for lower emissions scenarios are similar through 2050, as there is not a significant difference in projected sea level rise between different emissions scenarios until the second half of the century due to the lag between emissions, warming, and sea level rise.

THIS REPORT DEFINES FLOOD RISK BY ANNUAL CHANCE OF OCCURRENCE, NOT FLOOD DEPTH:

OCCASIONAL FLOOD RISK



At least 0.01 expected flood risk events per year, corresponding to approximately a 1% annual chance of a flood risk event. This is the level commonly used to establish flood hazard zones. One can statistically expect a 26% chance of a 100-year flood during a 30-year period. **FREQUENT** FLOOD RISK



At least 0.1 expected flood risk event per year. This is approximately a 10% annual chance of a flood risk event. CHRONIC FLOOD RISK



At least 1 expected flood risk event per year, or approximately a 99%+ annual chance of a flood risk event.

SITES CONSIDERED



1. Castillo de San Marcos



The Castillo de San Marcos as viewed by satellite. Pins are color coded by flood risk in 2050. Yellow pins represent occasional flood risk, orange pins represent frequent flood risk, and red pins represent chronic flood risk.

St. Augustine was founded in 1565 by Pedro Menendez, who was sent by King Philip II of Spain to oust French Protestant colonists near present-day Jacksonville. None of the city's original architecture survived its early years of conflict with local Native Americans and English buccaneers. Only Castillo de San Marcos, finished in the late 1600s, remains to this day, but the fort is now at significant risk of sea level rise and coastal flooding.

Built by the Spanish to defend Florida and the Atlantic trade route, <u>Castillo de San Marcos National</u> <u>Monument</u> is managed by the National Park Service. It preserves the oldest masonry fortification in the continental U.S. and interprets more than 450 years of cultural intersections.

Our analysis of the Castillo de San Marcos monument estimates that much of the building itself is currently experiencing frequent risk, while there is chronic flood risk to the parking lot area and some of the pathways leading to the fort. Within a decade, parts of the fortification are projected to experience chronic flooding.

2. Fort Matanzas



Fort Matanzas as viewed by satellite. Pins are color coded by flood risk in 2020. Orange pins represent frequent flood risk and red pins represent chronic flood risk.

<u>Fort Matanzas</u>, another National Park Service monument, is a fortified coquina watchtower, completed in 1742 by the Spanish to defend the southern approach to St. Augustine. The surrounding 300-acre parkland includes dunes, marsh, maritime forest, and associated flora and fauna, including threatened and endangered species.

To reach Fort Matanzas, visitors travel by ferry, as it is located on an island in the Matanzas River. The fort faces chronic coastal flood risk now, which is projected to worsen in the coming decades, until the base of the fort slips beneath the high tide line in the latter half of this century.

3. Fort Mose



Fort Mose Historic State Park's driveway, parking lot, and museum as viewed by satellite in 2050 (left) and 2100 (right). Yellow pins represent occasional flood risk, orange pins represent frequent flood risk, and red pins represent chronic flood risk.

<u>Fort Mose Historic State Park</u> is a 40-acre waterfront park that is the site of a former free-slave settlement. The park's amenities include picnic areas, observation and birding boardwalk, kayak launch boardwalk, a visitor center and museum.

Although much of the park is wetlands and thus accustomed to regular tidal flooding, sea level rise can harm even landscapes accustomed to regular floods. Rising sea levels can outpace the accumulation of sediment and organic materials that elevate marshes. This slowly drowns valuable habitat for local and migrating species, and degrades the flood protection the wetlands offer to neighboring farms and inland communities.

Additionally, floods could limit access to the park—the road entering the park already experiences occasional flood risk, which could escalate to frequent flood risk by 2050. The museum on the park grounds is projected to begin experiencing occasional flood risk by 2070 and frequent flood risk by 2090.

4. Lightner Museum



Lightner Museum as viewed by satellite in 2020 (left) and 2050 (right). Yellow pins represent occasional flood risk, orange pins represent frequent flood risk, and red pins represent chronic flood risk.

The <u>Lightner Museum</u> in St. Augustine provides visitors with exhibits and programs on art, architecture, history, and design. The building is the former Hotel Alcazar, a Gilded Age resort hotel commissioned by railroad magnate Henry Flagler in the 1880s.

About half the property of the Lightner Museum is already experiencing at least occasional flood risk. By 2030, a third of the area measured is estimated to be exposed to frequent or chronic flood risk. By 2050, about a quarter of the points sampled around the museum are expected to experience a flood risk event at least once a year.

5. Lincolnville District



Lincolnville District with areas below the projected annual flood level in 2050 marked in red.

Founded in 1866 by former slaves, the <u>Lincolnville Historic District</u> is St. Augustine's most prominent historically black neighborhood. Settled by newly-freed slaves after the Civil War, and named for President Lincoln, locations throughout the the Lincolnville Historic District neighborhood are significant for playing a role during the Civil Rights movement.

A number of areas around the edges of the district, particularly on the east side and south end, are currently expected to see occasional or frequent flood risk. By 2030, at least frequent flood risk is projected for more than a third of the locations analyzed. By 2050, over half of the locations analyzed show potential exposure to occasional or more frequent flood risk, with at least 14 out of 81 sites showing chronic flood risk.

METHODOLOGY

In this analysis, Climate Central's freely available <u>Coastal Risk Screening Tool</u> and proprietary <u>Portfolio Analysis Tool (PAT)</u> were used to estimate future coastal flood threats to several sites with cultural and significance to the Cuban community in Miami.

Using leading peer-reviewed science, the Coastal Risk Screening Tool allows users to explore coastal flood risk and sea level rise projections by year, water level, temperature increase, and more through interactive maps. See the *Details and Limitations* section of the tool for detailed methodology.

The Portfolio Analysis Tool combines sea level rise science with local flood history data to compute the number of statistically-expected future coastal flood risk events at specific locations each decadal year, from 2020 through 2100. A flood risk event is defined as the occurrence of nearby coastal water levels exceeding the elevation of the ground at a specific inland location (defined by latitude and longitude coordinates), with an unobstructed pathway for the water to reach that location. Not all such events will cause flooding at the location, but each event poses a risk.

Ground elevation is determined from a NOAA database of LiDAR-derived elevation data. Elevations of structures above the ground are not known or evaluated.

Local flood history comes from the nearest NOAA tide station with at least 30 years' history of hourly water level data. Tide stations that have not experienced a hurricane in their recorded history may not adequately represent the risk of a future hurricane. Precipitation or riverine flooding is not considered, but coastal high water impedes runoff and increases the risk of freshwater flooding inland.

Projected sea level rise is derived from a sea level rise <u>model</u> (Kopp et al. 2014). Inputs to the model include an assumption that carbon emissions continue unchecked (RCP 8.5).

The Portfolio Analysis Tool estimates the expected number of flood risk events each year and reports the results in decadal increments starting in 2020 through 2100. Our analysis is based on the statistically expected number of future flood risk events during the course of a year.

This report presents statistical expectations, not forecasts or predictions, and should be used for scoping and general planning purposes only. Climate Central accepts no responsibility for any damage to property, death or bodily injury, or other loss arising in any way from the use of this report for any purpose.

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Climate Central's Program on Sea Level Rise strives to provide accurate, clear, and granular information about sea level rise and coastal flood hazards both locally and globally, today and tomorrow. Anchored in rigorous primary research, our work distinguishes itself by its user-friendly maps and tools, extensive datasets, and high-quality visual presentation. The program dedicates its efforts to helping citizens, communities, businesses, organizations, and governments at every level to understand the consequences of different carbon pathways and to navigate the shifting waters of our warming world.

You can search or navigate <u>our interactive tools</u> to see maps of areas below different amounts of sea level rise and flooding, down to neighborhood scale, matched with area timelines of risk. Our tool also provides statistics of population, homes, and land affected by city, county, and state, plus links to factsheets, data downloads, action plans, embeddable widgets, and more.

If you are interested in a customized analysis using Climate Central's proprietary Portfolio Analysis Tool (PAT), contact us at <u>portfolio@climatecentral.org</u>.

