Florida Coastal Preparedness Report

Increasing sea level rise vulnerability of coastal counties and how the state of Florida is implementing coastal resilience strategies

A Interactive Report
May 15, 2021

Introduction

> **Sea level rise leads to coastal erosion, inundations, storm floods, tidal waters encroachment into estuaries and river systems, contamination of freshwater reserves and food crops, loss of nesting beaches, as well as displacement of coastal lowlands and wetlands** *UN Ocean Conference*

Florida coastlines are home to dynamic environments and serve as economic engines that support various industries of commerce, fishing, transportation, and tourism alike. Of the 19.6 million Florida residents, **approximately 15 million people live in coastal portions of the state.** The state's populations are jammed predominately along the coast and **more than half the population lives on land below the 4-ft line.**

The sunshine state is accustomed to severe weather events, like hurricanes and thunderstorms, that produce prolonged periods of coasting flooding coupled with extensive property damage throughout the entire state. On average, Florida experiences the highest number of thunderstorms in the U.S, **occurring 75–105 days each year.**

Moreover, while these extreme weather conditions are expected; anthropogenic factors have increased the frequency and severity of natural disasters.

> **Climate change is projected to exacerbate flooding due to storm surges, precipitation intensity, and rising sea levels that increase tidal (also referred to as nuisance) flooding.** *McKinsey Global Institute*

What is Sea Level Rise?

On Earth, human induced activities are changing the natural environment. Over the last century, the rate at which atmospheric carbon dioxide (CO2) has increased tenfold, a consequence of the reliance on fossil fuels (i.e. coal and oil). The burning of fossil fuels has enabled an influx of CO2 in the atmosphere, which has increased concentrations of greenhouse gases (GHGs).

In basic terms, higher concentrations of GHG's in the atmosphere lead to global warming of the planetary atmosphere. When the atmosphere experiences warmer conditions, it is more likely that glaciers and ice sheets will melt, which in effect, increase sea levels. When the ocean warms as well, the seawater will expand, further exacerbating sea levels.

Rates of local sea level result from of a combination of global, regional, and local change. The observed global increase is due primarily to melting of ice sheets and glaciers, as well as thermal expansion of ocean water. However, other factors are also important to note when discussing various causes of sea level rise.

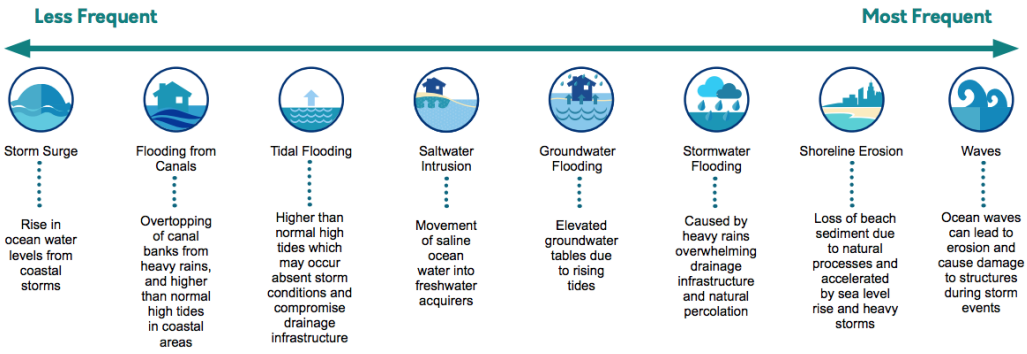
David Mcdonald's *Greenland's Ice Sheet is Melting* | March 8, 2017

Main causes of SLR?

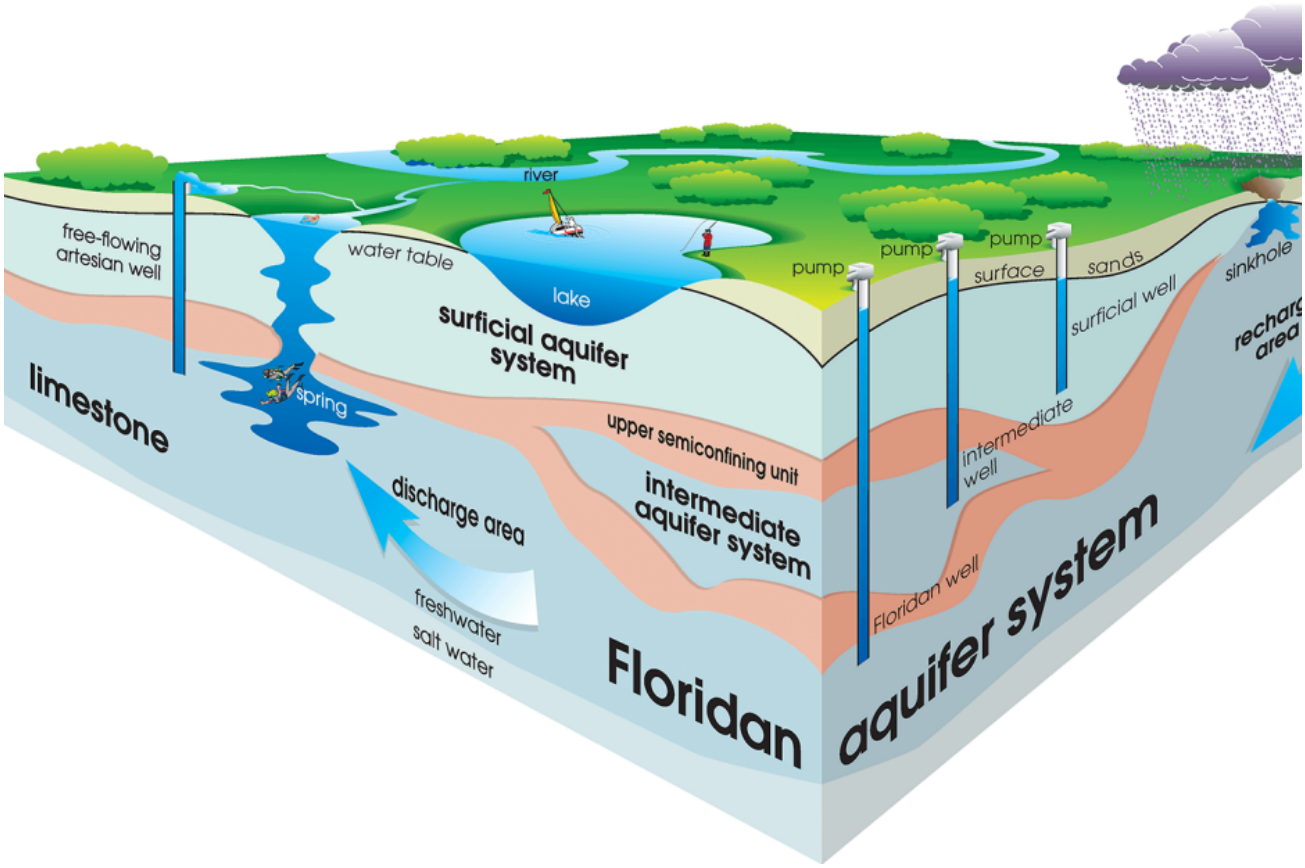
1. When ice melts from glaciers (continental & alpine) from land into the sea.
2. Thermal expansion (i.e. expansion of seawater as it warms), which is about 1/3 responsible
3. The slowing Gulf Stream, that contributes to the amount of water being piled up along the East Coast of the United States.
4. Sinking land mass varies greatly in geography, but also contributes to SLR.

Why is it a matter of concern for Florida?

> Though it may seem as though we have plenty of water to work with, it is actually our most precious resource and one that is facing many challenges today. As the ocean begins to rise and acidify it threatens our shores, the health of our river and the aquifer we drink from. *Miami-Dade Office of Resilience*



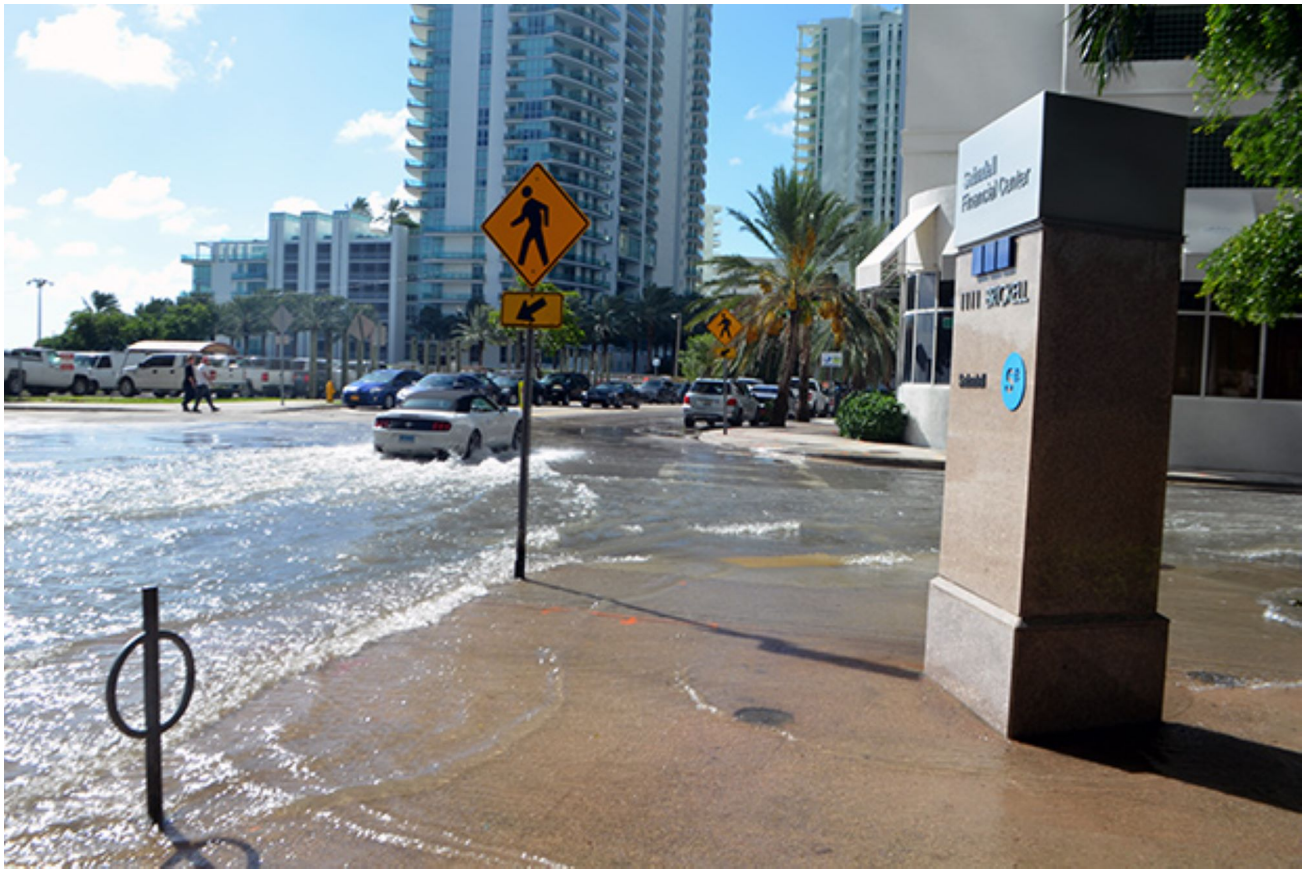
Miami-Dade Office of Resilience natural water events



> We are on this massive substrate of limestone and coquina rock which is porous and infused by water ~ Senator Bill Nelson

Florida's peninsula is made up of various porous bedrock formations, such as limestone that acts as a sponge of sorts.

The geologically makeup of the bottom rock layer, in addition to the low topography, makes building effective sea walls or levees almost impossible.



> Today, average annual losses for residential real estate due to storm surge damage in Florida are $2 billion and could increase to about $2.5 billion to $3 billion by 2030 and $3 billion to $4.5 billion by 2050 *McKinsey & Company*

Residential real estate in Florida is highly vulnerable to SLR and climate change. However, the bigger picture is that rising seas endanger urban infrastructure as well. We are seeing rapid increase in coastal development and populations becoming more concentrated in coastal areas. Infrastructure that supports the local and regional economy, oil and gas wells, sewage treatment plants, water supplies, and transportation highways are all at threatened from sea level rise.

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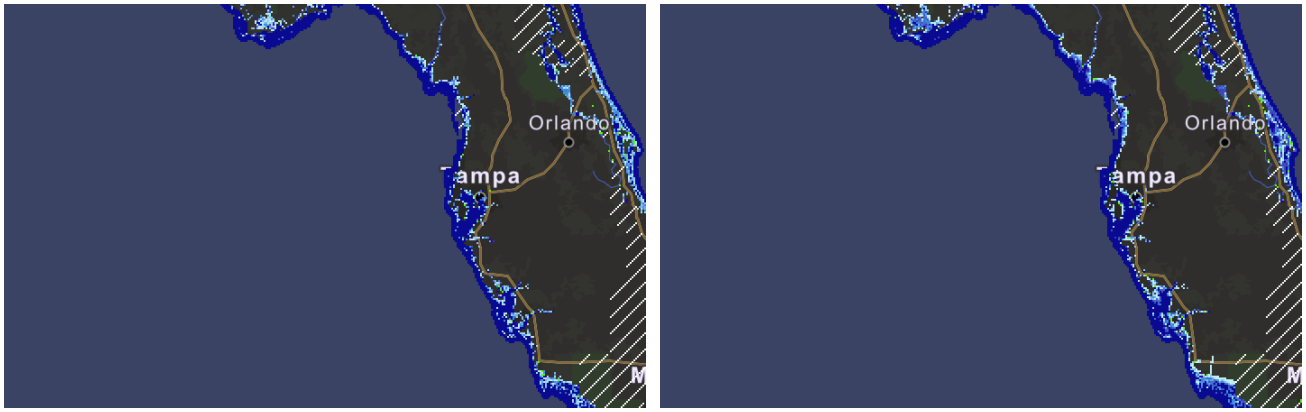
> ***Global sea level rise has risen by about 8 inches since reliable record keeping began in 1880. It is projected to rise another 1 to 4 feet by 2100*** *Fourth National Climate Assessment*

What is the climate science data telling us?

The Sea Level Rise Inundation is provided by the Office of Coastal Management (NOAA). The data collected by NOAA reports SLR data on near real time and is offered as a screening-level tool that enables users to gauge trends. The five relative sea level rise (RSL) scenarios shown in this tab are derived from NOAA Technical Report NOS CO-OPS 083 " Global and regional sea level rise scenarios for the United States" using the same methods as the USACE Sea Level Rise Calculator.

The scenarios are illustrated through 5 scenarios (low-extreme) and can be viewed through inundations of (1ft-10ft). These scenarios allow city residents, government agencies, and emergency responders to visualize the impacts of SLR and assess the risks that of the potential impact of SLR.

Explore the sea level rise Inundation of the Florida peninsula below



This swipe represents the significant difference between SLR at one and four feet. The areas in **blue** are places most vulnerable to sea level rise and the areas in **green** are low elevation areas.

Community Resilience Case Study

Earth's changing climate has big implications for individuals, businesses, and policy makers. Thus far, this report has discussed sea level rise, its causes, and how coastal cities, specifically the state of Florida, will be impacted by the surging seas.

Over the course of the spring semester, an independent research project came into focus to explore the various implications of sea level rise throughout nine coastal cities and two inland cities in Florida. The main objective was to understand the level of climate awareness present and available to the general public across 11 counties in Florida as well as what local and state governments are doing to combat the climate crisis and the issue of sea level rise. After designing a survey and distributing to local county managers, chief sustainability officers, and environmental specialists, there were a **total of four survey responses**. In the following sections, results from those received responses will be evaluated and reflected on.

Explore the interactive map tour below of the 11 counties researched and unique features present within their communities.

Hillsborough

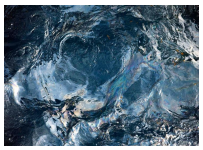
" The Tampa Bay region will likely experience between 1.9 and 8.5 feet of sea level rise by the year 2100 " Tampa Bay Climate Science Advisory Panel

Pinellas

With 37 miles of coastline, barrier islands, and lagoons, Pinellas county is encompassed by the Gulf of Mexico. The county is one of the most densely populated in the state and is...

Polk

" Polk County ranked No. 8 in net migration in the country, drawing more than 17,000 people in a year" Central Florida Development Council



Escambia

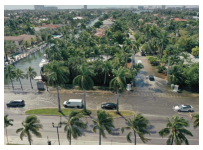
Escambia is the oldest county and served as the state of Florida's original capital. It is also home to 29 miles of coastline and two major barrier islands. The Gulf Coast region is no...

Duval

The county of Duval is one of the well-known counties in the state, as it is home to the City of Jacksonville. In relation to the area, by land mass, it is the largest in the U.S. While it...

Brevard

With an expansive 71 miles of coastline, lagoons, and wildlife refuges, Brevard county, or commonly known as the Space Coast, is home to biologically diverse ecosystems as well ...



Broward

“ Nearly 2000 homes and 200 businesses in eastern Broward would be impacted by a one foot rise in sea level. With a two foot rise, the impact is multiplied 5-6 times with propert...

Miami-Dade

With over 2,000 square miles occupied by 2.8 million residents, the county of Miami-Dade is the most populous county and third largest county, in terms of land mass. Miami-Dade...

Orange

Like Polk county, Orange county is inland and located in the central portion of Florida. The county supports over 1.4 million people and offers a wide range of activities, such a...

Lee

A smaller county made up of roughly 750 thousand residents, Lee counties has 47 miles of sandy beaches, three aquatic preserves, several barrier and tiny islands. The largest citi...

Dixie

An undeveloped coastal wilderness, the county of Dixie is preliminarily home to the Lower Suwannee National Wildlife refuge, a vast 53,000-acre estuarine system that meet...

Message from Our Leaders

> **You have to know where you are, to know where you are going ~** *Whit Remer, City of Tampa's Sustainability & Resilience Officer*

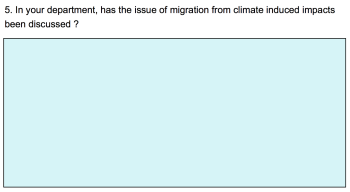
Florida communities are at the crosshairs of endangerment. Coastal cities are grappling with adverse effects of climate hazards, including exposure to dangerous storm surges and prominent precipitation events, worsened by the issue of sea level rise. These events have impacts far beyond local areas directly affected. The reality of what lies ahead presents a fight or flight scenario; a choice in which a number of experts, policy-makers, and Florida communities are still trying to make with complete confidence. Shuffling through the hysteria that comes with the issue of climate change has prompted a growing number of cities and governments across the globe to begin adapting to the present and projected impacts.

The difficulty of addressing the elephant in the room when climate change is debated, rests upon two factors, public awareness and government action. The climate crisis, especially sea level rise, is often contested due to the time scale of the risks associated with the issue. Making informed short-term decisions is more often than not, an easier task than making long-term decisions. While some coastal communities across the globe are experiencing drastic effects much sooner than their American counterparts, now is the

time to implement coastal resilient strategies to cope with the changing climate for decades to come.

Some strategies include; calculation of government agencies, business, and industrial sectors carbon footprints, and mitigating them through the reduction of greenhouse gas emissions, implementing climate action plans, and conducting numerous engineering projects - sea walls, surge barriers and reconstructing water drainage systems- to effectively prepare for rising sea level within and around coastal cities. However, more people-oriented strategies include “urban design, building resilience and retreating after all other options have been exhausted” (WeForum, 2019).

Survey Results



Q.5 from Florida Coastal Preparedness Survey Spring 2021

Evaluating the survey results, issues of climate migration and funding were amongst the key facet’s regarding the challenges of climate change. The phenomenon of climate migration has much nuance surrounding the terminology. Other terms commonly used are ‘strategic retreat’ and ‘climate gentrification.’ Regardless the term coined, counties that were surveyed, almost seemed to tip-toe around this question, striking a red flag. Per the responses, many correspondents either neglected to answer or stated that “some discussion” was had regarding the issue. The reality is, rising seas directly stress infrastructure capacity and the ability of the economy to function routinely. Vulnerable areas are particularly threatened during extreme events, such as storm surges and hurricanes, where citizens are displaced from their homes and forced to retreat to safe ground. Florida is already in the midst of increasing insurance costs due to coastal flooding and those figures are exponential for the decades to come.

Moreover, another key finding from the survey results was how critical a role funding plays in the development of coastal resilient initiatives. In the state of Florida, majority of the funding is granted on the federal level. Local government agencies and nonprofit organizations are granted funding

based on project proposal and design, such as engineering pilot projects.

County	Population in 2010	Population in 2020	Change Over A Decade	Percentage of Change	Counties Responded to Survey
Miami-Dade	2,496,457	2,812,130	315,673	12.6%	X
Broward	1,748,066	1,919,644	171,578	10%	X
Palm- Beach	1,320,134	1,447,857	127,732	9.67%	X
Hillsborough	**1,229,226**	**1,444,870**	**215,644**	**18%**	✓
Orange	1,145,956	1,386,080	240,124	26%	X
Pinellas	916,542	978,045	61,503	7%	X
Duval	864,263	970,672	106,409	12%	X
Lee	618,754	735,148	116,394	20%	X
Polk	**602,095**	**690,606**	**88,511**	**1.47%**	✓
Brevard	543,376	594,469	51,093	9.4%	X
Total	**11,484,869**	**12,979,521**	**1,494,661**	**12.6%**	

Representative chart depicts county population and percentage in population increase data from Florida's Office of Economic and Demographic Research, as well as response rate to survey results conducted during Spring 2021.

Additional Resources:

Resources for the Future

Local Governments for Sustainability (ICLEI)

Acknowledgements

To the National Oceanic and Atmospheric Administration's (NOAA), which has provided extensive Sea Level Rise inundation datasets. As well as, the Environmental Systems Research Institute that maintains geospatial analysis that helped to create the maps presented within this report.

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Florida Coastal Preparedness Survey- Sp...

This link will take you to the survey sent to 11 Florida counties

https://dochub.com/alliedadams17/gYzM7mBwDrpjyGNKqJ6EoO/coastal-survey-03-31-21-pdf

Sources

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Office for Coastal Management- National Oceanic and Atmospheric Administration

Sea Level Rise Viewer

Sea Level Rise. Org

Third National Climate Assessment

UN Ocean Conference