# MIAMI SEA LEVEL RISE
# RESEARCH BRIEF
# JULY 2016

BY: MARTHA MOLFETAS


IMPACT HUMAN

IMPACT HUMAN

# IMPACT HUMAN **MIAMI SEA LEVEL RISE RESEARCH BRIEF** JULY 2016

Written by: Martha Molfetas

# CONTENTS

Miami Sea Level Rise ..... 4
What is Causing Sea Level Rise? ..... 4
The Cost of Sea Level Rise ..... 5
The Making of a City ..... 5
What is Being Done to Combat Sea Level Rise? ..... 6
Local & State ..... 6
National & International ..... 6
Recommendations ..... 7



This Brief has been launched in conjunction with Impact Human's project on Miami Sea Level Rise. Information provided here is intended to provide additional insight on why and how sea level rise is affecting South Florida, and Miami Beach in particular. For more media from us on this topic, including podcasts, photography, and interviews, please see our project page.

# Miami Sea Level Rise

QUICK FACTS[1, 2, 3]

- 6 million people reside in S. FL
- $400 million in planned spending to fight sea level rise in Miami Beach
- Today: SE FL has had 1ft of sea level rise
- Projected by 2060: up to 2ft more of sea level rise for SE Florida
- Miami's beachfront property is valued at $14.7 billion, as of 2011
- $61.7 billion worth of Miami property is 1-3ft below sea level

Climate impacts are all around us, but none are as apparent as sea level rise. Across many parts of the United States and the world, sea level rise has begun to reshape coastal areas – at times even displacing entire communities.[4, 5]

In the past decades, sea level rise has begun to shape the city of Miami Beach, and South Florida more broadly. Sea level rise does not mean purely that the *seas are rising*, it relates to other broader issues of water displacement as well. Increased rains, storm intensity, flooding, and storm surges - all coupled with rising sea levels – are what South Florida is experiencing today.[6]

Two different issues are making sea level rise have a drastic impact for South Floridians:[7, 8]

- South Florida rests on porous limestone bedrock that feeds fresh water aquifers. This bedrock allows water to flow freely up through the ground during high tides, King Tides*, and floods. Conversely, when flooding and storm surges happen, it contaminates the fresh drinking water millions of South Floridians rely on.
- Most of South Florida is anywhere from one to four feet below sea level, historically.

## What is Causing Sea Level Rise?

Today, South East Florida has seen a one-foot increase in sea level from historic levels. By 2060 it is estimated to increase by an additional two feet, and potentially even more should Greenland's glaciers melt further.[9] Many predictions for our warming world made by scientists in the IPCC† Synthesis Report of 2014 have come to fruition sooner than expected.[10, 11]

Already, parts of the Arctic are completely ice-free during summer months. We've begun to see unprecedented glacial loss in Greenland and Antarctica. Losing that land-based ice is the primary culprit for our rising seas, but it isn't the only one.[12] Over the last ten years, we've broken the record for hottest year nine times, with 2016 poised to be the hottest year yet since records began 150 years ago.[13] As our global temperatures rise, our oceans too are becoming warmer. Warming oceans affect weather patterns, yielding stronger tropical storms and forcing seawater to expand. As seawater expands it takes up more surface area, raising the water line for low-laying coastal areas like Miami Beach, while also adding strength to storms and

* King Tides occur when the Moon and other planets align, or when the Moon is closest to the Earth. It forces water to flow more inland during high tide periods than they would normally.

† IPCC refers to the Intergovernmental Panel on Climate Change, a panel of leading climate scientists who assess the present and future impacts of climate change and green house gas emissions on our planet.

hurricanes.[14] The combination of Polar ice losses with warming waters is making sea level rise a reality for millions of Americans, and others around the world – from Pacific island nations like Kiribati to floodplain communities in Bangladesh.

### The Cost of Sea Level Rise

Our present reality has already tripled the odds of storm surges, causing prolonged flooding for many American coastal communities, especially Miami and South Florida.[15] In Miami Beach alone, flooding incidents have increased by 400% from high tides, and 33% from increased rain since 2006.[16]

Under a worst-case scenario for climate impacts, scientists predict up to six-feet of sea level rise globally by 2100. Should that come to pass, Florida would have the highest population at risk of climate displacement in the United States.[17] By 2050, $152 billion worth of Florida's coastal properties will flood at high tide.

While the global impacts and the impacts on Florida are apparent, no major metro area in the United States faces stakes as high as Miami-Dade County metro area. Just over half of Dade County lies less than six-feet above sea level, putting whole swathes of the County at risk of property damage and climate displacement. Today, the Miami area has $400 billion worth of assets and property that are in jeopardy. If projections account for future sea level rise and continued economic investments, the value of property and assets in danger could reach $3.5 trillion by 2070.[18]

## The Making of a City

In 1896, Miami became an incorporated city with 344 people calling it home. In time, the city quickly grew, attracting affluent individuals ranging from railroad tycoon Henry Flagler, to presidential candidate William Jennings Bryan. An influx of money and major building works would attract more and more people, causing the population to grow 440% by 1910. Continued population growth inspired almost 1,000 new subdivisions to be constructed across Miami by 1925, and set the Miami-Dade area on a trajectory for continued growth and building works that we can still see today.[19]

Like many coastal areas, what we now know as the Miami-Dade County metro area was previously swamplands, mangroves and sand dunes. South Florida, a part of the Everglades[‡], would be shaped by the Army Corps of Engineers to create transit canals, drain swamplands for agriculture, and build many of the communities South Floridians call home today. Before all this, South Florida was a part of the Everglades and the wider Everglades watershed, spanning 11 million acres. Today, the Everglades are a fraction of what they once were, but the Everglades watershed system that Miami-Dade County is a part of still flows today.[20] As sea levels rise and storms become more intense, this natural ecological flow of water could pose additional risks for South Floridians.

[‡] The Everglades are a UNESCO World Heritage Site.

# What is Being Done to Combat Sea Level Rise?

Despite the worst projections and realities likely ahead, much is being done on a local, national, and international level to combat climate change and aid mitigation strategies. These policies are in motion now and will begin to buttress communities like Miami Beach and South Florida more broadly against the impacts of sea level rise that we are seeing today.

## Local & State

Miami Beach could be the example of what to do when your city is facing stark climate impacts like sea level rise. The current Mayor of Miami Beach, Phillip Levine, has launched a robust $400 million plan to elevate roads, add height to sea walls, and install drainage pumps throughout the City. These efforts aim to tackle what we are seeing today, with one-foot of sea level rise.[21] The City of Miami Beach even has a Sustainability and Environmental Committee that meets semi-regularly to discuss climate and environmental issues.[22] While much is being done locally, many are cautious that what is being done today may not be enough to protect the city from further projected sea level rise.[23]

What we know as Miami is really a collection of various cities that make up the Miami-Dade County metro area. Dade County has undergone various studies to see how sea level rise will affect the local economy, and is a part of the South East Regional Compact on Climate Change. This South Florida regional group aims to mitigate and adapt to climate change despite present inaction by the state government.[24, 25] Dade County also has a Sea Level Rise Task Force to plan for and address sea level rise and storm surges.[26]

While the City of Miami Beach and Dade County are taking measures to address climate change, on a state level, Florida – the most vulnerable of US states – is sorely lacking in policies that could help deter the worst consequences of climate change. Shortly after Governor Rick Scott assumed office in 2011, he infamously forced Florida state communications and publications to stop using the terms 'climate change' and 'global warming' – despite the threat of sea level rise and other climate impacts the state of Florida is vulnerable to.[27] Currently, there are no state-run programs aimed at protecting Florida's coasts from sea level rise.[28]

## National & International

Climate change is a global issue, requiring global solutions. After many years of attempting to create a global agreement to combat climate change, the United Nations Framework Convention on Climate Change (UNFCCC) established the Paris Agreement[§] this past December. The Paris Agreement sets goals for nations to address climate change. By way of the Paris Agreement, nations around the globe are making commitments to cut their greenhouse gas (GHG) emissions, invest in clean energy, mitigate and adapt to climate impacts at home, and contribute towards climate finance to aid developing nations.

While the broader issue of climate change is being addressed internationally, climate refugees are not protected under international law. Currently, climate refugees do not have the same rights as those fleeing conflict and human rights abuses. Pacific island nations like Kiribati and the Marshall Islands are facing a stark reality where sea level rise is enveloping their countries

[§] The United Nations Framework Convention for Climate Change (UNFCCC) developed the Paris Agreement at the 21st Conference of the Parties (COP-21) this past December. The agreement seeks to address climate change by cutting emissions and providing financial support for climate adaptation and mitigation.

and displacing populations. Globally, it is estimated that there will be 250 million climate refugees by 2050.[29] Without being legally protected as a refugee, climate refugees face a unique reality where they may not be able to seek asylum or receive aid.[30]

Under President Obama, the United States has set an agenda to cut GHG emissions in line with the Paris Agreement, and has emerged as a leader on climate change internationally. While Congress has been relatively inactive or defensive towards acting on climate change, President Obama has utilized the US Clean Air and Clean Water Acts to push forward climate agendas at home that will set the US on the path towards cutting GHG emissions by 26-28% from 2005 levels by 2025.[31] Through the Clean Air and Clean Water Acts, the US Environmental Protection Agency (EPA) will be able to restrict emissions from new and existing power plants, create fuel economy standards for vehicles, and limit emissions from oil and gas development, among other areas.[32]

Specific to sea level rise, President Obama has gone a long way towards pushing for climate resiliency in the US. In 2015, he set a new flood standard for all new and old federal buildings to be assessed for potential sea level rise.[33] In 2013, President Obama released an Executive Order that called for the federal government to prepare for future climate impacts and address climate change, which included sea level rise.[34]

We are beginning to see the impacts of climate change and sea level rise in particular, affect communities in the United States, whether it's in Louisiana, Virginia, or Alaska – many low-laying communities now face potential displacement from sea level rise. These impacts are happening sooner than originally anticipated. Earlier this year, the federal government gave $48 million to Louisiana to help relocate residents of the Isle de Jean Charles.[35] Currently, no federal funding is going towards Florida's coastal defenses, likely due in large part to a lack of state government interest in addressing climate change.

## Recommendations

We need to act fast to save what can be saved, before it is lost. The cost of future climate impacts far exceeds the cost of addressing climate change today.[36] Many of the potential recommendations on a local level are already happening. Higher roads and sea walls are going up all over Miami Beach. However, on a state and local level, politicians need to assess the cost of relocating South Florida's cities, in the event of the worst possible impacts of climate change coming to pass. Such plans and projections for financial needs should be in place on a local and state level to prepare for these darkest of possibilities.

On a state level, Florida – as one of the states most at risk of climate impacts – needs to better address climate and environmental issues. The present leadership has made addressing climate issues untenable, as previously noted. The state of Florida should also create incentives to develop and utilize clean energies and lower emissions. Presently, there are no such incentives for businesses or homes to use solar panels. Financial and emissions-related policies paired with stronger action to address climate impacts would help communities at risk, prepare for future sea level rise, and help combat climate change.

Nationally, the United States needs to have an emergency budget and plan ready to go in order to aid future climate refugees coming out of the Sunshine State and other areas due to future

sea level rise. Congress should also establish committees devoted to addressing climate impacts in both the House and the Senate. President Obama should expand the EPA or create a department specifically devoted to addressing climate impacts. In this way, the federal government can be more agile at addressing these new insecurities facing millions of Americans. The federal government can contribute financially and send the Army Corps of Engineers to carry out coastal development projects to protect areas below current sea levels. These projects would further fortify sea walls to protect Miami Beach and the Dade County areas – as well as other coastal areas in the crosshairs of sea level rise.

Internationally, the United States and other governments need to ratify the Paris Agreement in full, and continue to make strides towards reaching and exceeding present climate goals to deter the worst affects of climate change. Most importantly, the United Nations needs to include climate refugees under the same legal doctrine and protections as those fleeing conflict, human rights abuses, and persecution.

---

[1] Weiss, Jessica. "Miami Beach's $400 Million Sea-Level Rise Plan is Unprecedented, but Not Everyone is Sold." *Miami New Times*, 19 April 2016, accessed 20 April 2016. http://www.miaminewtimes.com/news/miami-beachs-400-million-sea-level-rise-plan-is-unprecedented-but-not-everyone-is-sold-8398989.
[2] Miami-Dade County Department of Environmental Resources Management. "Miami-Dade County Beach Erosion Control: Local Government Funding Request for FY 2010-11." Accessed 01 July 2016, http://www.miamidade.gov/environment/library/reports/erosion-control-budget-10-11.pdf.
[3] Tompkind, Forbes and Christina Deconcini. "Sea-Level Rise and its Impact on Miami-Dade County." World Resources Institute (WRI), 2014. Accessed 02 July 2016, http://www.wri.org/sites/default/files/sealevelrise_miami_florida_factsheet_final.pdf.
[4] Ives, Mike. " A Remote Pacific Nation, Threatened by Rising Seas." *The New York Times*, 02 July 2016. Accessed 02 July 2016, http://www.nytimes.com/2016/07/03/world/asia/climate-change-kiribati.html?_r=0.
[5] Van Houten, Carolyn. "The First Official Climate Refugees in the U.S. Race Against Time." *National Geographic*, 25 May 2016. Accessed 30 May 2016, http://news.nationalgeographic.com/2016/05/160525-isle-de-jean-charles-louisiana-sinking-climate-change-refugees/.
[6] National Oceanic and Atmospheric Administration (NOAA). "How is Sea Level Rise Related to Climate Change?." Accessed 10 July 2016, http://oceanservice.noaa.gov/facts/sealevelclimate.html.
[7] Tompkind, Forbes and Christina Deconcini. "Sea-Level Rise and its Impact on Miami-Dade County." World Resources Institute (WRI), 2014. Accessed 02 July 2016, http://www.wri.org/sites/default/files/sealevelrise_miami_florida_factsheet_final.pdf.
[8] Cox, Stan and Paul Cox. "A Rising Tide." *The New Republic*, 08 November 2015. Accessed 08 July 2016, https://newrepublic.com/article/123216/miami-sinking-beneath-sea-not-without-fight.
[9] Tompkind, Forbes and Christina Deconcini. "Sea-Level Rise and its Impact on Miami-Dade County." World Resources Institute (WRI), 2014. Accessed 02 July 2016, http://www.wri.org/sites/default/files/sealevelrise_miami_florida_factsheet_final.pdf.
[10] Intergovernmental Panel on Climate Change (IPCC). "Climate Change 2014: Synthesis Report Summary for Policymakers." (2014) Accessed 13 November 2014, http://www.ipcc.ch/pdf/assessment-report/ar5/syr/AR5_SYR_FINAL_SPM.pdf.
[11] Kumar, V. Sheila. "Scientists Warn Drastic Climate Impacts Coming Much Sooner than Expected." *Inside Climate News*, 22 March 2016. Accessed 01 July 2016, https://insideclimatenews.org/news/22032016/scientists-warn-drastic-climate-change-impacts-will-come-sooner-expected.
[12] National Aeronautic and Space Administration (NASA). "Arctic Sea Ice Minimum." Accessed 12 July 2016, http://climate.nasa.gov/vital-signs/arctic-sea-ice/.
[13] Nuccitelli, Dana. "We Just Broke the Record for Hottest Year, Nine Straight Times." *The Guardian*, 11 July 2016. Accessed 11 July 2016, https://www.theguardian.com/environment/climate-consensus-97-per-cent/2016/jul/11/we-just-broke-the-record-for-hottest-year-9-straight-times?utm_source=tw&utm_medium=tweet&utm_campaign=socialmedia.
[14] National Oceanic and Atmospheric Administration (NOAA). "How is Sea Level Rise Related to Climate Change?." Accessed 10 July 2016, http://oceanservice.noaa.gov/facts/sealevelclimate.html.
[15] Climate Central. Strauss, Ben. "Florida and the Rising Sea." Accessed 10 July 2016, http://sealevel.climatecentral.org/news/floria-and-the-rising-sea.

[16] MacFarlane, Andrew. "Miami Beach Flooding has Increased Dramatically Over the Past Decade, Study Says." *The Weather Channel*, 08 April 2016. Accessed 09 July 2016, https://weather.com/science/environment/news/miami-flooding-increase-over-past-decade.
[17] Halper, Marsha. "Miami Beach Flooding Spiked Over Last Decade, UM Study Finds." *The Miami Herald*, 05 April 2016. Accessed 15 June 2016, http://www.miamiherald.com/news/local/environment/article70145652.html.
[18] Staletovich, Jenny. "Florida Leads Nation in Property at Risk from Climate Change." *The Miami Herald*, 27 July 2016. Accessed 12 July 2016, http://www.miamiherald.com/news/local/environment/article29029159.html.
[19] History of Miami. George, Paul. "Miami: One Hundred Years of History." Accessed 12 July 2016, http://www.historymiami.org/research-miami/topics/history-of-miami/.
[20] The Nature Conservancy. "Florida: Protecting the Everglades." Accessed 12 July 2016, http://www.nature.org/ourinitiatives/regions/northamerica/unitedstates/florida/placesweprotect/everglades.xml.
[21] Weiss, Jessica. "Miami Beach's $400 Million Sea-Level Rise Plan is Unprecedented, but Not Everyone is Sold." *Miami New Times*, 19 April 2016, accessed 20 April 2016. http://www.miaminewtimes.com/news/miami-beachs-400-million-sea-level-rise-plan-is-unprecedented-but-not-everyone-is-sold-8398989.
[22] Miami Beach. "Climate Change & Sea Level Rise." Accessed 13 July 2016, http://www.miamibeachfl.gov/green/default.aspx?id=74553.
[23] Cox, Stan and Paul Cox. "A Rising Tide." *The New Republic*, 8 November 2015. Accessed 08 July 2016, https://newrepublic.com/article/123216/miami-sinking-beneath-sea-not-without-fight.
[24] Miami Dade Green. "Climate Change." Accessed 13 July 2016, http://www.miamidade.gov/green/climate-change.asp.
[25] Miami-Dade County Department of Environmental Resources Management. "Miami-Dade County Beach Erosion Control: Local Government Funding Request for FY 2010-11." Accessed 01 July 2016, http://www.miamidade.gov/environment/library/reports/erosion-control-budget-10-11.pdf.
[26] Miami Dade. "Sea Level Rise Task Force." Accessed 13 July 2016, http://www.miamidade.gov/planning/boards-sea-level-rise.asp.
[27] Rice, Doyle. "Fla. Gov. Bans the Terms Climate Change, Global Warming." *USA Today*, 09 March 2015. Accessed 12 July 2016, http://www.usatoday.com/story/weather/2015/03/09/florida-governor-climate-change-global-warming/24660287/.
[28] Florida Department of Environmental Protection. "Current Program Activities." Accessed 13 July 2016, http://www.dep.state.fl.us/cmp/programs/index.htm.
[29] "FEATURE: Should International Refugee Law Accommodate Climate Change?." *United Nations News Centre*, 03 July 2014. Accessed 10 July 2016, http://www.un.org/apps/news/story.asp?NewsID=48201#.V4e9so5pz5I.
[30] Lewis, Renee. "Marshall Islanders set to Become Climate Refugees Before International Law can Catch Up." *The World Post*, 07 July 2016. Accessed 07 July 2016, http://www.huffingtonpost.com/entry/marshall-islands-climate-refugees_us_577e7996e4b01edea78cc4bc.
[31] "FACT SHEET: U.S. Reports its 2025 Emissions Target to the UNFCCC." The White House, 31 March 2015. Accessed 01 April 2015, https://www.whitehouse.gov/the-press-office/2015/03/31/fact-sheet-us-reports-its-2025-emissions-target-unfccc.
[32] United Nations Framework Convention on Climate Change (UNFCCC). "INDCs as Communicated by Parties: United States." Accessed 13 July 2016, http://www4.unfccc.int/Submissions/INDC/Published%20Documents/United%20States%20of%20America/1/U.S.%20Cover%20Note%20INDC%20and%20Accompanying%20Information.pdf.
[33] Podesta, John and Craig Fugate. "A New Flood Standard for Federal Investments will Help Communities Weather Climate Change, Extreme Storms." *The White House Blog*, 30 January 2015. Accessed 13 July 2016, https://www.whitehouse.gov/blog/2015/01/30/new-flood-standard-federal-investments-will-help-communities-weather-climate-change-.
[34] "Executive Order – Preparing the United States for the Impacts of Climate Change." The White House, 01 November 2016. Accessed 13 July 2016, https://www.whitehouse.gov/the-press-office/2013/11/01/executive-order-preparing-united-states-impacts-climate-change.
[35] Davenport, Coral and Campbell Robertson. "Resettling the First American 'Climate Refugees'." *The New York Times*, 02 May 2016. Accessed 03 May 2016, http://www.nytimes.com/2016/05/03/us/resettling-the-first-american-climate-refugees.html.
[36] The White House. "The Cost of Delaying Action to Stem Climate Change." (July 2014) Accessed 10 July 2016, https://www.whitehouse.gov/sites/default/files/docs/the_cost_of_delaying_action_to_stem_climate_change.pdf.

## IMPACT HUMAN CONTACTS & BOARD

**Martha Molfetas**
Executive Director & Founder
Board President

**Michelle Chasteen**
Director of Communications
Board COO

**Heather O'Brien**
Director of Events
Board Secretary

**IMPACT HUMAN**
Brooklyn, NY
www.impacthuman.org