

# Florida: Ground Zero in the Climate Crisis

## Climate Change Impacts and Solutions

### HIGHLIGHTS

*Florida faces multiple, cascading threats from climate change; among them are sea level rise and flooding, stronger hurricanes, and harmful algal blooms. The costs of managing stormwater and tidal flooding, of recovering from record-breaking storms, and of losing tourist and fisheries revenue because of algal blooms are significant and increasing. Regional leadership to reduce carbon dioxide emissions and to become more resilient to climate impacts is under way. But national leadership is essential to avoid the most dangerous and costly implications of climate change.*

Florida is on the front lines of climate change. The impacts have been visible for years. With more than 1,000 miles of tidal coastline, sea level rise is an existential threat to the state with the nation’s third-largest population and fourth-highest gross domestic product (BEA 2019). The cascading impacts of climate change—in the form of record-breaking hurricanes, sea level rise, flooding, and harmful algal blooms—threaten three crucial sectors of Florida’s economy: tourism, agriculture, and real estate development. However, solutions are available, and regional leadership on resiliency, adaptation, and carbon emissions reductions is under way. National leadership that puts a price tag on carbon emissions, passes clean energy standards, funds infrastructure resiliency projects, and drives innovation is also essential to avoid the highest cost implications of climate change.

### Impacts

#### SEA LEVEL RISE

Multiple Florida communities have experienced disruptive high-tide flooding, which could become chronic—defined as 10 percent or more of a community’s buildable land being flooded 26 times or more per year—within the next few decades. For example, Miami Beach has already spent \$650 million in storm water management, including pumping seawater out of its neighborhoods because of increased tidal flooding.



*“Sunny day,” or tidal, flooding in downtown Miami, Florida, during the morning high tide on October 17, 2016. According to the Union of Concerned Scientists, if we do nothing to reduce heat-trapping emissions roughly 30 percent of Miami Beach and 25 percent of Key Biscayne would become chronically inundated, flooding more than 26 times per year by 2045.*



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- Sea level rise, which exacerbates tidal flooding, is a result of increased heat-trapping emissions from burning coal, oil, and gas (SFRCC 2018).
- In a 2017 report, *When Rising Seas Hit Home*, the Union of Concerned Scientists (UCS) identified five Florida communities (Cape Sable, Key Biscayne, Key West, Lower Keys, and Middle Keys) that could face chronic inundation as soon as 2035 (Spanger-Siegfried et al. 2017). Based on this analysis, if we do nothing to reduce pollution, roughly 30 percent of Miami Beach and 25 percent of Key Biscayne would become chronically inundated by 2045—within the lifespan of a typical mortgage.
- According to a 2018 UCS report, *Underwater*, residential properties in Florida currently valued at about \$26 billion are at risk of chronic flooding by 2045. These homes currently provide almost \$350 million in annual property tax revenue (Dahl et al. 2018). However, if nations meet the goals of the Paris Agreement and limit global warming to below 2°C, roughly 93 percent of Florida’s at-risk homes could avoid chronic flooding by the end of the century. This could save most of the state’s coastal property values and property tax revenue.

## INTENSIFYING HURRICANES

Climate change is influencing hurricanes in multiple ways, notably that it is increasing the amount of rain that falls

during today’s storms. While it has been notoriously difficult to forecast how quickly Atlantic hurricanes will grow in strength, scientists are working to improve these forecasts to allow more time to warn residents in the path of a hurricane. Warmer ocean temperatures do increase the potential intensity—or power—of hurricanes. Furthermore, warmer air holds more moisture, which increases the potential for hurricanes to release extreme amounts of rainfall.

- Sea level rise leads to greater storm surge.
- Extreme event-attribution studies have found that climate change increased the amount of rainfall that fell during Hurricanes Harvey and Maria (Keellings and Ayala 2019; Risser and Wehner 2017).
- Changing weather patterns (e.g., the jet stream) can cause storms to stall out, potentially bringing additional flooding to an area over more than one high-tide cycle.
- In April 2019, six months after Hurricane Michael had passed, a reanalysis prompted the National Oceanic and Atmospheric Administration (NOAA) to upgrade the storm to a Category 5 hurricane.
  - Michael is the first Category 5 hurricane on record to make landfall on Florida’s Panhandle.
  - The seas over which Michael traveled before landfall in October 2018 were up to 3.6°F (2°C) warmer than the historical average (Beven, Berg, and Hagan 2019).



Jorge Agobian/VOA

Remains of a neighborhood destroyed by Hurricane Irma in Big Pine Key, Florida, on September 20, 2017. Warmer ocean temperatures increase the potential intensity—or power—of hurricanes. Furthermore, recent studies have found that climate change added to the amount of rainfall that fell during Hurricanes Harvey and Maria.

- The toll from Michael is high: 16 deaths from wind, storm surge, and rains; 43 indirect deaths during post-storm clean up; and around \$25 billion in total damages, with approximately \$18.4 billion in Florida alone.

#### FLORIDA'S DISAPPEARING REEFS

Coral reefs draw tourists, support fisheries, and provide protection from storm surge. But reefs today are facing numerous stressors—coral bleaching, ocean acidification, disease, and pollution. Coral bleaching occurs when surface temperatures remain abnormally high long enough for corals to expel the photosynthetic algae that live in their tissue and provide the corals with nutrients (FKNMS n.d.). A bleached reef is not necessarily dead, but it is more vulnerable to mortality (NOS

**More than half of the globe's shallow-water coral reefs are already dead from bleaching, including much of the Great Barrier Reef.**

n.d.). Corals are more susceptible to succumbing to disease after a bleaching incident, and increasingly frequent bleaching events reduce the ability of corals to recover, especially if the water is more acidic. More than half of the globe's shallow-water coral reefs are already dead from bleaching, including much of the Great Barrier Reef. Ocean acidification, the decrease in the pH (i.e., increase in acidity) caused by the ocean's absorption of carbon dioxide (CO<sub>2</sub>), also poses a threat to corals and other shell-forming marine organisms by depriving them of the carbonate ions they need to build their protective shells.

- Oceans have absorbed almost 30 percent of the CO<sub>2</sub> that humans have released since the beginning of the Industrial Revolution.
- Within the Florida Reef Tract, there are multiple species of corals being decimated from diseases such as White Plague and Stony Coral Tissue Loss Disease.
- NOAA suggests that “coral reefs in Southeast Florida have an asset value of \$8.5 billion, generating \$4.4 billion in local sales, \$2 billion in local income, and 70,400 full- and part-time jobs” (FKNMS n.d.). In the absence of emissions reductions, it is estimated that, by 2100, ocean acidification and warming ocean waters could cost

Florida \$95 billion (in 2017 dollars) in lost recreational benefits associated with coral reefs (EPA 2017).

- Coral reefs provide protection by reducing coastal flooding and erosion—acting like breakwaters that dissipate wave energy on coastlines. It is estimated that each year more than 5,000 people in Florida are spared from flooding because of protection offered by coral reefs. Florida's reefs prevent more than \$350 million in direct flood damages to buildings in the state each year, and homes and commercial and industrial buildings protected by reefs contribute nearly \$320 million in economic activity each year (Storlazzi et al. 2019).

#### HARMFUL ALGAL BLOOMS

Algal blooms have occurred naturally over time, but human activities are making these outbreaks worse. Climate change exacerbates algal growth in two main ways. First, warmer, wetter weather fuels the proliferation of harmful algal blooms such as “red tide” (toxic red dinoflagellate algae) and toxic blue-green algae (cyanobacteria) because algae thrive in warm waters. Second, climate change increases rainfall, which washes nitrogen- and phosphorus-rich nutrients from agriculture, septic tanks, and lawn fertilizer runoff into waterways, feeding harmful algal blooms. These blooms are toxic, compromising our drinking water and fouling recreational waters.

- During 2018, business owners from the Florida counties hit hardest by red tide lost almost \$90 million (Fears and Rozsa 2018).
- Florida loses \$82 million annually from its seafood, restaurant, and tourism industries due to red tide (Limitone 2018).



A red tide in 2013 killed fish off the coast of Sarasota, Florida. In 2018, business owners from the Florida counties hit hardest by red tide lost almost \$90 million.

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## Costs

### CLIMATE-PROOFING INFRASTRUCTURE

From roads, to utilities, to underground cables for internet, cities across Florida—and across all coastal regions of the nation—will need to spend billions of dollars to harden and build resilience into their infrastructure. Multiple taxpayer-funded, multimillion-dollar initiatives are already under way.

- The City of Miami Forever Bond is a \$400 million obligation bond, half of which must go to infrastructure that improves resilience to sea level rise and flooding (SFRCC 2018).
- Miami Beach is investing \$650 million to raise its roads and install water pumps in an attempt to protect its residents from sea level rise and flooding (Harris 2018).
- According to the executive summary of Miami-Dade County’s fiscal year (FY) 2018 budget, “the operating budget includes \$604.561 million in expenditures specifically targeted toward resilience efforts. In FY 2018-19, we anticipate spending more than \$2.486 billion of the total \$2.585 billion in capital projects dedicated to community resiliency in the multi-year capital plan. This

includes more than \$811.721 million in transportation and mobility projects and nearly \$545.187 million in water and wastewater projects alone. The multi-year total for all resiliency projects is \$22.373 billion” (Miami-Dade County n.d.).

### STORM DAMAGE

- Hurricane Michael led to \$5 billion in damages from 137,000 property insurance claims (Haughey 2019).
- Michael also resulted in \$1.5 billion in crop loss, \$1.3 billion of which was timber agriculture (Haughey 2019).
- This Category 5-level storm cost Florida somewhere between \$10 billion and \$12 billion in damages, according to estimates from insurance analysts (Haughey 2019).

### HIGHER COSTS OVER TIME

The longer we wait to act on climate change, the worse its impacts will be, and the more expensive it will be to fix the damage and prepare for future impacts. According to the Fourth National Climate Assessment and many other studies, risks to our economy will only rise as the impacts of climate change worsen (Martinich et al. 2018).



Jorge Agobian/Voice of America

Hurricane Michael left swaths of devastation in Mexico Beach, Florida, in 2018. The rapidly intensifying storm caused \$5 billion in damages from 137,000 property insurance claims, and \$1.5 billion in crop losses.

**Only by promoting a future fully powered by clean, carbon-free energy can we begin to turn back the tide and save Florida's economy, environment, and people.**

## Solutions

Florida's local governments are taking action to protect communities and reduce pollution. Florida municipalities are investing in clean energy and banding together to build regional resilience.

- Seven local governments have hired Chief Resilience or Sustainability Officers.
- 31 counties participate in regional climate resilience coalitions—a sixfold increase in just two years.
- Seven cities have passed resolutions to transition to 100 percent renewable energy by 2050.
- 24 municipalities host community solar cooperatives.
- Seven municipalities have invested in electric buses.
- Five higher education institutions rank among the top 50 campuses nationwide for most campus-owned electric vehicles.

National leadership is also essential to avoid the highest cost implications of climate change. The White House and Congress can—and should—put a price tag on carbon emissions, pass clean energy standards, fund infrastructure resiliency projects, and drive innovation that delivers the steep reductions in heat-trapping emissions that we need to avoid the worst consequences of climate change. Only by promoting a future fully powered by clean, carbon-free energy can we begin to turn back the tide and save Florida's economy, environment, and people.

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