

Issue: Sea Level Rise

Florida Under Water

Summary

Scientists predict that sea level will rise nearly 7 feet by the year 2100 if no action is taken to address climate change. By that time, 90 coastal communities in Florida will experience chronic inundation, which means that 10% or more of a community's land area will be flooded by high tides an average of 26 times annually (every other week). The area affected will be much greater than 10% in most of those communities; and some will virtually disappear under water.

Causes of Sea Level Rise

Climate change is the major cause of sea level rise. The carbon dioxide emitted by burning fossil fuels such as coal, oil, and natural gas causes global warming. Rising temperatures cause the ocean to swell because water expands when heated. In addition, higher temperatures melt glaciers, ice sheets, and ice caps, adding more water to the ocean. As the sea level rises, the tides claim more and more coastal land. To make matters worse, climate change has increased the frequency and magnitude of hurricanes. Higher sea levels amplify the storm surge during hurricanes, causing even more severe flooding. (Note: Land subsidence is another factor in sea level rise. But neither of the two common causes – shifting bedrock and compression of the underground aquifer system – is significant in Florida.)

Projections for Florida

The Southeast Florida Regional Climate Change Compact (a group of several county governments) compiled data from the Intergovernmental Panel on Climate Change, the U.S. Army Corps of Engineers, and the National Oceanographic and Atmospheric Administration to generate the following range of sea level rise projections. The range reflects uncertainty about the amount of greenhouse gases that will be emitted and the rate of ice melt.

1. By 2030—6 to 12 inches (0.5 to 1 foot)
2. By 2060—14 to 34 inches (1.2 to 2.8 feet)
3. By 2100—31 to 81 inches (2.6 to 6.75 feet)

The Union of Concerned Scientists analyzed the risk of chronic flooding under three possible risk scenarios:

1. Low—a sea level rise of 1.6 feet by 2100
Assumes very little contribution from ice sheet loss, a drastic decline in carbon emissions, and global warming of less than 2 degrees Celsius (the target under the Paris Climate Accord).
The number of Florida communities facing chronic flooding would be:
 - 3 now
 - 5 by the year 2060
 - 19 by the year 2100The number of people living below the 2-foot sea level is 100,000.

2. Intermediate—a sea level rise of 4 feet by 2100
Assumes growth in carbon emissions through the middle of this century and a slow decline thereafter.

The number of Florida communities facing chronic flooding would be:

- 5 by the year 2035
- 18 by the year 2060
- 58 by the year 2100

The number of people living below the 4-foot sea level is 660,000.

3. High—a sea level rise of 6.6 feet by 2100
Assumes rising carbon emissions and rapid ice sheet loss.

The number of Florida communities facing chronic flooding would be:

- 5 by the year 2030
- 32 by the year 2060
- 90 by the year 2100

Number of people living below the 7-foot sea level is 3.4 million.

By 2100 under the high-risk scenario:

- Miami, Fort Lauderdale, Fort Myers, St. Petersburg, and 12 other Florida cities with populations of 100,000 or more will face chronic flooding (*at least* 10% of land mass).
- Flooding will cover 50% to 90% of the land in 23 communities: Cocoa Beach-Cape Canaveral, Davie, Everglades, **Fort Lauderdale**, Grove City-Rotonda, Hallandale Beach, Hialeah, Hollywood, Hutchinson Island, Indialantic-Melbourne Beach, Jacksonville Beaches, **Key Biscayne**, Melbourne Shores, Merritt Island, **Miami**, Miami Gardens, Miramar-Pembroke Pines, Navarre Beach, North Westside, Pine Island, Plantation, Space Center, and Upper Keys.
- The following 12 communities will virtually disappear because flooding will cover 90% or more of their land mass: Boca Grande, Cape Sable, Estero Island, Key West, Longboat Key, Lower Keys, Marco Island, **Miami Beach**, Middle Keys, Sanibel Island, South Westside, and **St. Petersburg Beach**.

Comparing the consequences under the three scenarios clearly demonstrates the urgency of limiting global warming. If sea level rise is kept at the low scenario instead of the high scenario, 71 communities in Florida and millions of people could be spared from chronic flooding (19 vs. 90 communities, 100,000 vs. 3.4 million people). Reducing carbon emissions will slow the rate of global warming and the rate of sea level rise. The low scenario assumes an increase in global warming of 2 degrees Celsius or less. The Paris Climate Accord limits warming to 2 degrees Celsius through large-scale reductions in greenhouse gas emissions from fossil fuels. However, the current Republican administration has withdrawn from the Paris agreement.

Projections for Specific Legislative Districts in Florida

Surging Seas: Risk Finder is a tool that provides information about the risks of sea level rise in specific locations, such as an address, city, postal code, county, state, or legislative district. Go to <https://riskfinder.climatecentral.org/>. Enter Florida in the search field. Choose the type of location from the drop-down menu under the search field. Enter a sea level rise projection. Then scroll down to “What Is at Risk” to view the estimates of the impact of the projected sea level rise on the population, buildings, infrastructure, contamination sites, and land mass in the specified location.

Example:

Florida State House District 72

A 7-foot rise in sea level (the high scenario) would impact the following:

- 11,000 people (of whom 1,300 are highly vulnerable without resources to relocate).
- 12,000 homes, 4 medical facilities, 3 public safety facilities, 1 school, 1 govt. bldg.
- \$7.5 billion in property values
- 77 miles of roads
- Contamination risks: 1 extreme hazmat facility, 2 sewage plants, 14 wastewater sites

A 4-foot rise in sea level (the intermediate scenario) would impact the following:

- 5,100 people (290 of whom are highly vulnerable)
- 4,700 homes, 2 medical facilities, 1 public safety facility
- \$3.9 billion in property values
- 45 miles of roads
- Contamination risks: 2 sewage plants, 9 wastewater sites

Damages Caused by Sea Level Rise

Flooding will harm the state of Florida in a multitude of ways:

1. Homes and buildings—Rising tides will regularly soak the basements and first floors of homes, businesses, and other buildings, damaging them until they are uninhabitable. Property values will slowly decline until eventually the owners will be unable to sell or insure the property. Many are low-income families without resources to relocate. For some, their home is a retirement asset that will be rendered worthless.
2. Economy—Flooding will force frequent business closures and result in lost revenue. The state economy will lose billions from the decline of tourism, and jobs related to the beach industry will disappear. Encroaching saltwater will reduce the productivity of farmland. When floods damage cars and force road closures, employees will miss work and lose their jobs due to chronic absences.
3. Infrastructure—Roads, pipelines, power lines, communication systems, sewers, and other critical infrastructure will be damaged. Saltwater will invade freshwater aquifers and well fields, causing shortages in the drinking water supply. Flooded roads will make it impossible for emergency vehicles to reach their destinations. Police and fire stations, hospitals, schools, utilities, and energy facilities affected by flooding will have to close and relocate.
4. Contamination—Flooding of refineries, sewage plants, and hazardous waste sites will release toxic materials and pollutants into the environment and expose the population to serious health risks.
5. Coastal environment—Coastal habitats and wildlife refuges will be damaged. Hundreds of plants and animals, including endangered and threatened species, will be impacted.
6. Historical sites—Just a one-meter rise in sea level will destroy 6,000 historical and archeological sites in Florida.

Recommended Action

Reducing greenhouse gas emissions is the best way to protect coastal communities from future sea level rise. However, some communities are already being inundated, and current levels of global warming make chronic flooding inevitable for many more. Therefore, at-risk areas must adopt adaptation measures, which fall into three types of action.

1. **Defensive Measures**—Defensive measures include seawalls, tide gates, and levees. Not only are they costly and legally and logistically complicated, but they are not long-term solutions. Hard structures wear out over time, and eventually the sea level will rise above the structures. They also aggravate shoreline erosion and cannot prevent infiltration of saltwater through Florida’s porous limestone bedrock into wells and aquifers. Seawalls will have to stretch for long distances along the shore and can divert the seawater to unprotected coastline areas. Levees can fail.
2. **Accommodation**—Another approach is to make room for the influx of water and find ways to live with the rising tides. Elevating houses and roads, installing large-scale pump systems, and building channels along urban waterfronts are examples. Such projects are costly and have limited effectiveness.
3. **Retreat**—Residents and businesses relocate further inland. Retreat can be managed or unmanaged, voluntary or mandatory. Abandoning neighborhoods and commercial districts involves difficult social, emotional, and financial adjustments. Low-income vulnerable populations may lack the resources to move and the ability to secure employment elsewhere. Dispersing causes loss of community ties, support networks, and cultural heritage. However, managed relocation can minimize the impact not only on those moving, but also on the communities to which the displaced relocate.

Steps to address rising sea levels:

1. Slow the pace of climate change by reducing carbon emissions from fossil fuels and by developing renewable energy such as wind and solar.
2. Limit coastal development.
3. Stop federal and state funding of infrastructure projects (roads; bridges; transit, sewer, and water systems) that support development in flood zones.
4. Update building codes, zoning regulations, and infrastructure plans to account for sea-level rise projections.
5. Reform flood insurance policies so that premiums reflect actual risk levels. Currently subsidized insurance premiums encourage property owners to build in flood zones and rebuild in the same place after disasters.
6. Enhance emergency preparedness and emergency response/evacuation programs.
7. Fund large-scale home buyout programs.
8. Retreat from risk areas and invest in economic development and new infrastructure in safer locations where businesses and people can relocate.
9. Adopt policies to preserve natural ecosystems and protect cultural heritage sites.

Because the recommended actions will take many years to implement, experts warn that state and local governments must take proactive steps now. Otherwise, chronic flooding will be a matter of crisis response instead of problem solving. Responding to climate change disasters will cost significantly more than prevention and adaptation. Investments in pre-disaster mitigation measures have a payoff of at least 4-to-1.

State and Local Government Response

After taking office in 2007, then-Republican Governor Charlie Crist convened a climate change summit in Miami, created a climate change task force, and signed an executive order to reduce the state's greenhouse gas emissions and require more energy efficient building codes. However, such policies vanished from the state agenda when Republican Rick Scott assumed the governorship in 2011. He abolished the Florida Energy and Climate Commission and unofficially barred use of the term "climate change." Although the governor's office denied such a policy, Department of Environment Protection employees reported that they were verbally instructed not to use "climate change" or "global warming" in their reports, emails, and other official communications. When criticized for being a climate change denier in 2014, Scott claimed credit for spending \$350 million on sea-level rise. However, fact checkers revealed that the claim was not accurate. Although spent on worthy projects (such as \$100 million to modernize the sewer system in the Florida Keys, which indirectly benefits coral reefs), the funding was used for typical coastal projects, not to combat sea level rise. Furthermore, Gov. Crist laid most of the groundwork for those projects. (Crist later changed parties and became a Democratic Congressman).

In 2017 the legislature passed and Gov. Scott signed a bill creating a task force to coordinate state efforts dealing with natural hazards, including sea level rise. The governor also included a \$1.7 billion environmental package in the proposed 2018 budget, including \$3.6 million for the Department of Environmental Protection. However, critics say that Scott suddenly became interested in the environment because it's an election year and because of public support for conservation. In 2014 Florida voters approved a constitutional amendment requiring increased spending on land and water preservation and directing lawmakers to use 1/3 of the revenue generated by a real estate tax for conservation measures. The tax is expected to generate \$862.2 million to fund the amendment in the next fiscal year.

Although these developments are positive, critics say they fall far short of what's needed. The budget does nothing to move the state away from fossil fuels to renewable energy or otherwise address the underlying causes of sea level rise, and the budgeted amount is not enough to meet the financial need for mitigation and adaptation measures. For example, the cost just to upgrade seawalls across Broward County is \$4 billion to \$6 billion, and another \$360 million is needed for storm water improvements.

In the absence of state leadership, some local governments are filling the void. One model group is the Southeast Florida Regional Climate Change Compact, a coalition of four counties (Broward, Miami-Dade, Monroe, and Palm Beach) that coordinates mitigation and adaptation measures across county lines. In the Tampa Bay area, a regional planning commission hired a climate specialist to get local governments, planners, and scientists to work together. Without state help, they have established a multi-county network and climate advisory panel to address climate-related problems. Mitigation measures are being undertaken with local funding in some of the large metropolitan areas, such as the \$400 million that Miami residents are paying for a floodwater pump system. But small and medium-sized coastal towns do not have the financial means to protect their communities from sea level rise.

While some progress is being made at the local level, most local governments do not appear to be actively addressing sea level rise. In 2011 an amendment to state law allowed local governments to designate low-lying coastal zones subject to flooding and vulnerable to sea level rise as "Adaptation

Action Areas” in their comprehensive plans. In 2015 the Florida legislature imposed a mandate on local governments to consider sea level rise and flooding in their comprehensive plans. As of November 2015, 26 out of 188 local governments explicitly mentioned sea level rise in their comprehensive plans; only 8 mentioned Adaptation Action Areas; and only 2 actually designated a specific physical area as an Adaptation Action Area.

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