



# Miami-Dade in Hot Water

Why Building Equitable Climate Resilience is Key  
to Public Health and Economic Stability in South Florida

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By Cathleen Kelly, Miranda Peterson, and Madeleine Boel

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Center for American Progress



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# Introduction and summary

Miami-Dade County is famous for its warm Atlantic beaches and vast Everglades marshlands that draw millions of sun-seeking vacationers every year. This global tourism mecca on Florida’s Southeastern tip is also the self-proclaimed “gateway to Latin America and the Caribbean” and a major trade, banking, and real estate hub.<sup>1</sup> But in recent years, Miami-Dade’s image as a haven for those seeking carefree subtropical living has been confronted by a new phenomenon. Climate change is bringing more flooding, extreme heat, and other impacts that affect the way people live, work, and even vacation in this low-lying county.

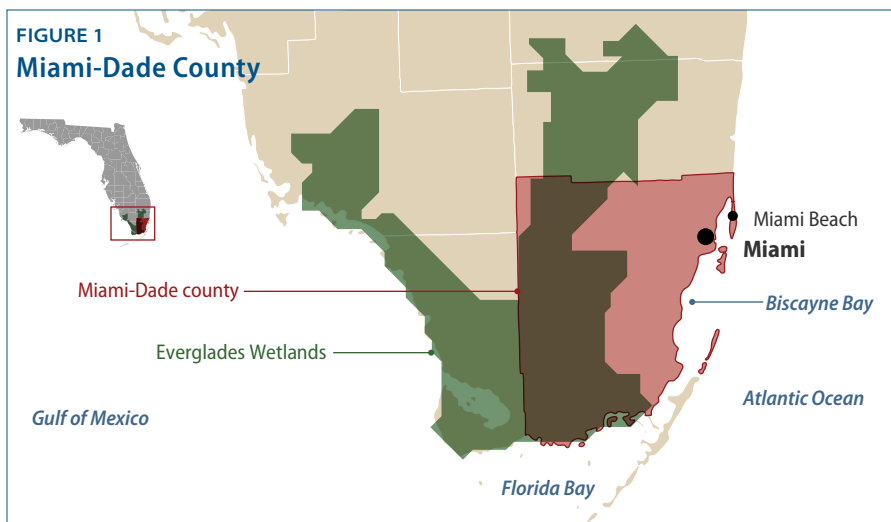
In Miami-Dade—the United States’ seventh most populous county—the symptoms of climate change are undeniable.<sup>2</sup> The sea level has risen about a foot since the pre-industrial days of the 1870s, and the increase is expected to accelerate in coming years, with projections of up to 6.8 feet sea level rise by 2100.<sup>3</sup> Flooded streets are becoming routine even on sunny days, triggered not by extreme storms but by high tide.<sup>4</sup> Rising seas will exacerbate the impact of hurricanes, which remain ever-present threats. The number of days with temperatures higher than 95 degrees Fahrenheit in Florida and other Southeastern states has steadily increased since 1970, putting the health of residents at risk.<sup>5</sup> These dangerous climate change effects pack the hardest punch in the county’s sizeable low-income communities, which lack the economic stability and quality housing to safely weather the stifling heat and flooding that are part of the new normal.

Despite these risks, a majority of residents and leaders in Miami-Dade are just starting to consider building resilience to the consequences of climate change. If county leaders act quickly, they can take advantage of opportunities to build climate change resilience in ways that support equitable economic growth and allow all South Florida communities to thrive in the 21st century. Some of these opportunities include:

- Prioritizing climate change resilience and mitigation starting with implementing existing county recommendations and embedding climate risk reduction management into planning and policies across all county government offices.

- Improving public knowledge of climate change risks through education and outreach to the county’s diverse communities.
- Creating a public climate change forum to ensure Miami-Dade residents receive an opportunity to voice their concerns and ideas for strengthening equitable resilience to County officials.
- Mapping social and climate vulnerability and developing resilience solutions using data and community input to help planners and emergency responders focus resources on addressing the most urgent resilience needs.
- Strengthening and leveraging social cohesion to help Miami-Dade’s low-income communities prepare for climate change impacts, and expand knowledge of available resources to build climate resilience.
- Leveraging community organization strengths to help county leaders communicate with low-income residents and provide resilience assistance to those vulnerable to climate change risks.
- Planning for storm displacement before it happens by prioritizing extreme weather preparedness and incorporating lessons learned from other metropolitan regions that experienced mass displacement of residents by extreme storm damage.

By taking these steps, county leaders can make rapid progress toward building equitable climate change resilience across Miami-Dade County. In addition to describing these steps in more detail below, this report assesses the growing risks of climate change in Miami-Dade County, particularly in low-income areas.



# A magnet for migration: Miami-Dade's population boom

South Florida's beautiful beaches and strategic trade location attract not only tourists and businesspeople but also families seeking jobs and a high quality of life. In 2014, 6 million people lived in the neighboring counties of Miami-Dade, Broward, Monroe and Palm Beach.<sup>6</sup> The collective population of these four counties is expected to grow by almost 800,000 people in the next 15 years.<sup>7</sup>

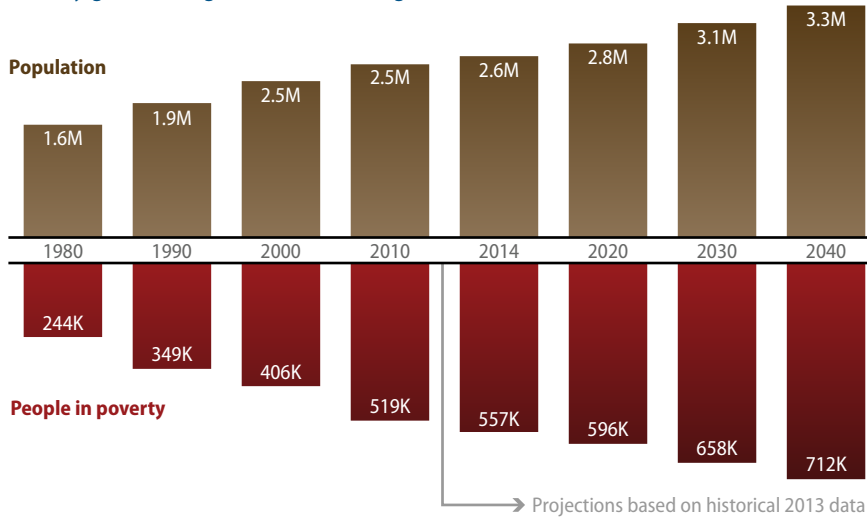
In 2014, Miami-Dade alone had over 2.6 million residents, roughly half of whom were foreign-born. High levels of immigration are projected to continue, and the county's population is expected to grow 18 percent by 2030 to 3.1 million people.<sup>8</sup>

This population surge is partly due to Miami-Dade's rapid economic growth. The gross domestic product, or GDP, of the Miami metropolitan area—which consists of the cities of Miami, Fort Lauderdale and West Palm Beach—increased 3 percent in 2014, or 0.6 percent higher than the national growth rate.<sup>9</sup>

But not all Miami-Dade residents have access to this prosperity. Currently, close to 60 percent of Miami-Dade households are considered financially unstable, and one in five households live in poverty.<sup>10</sup> Poverty levels are the highest among African American and Hispanic communities, which together make up 85 percent of Miami-Dade's population.<sup>11</sup> Although countywide unemployment dropped between 2010 and 2012, poverty rates increased during that same timeframe.<sup>12</sup>

**FIGURE 2**  
**Population and poverty in Miami-Dade County**

Poverty grows alongside climate change risks



The authors compiled data from the following sources: Miami-Dade County Department of Planning and Zoning, Research Section, "Miami-Dade County At a Glance" (2007), available at <http://www.miamidade.gov/planning/library/reports/at-a-glance/2007-poverty.pdf>; Department of Regulatory and Economic Resources, Planning Research Section, "Miami-Dade County At-A-Glance: Poverty in Miami-Dade" (2013), available at <http://www.miamidade.gov/planning/library/reports/at-a-glance/2012-poverty.pdf>; Florida Office of Economic and Demographic Research, "Projections of Florida Population by County, 2015-2040, with Estimates for 2014," available at [http://edr.state.fl.us/Content/population-demographics/data/Medium\\_Projections.pdf](http://edr.state.fl.us/Content/population-demographics/data/Medium_Projections.pdf) (last accessed January 2016); Florida Office of Economic and Demographic Research, "Population and Population Change for Metropolitan Statistical Areas in Florida," available at <http://edr.state.fl.us/Content/population-demographics/data/MSA-2015.pdf> (last accessed January 2016).

Counties whose populations grow bigger by the day increase their risk of damage due to flooding and the impact of extreme weather events in South Florida counties. Moreover, climate change threatens to derail the region’s economic growth and harm residents—many of whom are strapped for cash. As the population continues to grow alongside climate change hazards, county leaders have no choice but to prioritize management of these costly and dangerous risks.

# Climate change risks are not equally shared

All communities are affected by more extreme weather and other climate change effects, but these risks are not shared equally in a world of growing inequities.<sup>13</sup> Floods and storms easily damage aging or poorly constructed housing and infrastructure, which are common in low-income communities. In the wake of an extreme weather event, lost wages and other financial hardships can push already struggling families into poverty. Low-income individuals, individuals with low English proficiency, and immigrants have historically had a hard time accessing and overcoming bureaucratic challenges to post-disaster aid.<sup>14</sup> At the local government level, lower tax bases and lack of political access to higher levels of government can also affect low-income communities' ability to harness post-disaster resources.<sup>15</sup>

In 1992, Hurricane Andrew—a Category 5 storm with winds ranging up to 175 miles per hour—hit South Florida, causing damage of \$46 billion in 2015 dollars.<sup>16</sup> In Miami-Dade, Andrew destroyed 25,000 homes and took 15 lives.<sup>17</sup> However, some of the most sizeable and lasting impacts happened in Florida City, a small Miami-Dade municipality south of downtown Miami that was hit by the eye of the storm.<sup>18</sup> In 1990, 37 percent of Florida City residents lived in poverty, making it one of the poorest towns in the United States.<sup>19</sup> After Andrew, single-family homes in Florida City lost 81 percent of their value. Home values would not recover until 2000.<sup>20</sup>

By contrast, the neighboring municipality of Homestead, which had a strong town government and home values of \$10,000 or greater, bounced back from Andrew more quickly.<sup>21</sup> After Andrew, single-family homes in Homestead lost 47 percent of their value, but took only two years to recover.<sup>22</sup> By 2000, median incomes in Homestead grew, following national trends, while Florida City median incomes dropped and poverty rates increased.<sup>23</sup>

Nearly 60 percent of Miami-Dade households lack the adequate savings needed to live above the federal poverty level for three or more consecutive months; another crippling storm could be devastating for these households.<sup>24</sup> Miami-Dade policy leaders and residents alike will need to carefully craft climate resilience and mitigation strategies that recognize the reality of stratified economic opportunity and vulnerability to the county's top climate threats: sea level rise, extreme storms, and extreme heat.



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## The financial squeeze of a rising sea

According to the Risky Business Project—a nonpartisan research project focused on the economic risks of climate change—no U.S. state stands to lose more to rising seas than Florida.<sup>25</sup> In 15 years, an additional \$69 billion of insurable, private property will be at risk of high tide flooding.<sup>26</sup> By 2030, experts predict that Florida will suffer \$15 billion in real estate flood losses.<sup>27</sup>

The Miami-Dade municipality of Miami Beach, a barrier island and one of the state’s most climate-vulnerable cities, is also one of its most profitable tourist destinations. In 2014, 14.5 million tourists stayed overnight in Miami-Dade and spent \$23.7 billion.<sup>28</sup> Many of these tourists stay at one of Miami Beach’s prime real estate properties—together valued at \$27 billion but highly vulnerable to sea level rise. Stories of tourists changing vacation plans and checking out of their hotels early are becoming more common as flooding due to high tide or rainfall becomes a nuisance that blocks access to attractions, businesses, and famous Miami Beach hotel lobbies.<sup>29</sup> Some local business owners have reported revenue losses of 15 percent on days with flooding.<sup>30</sup>

PortMiami—which is adjacent to Miami Beach on Dodge Island in Biscayne Bay—is equally as valuable and vulnerable. The port supports 207,000 jobs and moves \$28 billion annually, making it the county’s second most valuable economic asset.<sup>31</sup> Not only is the port a cargo hub, but it is also the arrival location of nearly 5 million cruise ship tourists every year.<sup>32</sup> According to PortMiami’s “2035 Master Plan,” sea level rise and global climate change are major threats to its future.<sup>33</sup>

A changing climate and coastline will have vast impacts on the functionality of the Miami-Dade economy, particularly for the low- and middle-income households who depend on it. The trade, transportation, and utilities sector provides 26 percent of county jobs and an average annual income of \$44,068.<sup>34</sup> The leisure and hospitality sector accounts for more than 12 percent of all employment within the county and provides an average wage of \$27,544 per year.<sup>35</sup> Together these two climate-affected sectors provide nearly 400,000 jobs.<sup>36</sup>

While leaders of the City of Miami and the City of Miami Beach—home to some of the county’s most high-income assets—recognize the need to combat climate change risks, this does little to protect commuters who live in lower-income areas and travel into coastal and downtown municipalities for work. For example,

when businesses are damaged and roads are blocked due to flooding, many commuters lose working hours or cannot reach their jobs—a preeminent stress in a county that already considers traffic a major concern.<sup>37</sup> Far from the beaches, in low- and middle-income communities where housing costs are low and tourist attractions are few, there is minimal recognition by municipal leaders of the dangers of floods and other climate change risks.

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## Higher seas further strain Miami-Dade's Everglades wetlands

Miami-Dade County lies across porous limestone land that hugs the Atlantic Coast an average of 4.9 feet above sea level.<sup>38</sup> The western edge of the county lies in the center of the Florida peninsula, which is home to the largest freshwater marsh in the nation: Everglades National Park and Everglades Wildlife Management Area.<sup>39</sup> The majority of Miami-Dade's development sits on the narrow strip of dry land between these natural borders, which creates several pressing problems for the county as seas rise.<sup>40</sup> Coastal flooding from the swelling ocean is washing away beaches, damaging roads, and putting homes and businesses at risk.<sup>41</sup> As the Florida Bay pushes more water inland, the county will be squeezed by the encroaching Everglades.

Climate change, however, will affect Miami-Dade's natural environment in more ways than just constricting the availability of dry land. As the sea level rises, dense saltwater intrudes into South Florida's freshwater system, harming the fragile Everglades ecosystem with unsustainable water levels and increased salinity. The Everglades is the only large wetland system in the world supported by precipitation.<sup>42</sup> If rainfall levels decline there will be less freshwater to support the ecosystem and push back against saltwater intrusion. Increased temperatures will also risk the evaporation of much-needed freshwater.<sup>43</sup>

These effects threaten the Everglades' vast mangrove forests, which can scrub more carbon dioxide out of the atmosphere than any other type of terrestrial forest.<sup>44</sup> Carbon dioxide is the main driver of climate change; the loss of mangrove forests and their carbon-sink properties exacerbates the region's contribution to global climate change.

After years of concerted efforts to drain the Everglades to create more dry land for development, many South Florida leaders are now banking on initiatives to restore the Everglades to protect the region from sea level rise. The Everglades,

and other wetlands, provide unmatched natural flood protection. One acre of wetlands is able to store up to 1.5 million gallons of floodwater.<sup>45</sup> Miami-Dade County plays an active role in the South Florida Ecosystem Restoration Task Force that collaborates with the federal government to rehabilitate this valuable ecosystem.<sup>46</sup> Yet while the Task Force works to restore the Everglades, other forces driven by a changing climate are working against it.

The quicker the Everglades return to their former health, the more capable the wetlands will be of withstanding sea level rise, higher temperatures, and erratic rainfall patterns. If restored, the Everglades will be able to help protect densely populated Miami-Dade from more intense storm surges during hurricanes and continue to support the region's drinking water.

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## Bailing out Miami-Dade's water infrastructure

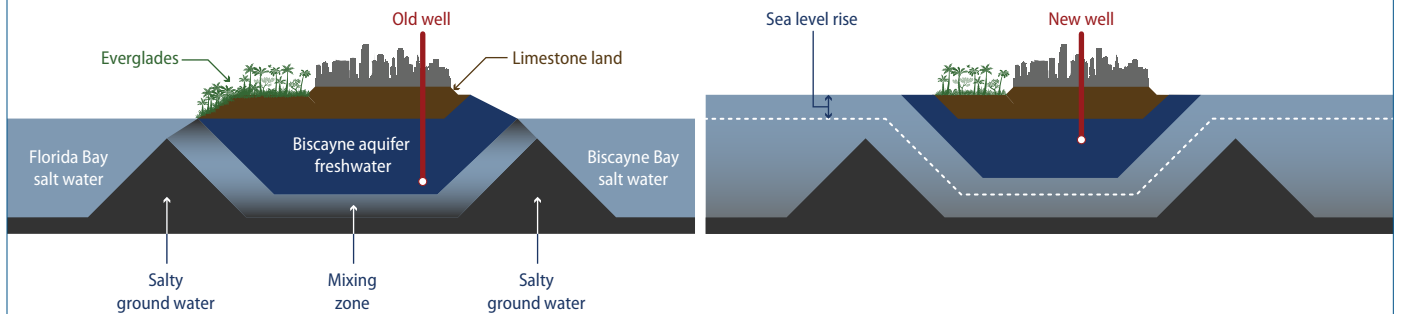
As the subtropical waters surrounding Miami-Dade County warm and expand due to rising global temperatures and melting polar ice, the sea level rises and burdens the region's water resources and infrastructure.

Saltwater is seeping into and contaminating South Florida's main source of freshwater—the Biscayne Aquifer—which supports 7 million people.<sup>47</sup> According to local Florida Atlantic University, the saltwater can move through Florida's limestone foundation and reach as far as 10 miles inland.<sup>48</sup> In light of these risks, some Miami-Dade municipalities, like Hallandale Beach, no longer use all their drinking water wells and have plans to adapt by moving water infrastructure further inland.<sup>49</sup>

Rising seas are also causing higher and longer-lasting tidal inundations that threaten Miami-Dade's already overburdened water infrastructure.<sup>50</sup> South Florida's stormwater drainage systems were designed to rely on gravity to pull extra water down through the limestone bedrock. But upward pressure from rising seas is leaving less room for floodwaters to drain. When rain storms come through or king tide hits, this lack of space in the groundwater system causes sewers and drains to overflow, blocking roads and damaging property.

**FIGURE 3**  
**Sea level rise puts the squeeze on South Florida**

How rising seas and saltwater intrusion pose a threat to life in Miami-Dade County



Note: For more information on sea level rise and salt water intrusion, please see Southeast Florida Regional Climate Change Compact Sea Level Rise Work Group, "Unified Sea Level Rise Projection" (2015), available at <http://www.southeastfloridaclimatecompact.org/wp-content/uploads/2015/10/2015-Compact-Unified-Sea-Level-Rise-Projection.pdf>; Florida Oceans and Coastal Council, "Climate Change and Sea Level Rise in Florida: An Update on the Effects of Climate Change on Florida's Ocean and Coastal Resources" (2015), available at [http://www.dep.state.fl.us/oceanscouncil/reports/climate\\_change\\_and\\_sea\\_level\\_rise.pdf](http://www.dep.state.fl.us/oceanscouncil/reports/climate_change_and_sea_level_rise.pdf); Intergovernmental Panel on Climate Change, "Climate Change 2007: Working Group II: Impacts, Adaptation and Vulnerability: Freshwater resources" (2007), available at [https://www.ipcc.ch/publications\\_and\\_data/ar4/wg2/en/ch6s6-4-2-1.html](https://www.ipcc.ch/publications_and_data/ar4/wg2/en/ch6s6-4-2-1.html).

Not all of Miami-Dade's water infrastructure issues are a result of climate change. For a number of years, Miami-Dade's Board of Commissioners siphoned water infrastructure maintenance funds for other projects.<sup>51</sup> In 2012, this negligence and the resulting overflowing sewage system attracted the attention of the U.S. Environmental Protection Agency, or EPA.<sup>52</sup> The county now has a \$1.6 billion 15-year plan to update its sewage and stormwater infrastructure, driven by a 2013 Clean Water Act settlement with the EPA.<sup>53</sup>

While these upgrades will be a significant improvement for residents over the status quo, the U.S. district court did not require the county to take sea level rise or storm surge into account.<sup>54</sup> As a result of community criticism—mainly from the Biscayne Bay Waterkeeper, now known as the Miami Waterkeeper, who attempted to block the court agreement because it did not take climate change risks into account—the Miami-Dade Board of Commissioners passed a resolution in May 2014 saying that all new infrastructure projects or upgrades "shall consider" sea level rise and storm surge.<sup>55</sup>

Perhaps due to the attention that the EPA lawsuit brought to the county's aging water infrastructure, in 2015 the county embarked on a two decade \$11.9 billion wastewater and water distribution capital improvement program.<sup>56</sup> The plan seeks to upgrade the county's water infrastructure to meet existing and new state and federal regulations, improve water efficiency, and help meet the needs of a growing population.<sup>57</sup> As a new infrastructure project, the plan must fulfill the Board of Commissioners' resolution requirements to consider sea level rise and storm surge in its designs.<sup>58</sup>

The municipality of Miami Beach is working with the state to carry out a \$300 million plan to install 60 new stormwater pumps to reduce flooding risks.<sup>59</sup> In 2015, 10 of the pumps were installed and proved capable of keeping some city blocks dry when the October king tide hit.<sup>60</sup> However, the project has created other problems.

Soon after the pumps were installed, hydrologists at the local Florida International University found increased levels of pollution in Biscayne Bay—the outlet for the water pumps. The Bay's water now contains increased levels of phosphorus and nitrogen because flood water was pumped through soil laden with fertilizers and animal feces.<sup>61</sup> As flood risks rise, local and state officials will need to work quickly with planners to improve the Bay's water quality.

Although Miami Beach has yet to chart a clear path to climate resilience, city officials are determined to adapt to rising sea levels. Much of the municipality's funding for its plan is dependent on the tax base brought by development. Yet, if Miami Beach is to succeed in funding its climate resilience plan it will have to encourage even more development within its flood plain, which will compound flood risks and other environmental stressors that increase the city's vulnerability to climate change.<sup>62</sup>

While the Board of Commissioners' 2014 sea level rise resolution was a step in the right direction, the extent to which infrastructure developers are analyzing sea level rise risks and alerting their designs to reduce them is unclear. Without immediate action to build infrastructure resilience, current water system challenges throughout the county are likely to be compounded when the next extreme storm strikes—a worrying prospect for a county frequently in the path of hurricanes.<sup>63</sup>

# Climate change intensifies Miami-Dade's extreme weather risks

In addition to slow-onset impacts such as sea level rise, climate change also increases the strength and frequency of extreme weather events around the globe. In South Florida, specifically, extreme storms and heat waves pose the greatest threat to Miami-Dade County.

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## Extreme rain

In early December 2015, record rain in Miami-Dade created flooding and headaches on one of the county's busiest tourist weekends of the year: the opening weekend for the internationally famous Art Basel festival.<sup>64</sup> One of the region's top economic and cultural priorities is attracting more artists through such initiatives.<sup>65</sup> Yet, the deluge challenged this goal—and showcased a symptom of climate change's impact on the region's weather systems.

As global temperatures warm, more water evaporates into the atmosphere and results in prolonged periods without rainfall, followed by heavy downpours. The December rain event was one of many rain-induced flood events that the county experienced in 2015.<sup>66</sup> Similar extreme rainstorms have caused extensive and deadly flooding in other cities, including Houston, Texas, which in spring 2015 was hit by a wave of heavy downpours that caused widespread damage.<sup>67</sup>

Since rainstorms are difficult to prepare for and are often perceived as less of a threat than hurricanes, most government attention goes towards hurricane preparedness.<sup>68</sup> Unlike with hurricane tracking, extreme rain can be more difficult to predict and government leaders are less likely to alert residents, call for evacuation, or activate shelters. After a rainstorm passes, pooling can create a checkerboard of flooding, cutting people off from emergency services.<sup>69</sup> While Atlantic hurricane season only lasts from June through November, severe rainstorms can strike Miami-Dade County at any time.<sup>70</sup>

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## Hurricanes

South Florida is on the receiving end of the northern Atlantic's Hurricane Alley, a warm-water nursery for tropical storms that starts on the west coast of Africa. According to the U.S. National Oceanic and Atmospheric Administration, or NOAA, Miami-Dade has a 48 percent chance of being hit by a hurricane or tropical storm during hurricane season.<sup>71</sup> However, the U.S. has not witnessed a major storm—Category 3 or higher—since 2005, when Hurricane Wilma battered the Miami metropolitan region as a Category 3 storm with winds of 120 miles per hour.<sup>72</sup> According to NASA, a major hurricane drought lasting more than nine years may occur on average in the United States once every 177 years.<sup>73</sup> In Florida, however, the absence of a hurricane—major or not—has been an even lower probability since Wilma: Florida is the only state that has not been hit by a hurricane since 2005.<sup>74</sup>

Given the state's high exposure to severe storms in any year, extreme weather is ranked as one of Florida's top security threats.<sup>75</sup> In light of this concern, Miami-Dade's Chief Resilience Officer James Murley told the authors that local, state, and federal emergency management professionals coordinate and prepare for tropical storm threats year-round.<sup>76</sup>

This concern for extreme weather preparedness, however, may not extend to residents. Kamalah Fletcher, senior director of community engagement at Catalyst Miami, a poverty-focused community organization – worries that South Florida's luck with hurricanes may run out soon and create a dangerous situation, especially for new residents who lack experience preparing for extreme storms and knowledge of local emergency protocol.<sup>77</sup> In an interview with the authors, Fletcher said that Florida residents and leaders are “getting comfortable and forgetting how you behave when you think something is more imminent.”<sup>78</sup> She is concerned that Miami-Dade residents are not yet aware of the real dangers of climate change and more extreme weather emergencies.

According to a 2015 Mason-Dixon Florida Poll, one in three Floridians would not evacuate their homes for an impending Category 1 hurricane, even if ordered to do so by emergency management professionals.<sup>79</sup> The poll reported that most Floridians felt a lack of concern about being hit by a hurricane in 2015 or felt vulnerable to potential storm damage.<sup>80</sup>

## Hurricane flood prevention is necessary but overlooked

Miami-Dade has some of the strongest wind resistance building codes in the world.<sup>81</sup> But the county lacks similar codes for flood prevention, such as a requirement to elevate new and substantially improved buildings and homes. While some wealthy developers are beginning to design hotels and condos with so-called wash-out floors, most real estate within the county is at risk of being damaged by flooding from extreme storms and slow-onset sea level rise.<sup>82</sup>

Miami-Dade has more than 1.4 million people living within its 100-year coastal flood plain, including more than 21,000 people living in vulnerable mobile homes.<sup>83</sup> This concentration of people in high flood-risk areas, coupled with an overloaded stormwater system and the potential for dangerous storm surge, puts Miami-Dade at risk of sudden catastrophic flooding.

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## Limited mobility puts Miami-Dade residents at risk

In 2013, Miami-Dade County updated its hurricane evacuation zone mapping.<sup>84</sup> The updated maps call on 1.8 million residents—three times previous estimates—to be prepared for evacuation procedures.<sup>85</sup> In 2015, corresponding shelter, evacuation assistance, and evacuation route bus pick-up location plans were updated by the county, but not all resource materials have been translated for people with low English proficiency.<sup>86</sup> Ensuring that residents are aware of evacuation services is key to public safety, particularly for the county's low-income communities.

As reported in early 2013, more than 111,000 Miami-Dade households do not have a personal vehicle and depend largely on the county's limited public transportation options, such as the bus system, for mobility.<sup>87</sup> Historically, lack of personal transportation has been a major contributing factor to low-income communities' inability to follow evacuation procedures when storms have threatened the United States. According to the Federal Transit Administration, more than 14 percent of Miami-Dade households would require assistance in the event of a major evacuation.<sup>88</sup> Caroline Lewis—executive director of Climate Engagement Leadership Opportunities, or the CLEO Institute, which specializes in engaging residents with climate change science, seriousness, and solutions—is concerned that the county's low-income communities will be left behind to weather the dangers and damages of the next big storm.<sup>89</sup> In an interview with the authors, Lewis said, “Those of us that can drive away will. But countless others will be stuck.”<sup>90</sup>



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## The risks of mass displacement run high

In addition to acute public safety risks, widespread property damage could permanently push county residents from their homes. With high-rates of financial instability, most Miami-Dade residents cannot afford to repair or rebuild homes and businesses damaged by flooding. Likewise, many who are provided evacuation services are unlikely to be able to afford a trip home.

The combination of physical and financial vulnerability within the Miami metropolitan area creates the potential for disruption on par with recent mass displacement events in the United States. For example, in 2012, Hurricane Sandy displaced 776,000 people from metropolitan New York City and caused \$68 billion in losses across the country.<sup>91</sup> In 2005, Hurricane Katrina displaced a record 1.5 million people from metropolitan New Orleans with \$151 billion in national losses in 2015 dollars.<sup>92</sup>

According to catastrophe risk management consultancy Karen Clark and Company, if a storm with winds of 200 miles per hour made a direct hit to Miami—a scenario similar to that of the recent Pacific-basin Hurricane Patricia—it would cost an unprecedented \$300 billion in losses.<sup>93</sup> In a county of almost 3 million people, the human losses would be immeasurable.

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## Rising temperatures and growing health threats

In addition to the growing risks of more extreme storms and sea-level rise, Florida and the entire Southeastern region of the United States is getting hotter. Compared with its historical climate, by 2040 the region is projected to experience more than 50 additional 95-degree days—or hotter—per year.<sup>94</sup> According to NOAA, in 2014 climate change boosted the rate and strength of heat waves nationally.<sup>95</sup> In addition to driving more intense droughts that are projected to further disrupt the water cycle on which the Everglades and Biscayne Aquifer depend, hotter temperatures also threaten public health.

Unlike other parts of the country, the Florida peninsula benefits from prevailing winds that prevent serious air pollution problems.<sup>96</sup> While Miami-Dade as a whole is reported to experience “good and moderate” air quality year round, not all residents have access to clean air. According to the EPA’s environmental justice screening and mapping tool, the worst air quality in the county is concentrated in low-income areas.<sup>97</sup>

Warm air interacts with pollution from vehicles and factories, accelerating the formation of harmful air pollution.<sup>98</sup> In traffic-ridden South Florida, climate change will further exacerbate the risk of respiratory and cardiac illnesses, including asthma and heart attacks.<sup>99</sup> These diseases are particularly prevalent in urban areas with similar demographic make-ups to that of Miami-Dade County.<sup>100</sup>

High temperatures can also lead to heat-related illnesses, particularly among low-income people. Many poor Miami-Dade residents do not have or cannot afford to use air conditioning, which reduces the risks of heat-related illnesses by cooling the air.<sup>101</sup> In addition, those living in socially unstable areas may lock their windows and doors for safety reasons.<sup>102</sup> This reduces airflow, raises indoor air temperatures, and elevates the risk of heat-related illness. In 2014, 36 people were hospitalized in Miami-Dade County for heat-related illness.<sup>103</sup>

Miami-Dade is also disproportionately at risk of disease epidemics compared with other U.S. areas. A warmer and more waterlogged environment can lead to increased breeding of pests like mosquitos, which are vectors for diseases like malaria and dengue fever.<sup>104</sup> Additionally, Miami's status as a transportation gateway between nations makes it vulnerable to first-entrance of tropical diseases from Central and South America.<sup>105</sup> According to Miami-Dade's Comprehensive Emergency Management Plan, the county's medical professionals are trained to detect these diseases in order to halt risk of an epidemic.<sup>106</sup> However, Miami-Dade's linguistically and culturally diverse population may complicate efforts to communicate and prevent disease risks as the threat to public health rises.

Additionally, Florida's high-uninsured rate has the potential to exacerbate the negative health impact of higher temperatures. Low- and middle-income residents without health insurance are unlikely to seek medical attention in an emergency due to the high cost of care. However, the national implementation of the Affordable Care Act, or ACA, is helping ensure that more Floridians have health insurance. In 2015, more than 1.3 million Floridians were enrolled for federal coverage under the ACA, and the heavily Hispanic and low-income Miami-Dade municipality of Hialeah led the nation in ACA enrollment.<sup>107</sup> Yet, 33 percent of Miami-Dade County residents are still without health insurance. Florida is one of 19 states that have not accepted federal funds to help expand Medicaid. This significantly undermines the overall health and climate preparedness of the state, as Medicaid expansion would help 567,000 uninsured low-income Floridians gain health insurance, many in Miami-Dade County.<sup>108</sup>

In light of the public health risks exacerbated by climate change, Miami-Dade leaders will need to educate and prepare medical professionals and residents on how to protect communities from higher rates of illness linked to rising temperatures. Leaders can also help mitigate these risks by promoting smart transportation planning and expanding mass transit to cut vehicle-related air pollution within the county.

# Resilience plans without accountability

As climate change accelerates, Miami-Dade communities are increasingly recognizing the need to strengthen their resilience to sea level rise and more extreme weather risks. The county's "GreenPrint: Our Plan for a Sustainable Future," released in 2010, outlines a plan for the county to both mitigate and adapt to climate change.<sup>109</sup> The plan includes a county pledge to cut greenhouse gas emissions to 80 percent of 2008 levels by 2050 and 137 recommended initiatives to build a more sustainable and resilient county. Among the recommendations is implementation of the Southeast Florida Regional Climate Change Compact—a regional climate action commitment for Miami-Dade, Broward, Palm Beach and Monroe Counties known as the 4-County Compact.<sup>110</sup> The GreenPrint also includes proposals to improve water and energy efficiency, preserve coastal ecosystems, and increase public transportation use.

In 2013, the county released its first "GreenPrint Progress Report."<sup>111</sup> While the progress report indicates that the county has completed or is taking action on 110 GreenPrint initiatives, in reality progress has been slow and not widespread. For example, the GreenPrint encourages all Miami-Dade municipalities to pledge to implement the plan, yet only 5 of the county's 36 municipalities had done so according to the progress report.<sup>112</sup>

As temperatures and flood risks across the county continue to rise, political and cultural challenges have stalled action to create a sustainable and resilient Miami-Dade County. After the Miami-Dade leaders who created the GreenPrint left office, the plan's recommendations became a lower priority. James Murley describes the GreenPrint as a guiding document for the county.<sup>113</sup>

Murley points to the Miami-Dade County Sea Level Rise Task Force, stormwater system upgrades, and the Everglades rehabilitation project as signs of progress toward a more climate-resilient county.<sup>114</sup> However, the county has no master plan to track the impacts of these efforts or to communicate progress to the public.

Kamalah Fletcher believes that progress through the county’s resilience initiatives, including those in the GreenPrint, is possible, but that county and local officials need to make plan implementation a higher priority.<sup>115</sup> “With over 200 recommendations from various regional initiatives, there should be more happening,” Fletcher said. “But there is not enough accountability.”<sup>116</sup> She said that resilience has not yet become an institutionalized concept within the Miami-Dade government and that the current status of resilience planning “creates a vague understanding of the threats, what’s being done, and how it applies to daily life.”<sup>117</sup>

After the appointment of James Murley as the county’s first chief resilience officer, at the urging of community advocates, the county began updating the GreenPrint in early 2016.<sup>118</sup> Community advocacy for action on climate change has been key to county progress.

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## An empowered community is a resilient community

Among those working in Miami-Dade to address climate change, there is universal agreement that the county needs to do what it can, and fast, to build resilience to mounting sea level rise and extreme weather threats. Community advocates are working to fill climate preparedness gaps left by lackluster county efforts by raising public awareness of climate change threats and supporting dialogue between community members and county policymakers about strategies.

In September 2015, climate advocates made local headlines at the mayor’s budget hearing when they called on county officials to make climate change a top priority.<sup>119</sup> They highlighted that not one item in the new budget funds resilience measures.<sup>120</sup> In response to their demands, the county moved to appoint a chief resilience officer—Murley—and a \$300,000 budget for engineering more resilient county infrastructure.<sup>121</sup>

After the hearing, Miami-Dade County Mayor Carlos Gimenez called for local universities to make solutions to sea level rise a top research priority. He was quoted in the *Miami Herald* as saying, “We don’t have a solution, ... So even if I have a billion dollars right now, we wouldn’t know what to spend it on. Because there is no solution right now.”<sup>122</sup>

Community leaders see this attention to sea level rise from the County Mayor's Office as a step in the right direction, but they continue to press for county leadership to be accountable to its existing plans, including the recommendations and action framework of the GreenPrint, the 4-County Compact, and the county's Sea Level Rise Task Force.<sup>123</sup>

In October 2015, the budding movement of community members and leaders organized the largest local march to date to rally for climate action. An estimated 2,000 community members showed up to the County Government Center to demand more progress in Miami-Dade on climate mitigation and resilience.<sup>124</sup>

In light of the high risks of climate change to the county, advocates hope to expand public engagement and accelerate momentum for more change. As Caroline Lewis of the CLEO Institute sees it, "Business and grassroots coalitions are being built to advocate for the implementation of climate resilience plans, but large-scale change remains difficult. Funding for community education and engagement might give elected leaders the support they need to act."<sup>125</sup>

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### Lack of public awareness creates space for a state of denial

As 60 percent of Miami-Dade residents live with financial instability, their near-term needs often take precedence over addressing longer-term—yet potentially devastating—climate change threats. The majority of Miami-Dade residents remain uninformed about the threats that climate change poses to their health, communities and livelihoods.<sup>126</sup> This lack of awareness and absence of a strong public outcry for action has created space for elected officials to ignore the urgent need for climate change solutions and to focus on other matters.<sup>127</sup> This dynamic is not unique to Miami-Dade County.

Climate denial by state leaders minimizes pressure on local officials to address climate change. For example, counter to decades of scientific evidence and research in Florida, Gov. Rick Scott denies that climate change is a threat.<sup>128</sup> In 2015, state employees widely alleged that Gov. Scott's administration had banned them from using the words "climate change" and "global warming" in the workplace and in reports.<sup>129</sup> While "sea level rise" was never taken out of the government lexicon, according to the Florida Center for Investigative Reporting, government reports avoid mention of the cause, which not only keeps the public in the dark but undermines the ability of government officials and business leaders to develop and pursue solutions.<sup>130</sup>

Experts at The George Washington University recently examined attitudes towards climate change adaptation in some of the nation's cities most vulnerable to climate change, including Tampa, Florida.<sup>131</sup> The experts found that, "Interviewees in Tampa overwhelmingly claimed that, mainly due to lack of political buy-in regarding climate change, their city remains one of the most vulnerable and least prepared cities in the country."<sup>132</sup>

The need for political backing for a climate resilience push is not limited to Tampa and Miami-Dade. According to the States at Risk project, which grades U.S. states' preparedness to climate change impacts, Florida rated a "C-," with "D," "D-," and "F" grades on efforts to reduce extreme heat, inland flooding and coastal flooding risks, respectively.<sup>133</sup>

For local leaders who are working to build community resilience, a lack of recognition of climate threats from the state level can be a major roadblock. While the state is helping Miami Beach install its new pumping system as a routine water infrastructure project, in May 2015, Miami Beach Commissioner Michael Grieco complained that state leaders are unwilling to provide any financial assistance for climate change mitigation and adaptation projects, leaving localities to foot the bill.<sup>134</sup>

In the absence of meaningful assistance from the state, some Florida localities are looking to the federal government for support. Government officials in Broward County, a Miami-Dade County neighbor and member of the 4-County Compact, have cited support from federal agencies under the leadership of President Barack Obama as key to making progress.<sup>135</sup>

In October 2014, Miami-Dade County hosted a regional climate change summit with White House representation during which Mayor Gimenez called for greater climate change action.<sup>136</sup> While neighboring counties and the federal government may help draw the attention of Miami-Dade's leadership to climate issues, community leaders in the county feel that, aside from a few meetings and reports, there has been little tangible action in Miami-Dade to protect the economy, livelihoods and public health in South Florida. As Lewis puts it, "We are impatient with their patience."<sup>137</sup>

# Policy recommendations

The costs and consequences of unchecked climate change in Miami-Dade are simply too high to ignore, particularly in low-income areas. To build a more resilient and equitable Miami-Dade, county residents and city and county officials must take the following steps.

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## Prioritize climate change resilience and mitigation

Miami-Dade officials need to make climate change resilience and mitigation a top priority, particularly given growing flood and extreme weather risks to residents and the economy. By implementing existing County recommendations from the GreenPrint, the Sea Level Rise Task Force, and the four-county Southeast Florida Regional Climate Compact, among others, Miami-Dade and its municipalities can make serious gains. Many of the standing recommendations, such as improving public transportation options; upgrading energy efficiency; and increasing access to renewable energy in the County, have dual climate mitigation and resilience benefits.

The federal government can support county climate action by ensuring that federal grants and other programs support low-carbon and climate-resilient infrastructure, ecosystems, and community development.

Additionally, the Miami-Dade Mayor's Office and Board of Commissioners should support efforts to make resilience an interdisciplinary practice involving planners and policymakers from all county offices, and embed climate change risk management strategies into county planning and policies. Resilience should also be made a priority in county and municipal government engagement with the business community. County leaders should go a step beyond the current resolution that requires all infrastructure projects to consider sea level rise and storm surge by requiring that all county programs and decisionmaking take into account the threat of climate change.



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## Improve public knowledge of climate change risks

County officials and community advocacy groups must improve awareness among residents of their climate change risks. According to Caroline Lewis, people are eager to take action and build resilient communities once they learn how climate change affects daily life.<sup>138</sup> The more Miami-Dade residents know about climate change risks, the more they will be empowered to make personal changes and demand action from county and municipal leaders. The county should make translating education and outreach materials for low English proficiency communities a high priority.

The federal government can help by improving access to up-to-date science and other information on local climate change risks.

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## Create a public climate change forum

The county mayor should create an official forum for public engagement on climate change to ensure that the diverse needs of Miami-Dade residents are considered in climate resilience and mitigation planning efforts. Climate change threatens all Miami-Dade residents, and they deserve an opportunity to voice their concerns and ideas for strengthening equitable resilience to county officials. This forum could follow the format of county budget hearings, which are open to all residents, or a special roundtable could be created of government officials in partnership with leaders appointed from the county's diverse communities and advocacy groups.

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## Map social and climate vulnerability

County policymakers cannot change what is not measured. To reduce vulnerability and increase resilience across low-income communities, Miami-Dade should use its cross-departmental data and collaborate with local research institutions to create a social and climate vulnerability index. The index could help climate resilience planners and emergency response managers target solutions and formulate budgets to address threats including storm surge, sea level rise, and heat islands. These data would also help emergency preparedness planners understand where and how to focus resources. Once climate and economically vulnerable communities are identified, county and local government leaders should seek to

build trust with leaders within these areas. These leaders could help facilitate a dialogue to increase community understanding of climate change threats and resilience strategies, identify unique needs within low-income areas, strengthen existing vulnerability mapping, and coordinate preparedness efforts.

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### Strengthen social cohesion

Low-income communities are often best supported by their own community networks during emergencies. One such example is Peacemakers Family Service Center, which was started by community leaders at Miami Garden's Trinity Church.<sup>139</sup> Peacemakers works with the Miami-Dade Office of Emergency Management to help the community at large understand potential extreme weather threats and support actions to prepare.<sup>140</sup> One of their programs is the Adopt-A-Senior initiative, which helps senior residents prepare for and cope with the potential impacts of hurricane season.<sup>141</sup> Peacemakers also organizes its own volunteer-lead Certified Emergency Response Team to help provide emergency management training to community leaders, including a recent group of 30 chaplains from the Miami area.<sup>142</sup> These efforts build on existing social networks, and will help ensure that Trinity Church's membership and the wider community know what to do in the event of catastrophe.<sup>143</sup> The Miami-Dade government can launch similar initiatives with other faith, language, and community groups throughout the county to help people prepare for climate change impacts; know where to get help and resources; and build climate resilient communities.

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### Leverage community organization strengths

Community organizations can leverage existing relationships, trust, and local knowledge to quickly identify low-income community vulnerabilities and communicate with residents. During past extreme weather events in other U.S. urban areas, these organizations have responded quickly to support community members, prevent people from being displaced from their homes, and complement and fill other gaps in government recovery and resilience efforts.<sup>144</sup> Moreover, some poverty-focused community organizations, like Catalyst Miami, view climate resilience as an opportunity to build economically resilient and vibrant communities in Miami-Dade from the ground up.<sup>145</sup> Recognizing and supporting the role that community organizations play in meeting the county's resilience goals will enhance inclusion and equity. County and municipal governments should help strengthen the ability of these organizations to assist their communities before and after extreme weather events through grants, training, and collaboration.

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## Plan for storm displacement before it happens

To minimize people's displacement, government resilience plans should be developed before extreme weather strikes, not after. While extreme weather preparedness and evacuation planning is touted as a priority in Florida and Miami-Dade County, the experiences of other U.S. urban areas including New York City and New Orleans point to the need for better planning everywhere. During Hurricanes Sandy and Katrina, government leaders were developing rebuilding and anti-displacement programs as the crises unfolded, leading to hardships, confusion, unnecessary red tape and negative press.<sup>146</sup> Some residents are still displaced.<sup>147</sup> Miami-Dade County should consider emergency preparedness and displacement prevention programs similar to those adopted by New York and New Jersey after Sandy—which were among the first in the nation to incorporate climate change data—and learn from and improve upon their missteps.<sup>148</sup>

# Conclusion

There are few places in the United States that are more vulnerable to climate change than Miami-Dade County. Meeting the challenges of sea level rise and more extreme heat and storms may seem daunting, but county leaders have many tools at their disposal to make Miami-Dade a global model for climate change resilience. Evidence in the form of flooding, heat waves, and heavy rainfall— together with volumes of scientific research on climate change risks—make clear that Miami-Dade must immediately move beyond promise to action.

County leaders and residents must build the political willpower to strengthen, fund, and implement the county’s existing resilience plans. The county must work with the business community to strengthen their commitments to climate resilience to help safeguard jobs and wages. County officials also should work more closely with community advocates to expand and strengthen public outreach to improve understanding of climate change risks and resilience, as well as the mitigation strategies that can save lives. In order to thrive in the 21st century, county leaders must accelerate efforts to build a climate resilient, low-carbon and equitable Miami-Dade community.

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