The Future of the Built Environment in Florida

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Introduction: Florida's Special Characteristics and Climate Challenges

The state of Florida has a unique history and collection of offerings for the country that give it special challenges in the era of climate change and a global pandemic; as such, it also must approach these challenges in unique ways. These special characteristics range from the location and topography of the land itself, to its culture and ways it survives economically, to the culture of its government. Solutions to impending climate catastrophes must be handled in such a way that involves responsible communication, scientific and engineering research, and a focus on the survival of future generations. No population should be excluded from this communication and focus, especially lower-income and frontline communities who will see the greatest amount of impact from climate change.

Florida has a history that impacts the climate challenges it deals with today. At the same time that the population started booming in the state, developers wanted to prepare the land to accommodate those new people. 150 years ago, Florida at the time was composed of wetlands, which those developers saw unfit for settling and promoting agriculture (Bloetscher et al., 2017). In response, they decided to create a series of canals, dikes, and pump stations to solve this "water problem." They even diverted the flow of water away from the Everglades in order to direct it to agriculture and cities (United States Environmental Protection Agency [USEPA], 2016). State leaders quickly saw the issues with these past decisions when they realized that a pattern of drought occurs in the state every 6-8 years, and that the state usually endures dry winters. Today, Florida has major concerns regarding water supply for its citizens.

Florida's location and topography also poses special climate change concerns. Due to the land's low position, the state sees a major threat of sea level rise with global warming. Adding to that water control issue is the area's susceptibility to hurricanes, tropical storms, and rain, causing a threat of flooding not only in coastal areas but inland as well. All of this unwanted water actually adds to the aforementioned potable water shortage, due to saturated land and collection challenges. For context, the entire state is enduring a combination of all of the threats

listed, but because of how these threats are distributed throughout the state, the Atlantic coastal area should be focused primarily on flooding, the South on sea level rise, and the North and West on water supply (Bloetscher, 2017).

Florida's government has been concerningly unhelpful with these issues, because anthropogenic climate change goes unacknowledged by a large number of high-ranking officials. Unfortunately, the COVID-19 pandemic has been yet another issue that these officials have failed to deal with effectively, and the combination of climate threats and high infection rates have been detrimental to the state's overall health, as well as its economic prosperity as of late.

The other challenges going hand-in-hand with climate and the pandemic have to do with specifically how Florida makes its revenue. Because of its placement surrounded by water, it is a hub for international commerce. Also due to its Gulf of Mexico and Atlantic ocean access, plus its temperate weather during winter months, the state is a hub for tourism. Florida boasts multiple tourist attractions, including Walt Disney World, Universal Studios, Miami beach, the Florida Keys, and the Everglades, among other nature-related draws. This nature is not only beautiful and great for a vacation, but fertile. The parts of the state that are not for tourism are strong agricultural hubs. All of these strengths that help Florida thrive are in danger economically due to climate change and the above listed threats. This paper will discuss suggestions on how the state might approach and mitigate those threats.

Likely Impacts of Climate Change and Suggested Approaches

Sea Level Rise

Rising sea levels are a threat for coastal Floridians, especially those on the Southeastern coast and near Tampa Bay. The ocean water has the potential to raise the salinity levels of more inland freshwater aquifers, such as the Biscayne aquifer, on which residents rely for potable

water use. In Hallandale Beach, Florida, the city had to cease usage of six out of eight of its wells due to high salinity. Wildlife is also in danger, as some ecosystems—such as those in the Everglades—cannot tolerate salt water and will perish, such as cypress swamps (USEPA, 2016).

Properties close to the shore are in danger, as well. The people who live on the coast are either wealthy and own vacation property which they might use only seasonally, or low-income community members facing persistent flooding. People seeking property along the coast have understandably been asking questions about how flood-resistant the property is, and the transparency of those who rely on those properties for profit is shaky. Roads and infrastructure are in danger, and need to be raised. See Figure 1 for a visual of how sea level rise might affect roads.

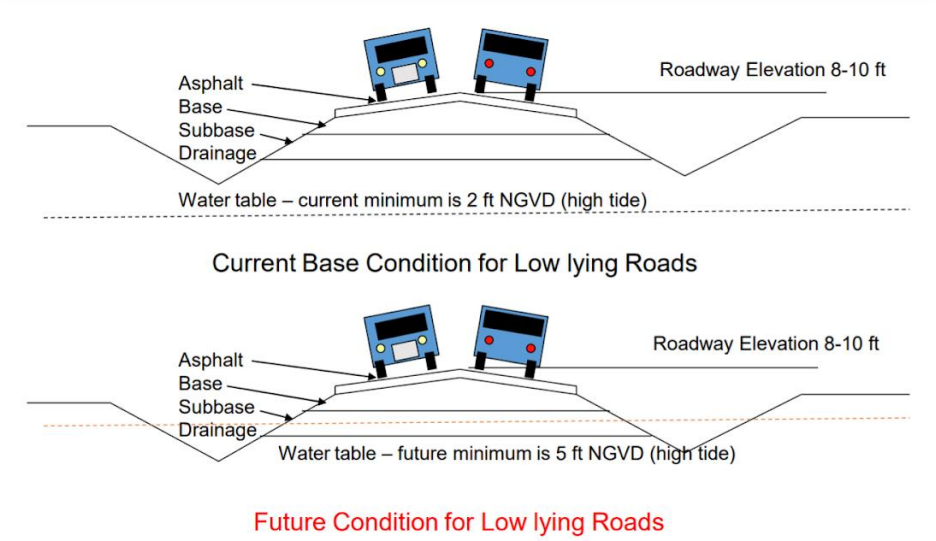

Figure 1. Diagram of Future Condition for Low Lying Roads (Bloetscher, 2017)

Approach: Preparatory Infrastructure for Flooding

The only way to properly prepare for sea level rise is to invest in infrastructure that can withstand the flooding. This includes raising infrastructure higher above sea level. Miami Beach

has been taking the right steps by updating their building codes to actually require buildings, roads, and sea walls to be taller (Bolstad, 2016). These codes will be helping future projects, but they will be less effective on already constructed structures.

Approach: Education for Property Owners

Hurricane disasters have caused insurance companies to leave the Florida coastline, because the properties there are under too much risk. However, the Florida government, in an effort to protect themselves economically, responded by offering its own insurance policies to buyers. The government essentially decided to ignore the risk of climate catastrophes on these properties to keep people from leaving and to keep the influx of new owners. Actually, even after hurricane Andrew's devastation in 1992, "more than five million people have moved to Florida's shorelines, driving a historic boom in building and real estate" (Lustgarten, 2020).

The state of Florida is taking on a tremendous financial risk by insuring these properties. Erika Bolstad from *Scientific American* magazine reports that "by 2050, an estimated $15 billion to $36 billion of Florida's coastal property will be threatened by sea-level rise" (2016). Not only are these properties an economic hazard, but a physical hazard.

The more just approach to sea level rise and catastrophe on the coast is to do effective land assessments and to fortify these properties to be structurally higher and more resistant. One example of a positive response is the company Coastal Risk Consulting, who are doing just that. The founders are not just only after business profits, but they care about the well-being of these property owners (Bolstad, 2016).

Approach: Place Focus on Low Income Communities

Coastal communities are also in many areas filled with low-income residents who suffer from several flooding events a year, but cannot afford to vacate. To help this at-risk population, the government should allocate funds to buy out these homes, and use the land as floodplain, as it was originally intended (Bolstad, 2016).

Flooding, Hurricanes, and Tropical Storms

The East side of Florida is prone to tropical storms and hurricanes, which are especially unpredictable due to the effects of warming ocean water and air. The West coast of Florida is also at risk, but weather conditions in the West area often are able to let the storms die down before hitting land. Still, historically, the entire state has seen large disasters due to strong hurricanes. Rain is also a concern. According to the EPA, “Since 1958, the amount of precipitation during heavy rainstorms has increased by 27 percent in the Southeast” (2016).

Approach: Preparatory Infrastructure

According to CNBC, hurricane-resistant homes should have structures that extend deep into the ground, but do not extend far above the ground. The news source reports that fortifying these structures can be of manageable cost, and “the biggest driver of those costs is in impact-resistant windows and doors, shutter systems and upgrades to any other openings that expose a home to the elements” (Olick, 2019). The state of Florida should look at allocating budget to applying these impact-resistant features to as many at-risk homes as possible.

Rising Temperatures

Climate change is making Florida, a state that was already seeing high temperatures, become dangerously hot—much like many other parts of the country. According to the Environmental Protection Agency, the Florida peninsula has warmed by more than one degree Fahrenheit in

the last 100 years (2016). In addition, there has been a greater amount of dangerously hot days: see Figure 2.

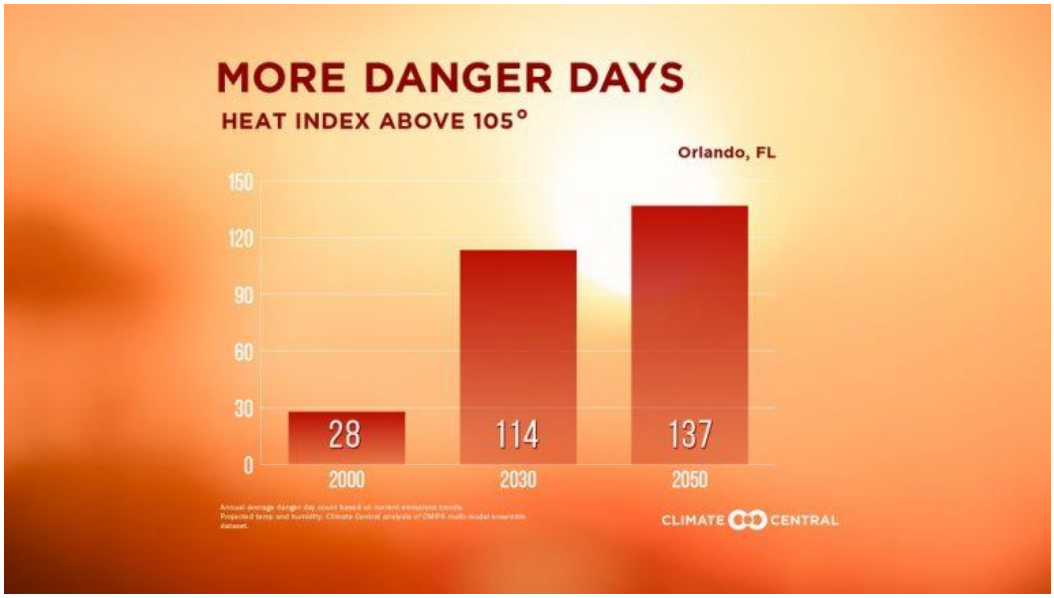

Figure 2. Number of Days the Heat Index will Surpass 105 Degrees Fahrenheit by 2030 and 2050 in Orlando, Florida (The CLEO Institute, 2021b)

Ocean warming and acidity has also been a concern with rising temperatures. In the past 300 years, ocean acidity has increased by 25 percent, and it has the potential to increase by an additional 40 to 50 percent by 2100. This is causing coral bleaching, which is directly affecting Florida's ocean habitats, tourism draws, and fisheries (USEPA, 2016).

The effect on the natural environment and the economy goes past ocean warming, as rising temperatures destroy crops. Namely, the warming climate has been adversely affecting the growth of corn, sugar, peanuts, and cotton (USEPA, 2016).

Approach: Reduce Energy

According to the Center for American Progress, Florida "is the fourth-largest energy consuming state in the United States and third-largest emitter of greenhouse gas emissions" (Majumder,

2021). These numbers are disappointing. Florida needs to develop incentives for energy reduction, and give businesses help in achieving energy reduction goals. They must begin with low-hanging fruit, such as placing timers on lighting and heating and cooling. They can then look to larger projects, such as electric vehicle infrastructure and incentives.

Approach: Reduce Heat Islands

The general layout of Florida as a whole is very spread-out. A large amount of land is used for parking lots, most of which are non-permeable. The abundance of roads and interstates as well as gated communities in the state has made it almost impossible for most of the population to access basic everyday needs without owning a vehicle. This requirement has led to a tremendous amount of vehicles in the state, calling for a large amount of parking. The state of Florida should work to bring commerce closer together, allowing residents access to basic needs within walking or biking distance. This move can reduce the need for parking and increase the availability of taller parking garages as an option, lessening the footprint of dark pavement causing heat island effect in the state. In places where this cannot happen yet, Florida should implement more permeable surfaces, such as grass parking lots with metal and stone to protect against erosion.

Water Shortages

The State of Florida is suffering from water shortages, due to a number of reasons. Florida residents get their potable water from one of five different sources depending on location: the Biscayne aquifer, the Floridan aquifer system, a series of small sand aquifers, limited surface water entities, and the sea. They have varying challenges: the Biscayne has the potential to be contaminated by salt from rising sea levels, the surface bodies in the North and West of the

state will be refilling slowly due to drought, and the Floridan is not being effectively recharged (Bloetscher, 2017).

Approach: Water Body Clean-Up Programs

In the 1980s, the Save Our Rivers program and the Surface Water Management and Improvement Act of 1987 were created to help protect and save Florida's essential bays, lakes, rivers, and estuaries (Bloetscher et al., 2017). More of these water-care projects and programs need to be implemented to protect these bodies.

Approach: Proactive Spending

Much expense could be avoided if legislators considered the prosperity of future generations of the state in their decisions, especially regarding water storage. Government officials have understandably been avoiding large costs, but investments now will lessen the need for very expensive damage control later. Therefore, as soon as possible, the state of Florida should invest in desalinization for the Biscayne aquifer and the recovery of the Floridan aquifer system. They should also invest in the reuse of non-potable water from municipalities for irrigation, through improved and added irrigation infrastructure. The Center for American Progress offers helpful data, reporting that "For every $1 invested in building resilient communities and infrastructure, $6 is saved in future climate change induced costs, including from economic disruptions, property damage, public health crises, and deaths caused by extreme weather disasters" (Majumder, 2021). This amount of saving should be a great incentive for officials.

Approach: Water Collection

The state does not have much land available for surface storage, but they have started a project called the C51 Reservoir in Palm Beach County (Bloetscher, 2017). More land should be allocated to this cause.

Societal Concerns

Population Growth and Pollution

The Florida Red Tide is an effect where ocean waters appear red due to large amounts of algal blooms, caused largely in part due to coastal population growth. Fertilizers, pesticides, and other pollutants enter the water, feeding the algae, which produces toxins that are then released into the water and atmosphere. The toxins, called brevetoxins, have the power to cause respiratory, gastrointestinal, or neurological illnesses in humans, and cause paralysis and death to fish and other sea life. The education surrounding these toxic blooms is suppressed in Florida, because increasing public knowledge of it decreases visitors to beaches, jeopardizing the tourism industry (Hoagland et al., 2020).

Approach: Smart Technology

Figure 3 displays an example of a proposed app that could educate locals and visitors on the Florida coast of red tide conditions and how safe they are certain days in certain areas. Instead of hiding this knowledge, the knowledge should be updated continuously by trusted scientists and reported on media such as this app. Smart technology such as this form of education can create more transparency and communication between concerned scientists and the public, and can help prevent illness.

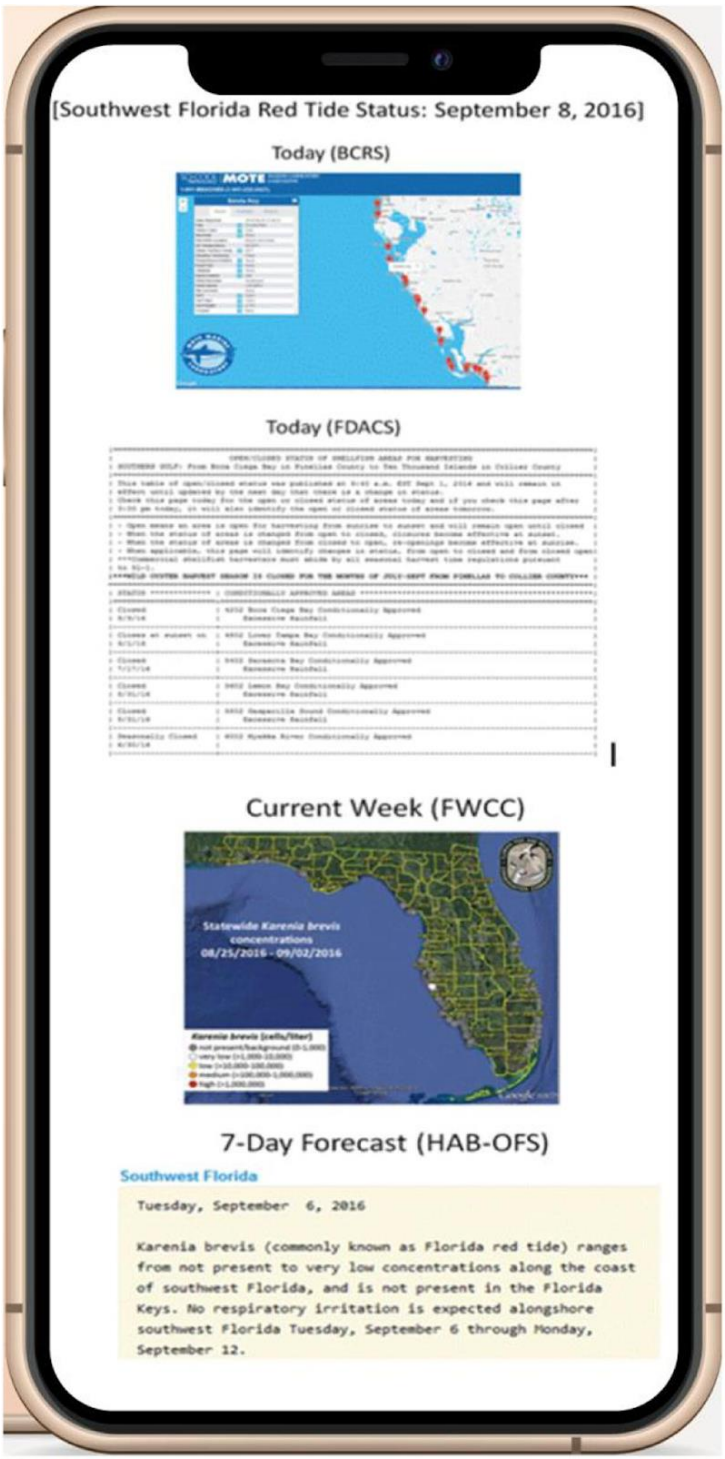

Figure 3. Red Tide Informational App Proposed Interface (Hoagland et al. 2020)

COVID-19

The recent pandemic has posed a unique challenge to the state of Florida, because it has a large effect on Florida's income from tourism. This fact by itself has been detrimental to communities, and cities are using any funds they have for relief. Even today, the state is seeing high infection rates and low vaccination rates (Majumder, 2021).

Approach: Government Regulations

The government of Florida, in order to protect its citizens, must impose mandates and regulations aimed at protecting its public and its economy. Legislators must recognize, if only for financial reasons, that requiring masks in indoor places reduced infection rates. They must recognize that vaccination success is high, and the faster they can lower their infection rates in the state, the faster they can recover their lost revenue from low tourism numbers.

Government and Inequality

Lack of Governmental Support and Concern

The governor of Florida, Ron DeSantis, has done very little to mitigate climate change. Actually, initiatives he has enacted in support of the environment have failed to explicitly mention the threat of climate change, or acknowledge anthropogenic climate change. Shortly after his election, DeSantis introduced the Resilient Florida Initiative, which aims to direct funds to public works projects which address sea level rise, weather disasters, and flooding. The funds he and the Initiative team have allocated are trivial: $1 billion over the course of four years. The board allocating these funds has no representation from the fields of science nor engineering, nor representation from local municipalities. There is no mention of a greater impact of extreme weather and flooding on frontline and low- income communities (Majumder, 2021).

The Role of the Community in Decision Making

Approach: Florida Future Fund

The Center for American Progress and the Climate Leadership Engagement Opportunities (CLEO) Institute have proposed a plan which would involve a variety of individuals in the community to create a board, which would fund climate change mitigation projects. The plan is called the Florida Future Fund. The board would include members from banks or the investment sector to weigh in on how to secure ongoing funds, members of frontline communities to advocate for their needs, experts on climate change, and clean energy and transportation experts (Majumder, 2021). This board would be a more effective team than top-ranking officials in the state of Florida, who do not prioritize climate change as an issue at all.

Approach: Surveys and Projects

CLEO has put together a project that has been instrumental in helping residents feel seen by their local governments. The project is called “Hyper-Localism: Transforming the Paradigm for Climate Adaptation,” and it is an online series of workshops which bring together residents and members of their local governments in order for their voices to be heard. According to the CLEO Institute, in the workshops, “Residents use photography and storytelling to document issues such as flooding, inadequate street lighting, a lack of crosswalks, or the absence of trees and sheltered bus stops to protect against heat” (2016a). More municipalities in Florida should implement programs such as this one, as local governments cannot properly allocate funds unless they know what their residents need most urgently. Developing this kind of trust leads to future and ongoing collaboration between the two parties.

Approach: Bring Communities Closer Together

The existence of a large number of gated communities in suburban areas in Florida is leading to a disconnect between residents, and a perpetuation of income inequality. These communities are attractive to residents who want a place to live that is elite and removed from busy happenings. However, they have the effects of blocking residents from interaction with the rest f their communities. Instead, residents are able to ignore residents out of their tax bracket, and "retreat from civic responsibility" (Goodyear, 2013). In order to unify communities together against causes about which they are passionate, Florida must build its homes closer to each other.

The Role of Local Business Leaders

Local business leaders have the power to make decisions for their firms which effect climate change in several ways. To be a responsible business, they must prioritize transparency and sustainability. They must realize that long term investments will lead to larger returns, including returns in the form of stakeholder support. In order to make responsible long-term investments, business leaders will prioritize the development of sustainable supply chains which take into consideration the life cycle of a product from beginning to end. They will also champion a built environment which reduces energy and water use, from the implementation of low-flushing toilets to LED lighting and efficient HVAC. For businesses in Florida specifically, buildings will need to reduce heat in order to save energy. Building a sustainable firm will take into consideration the placement of windows to minimize direct sunlight.

Health of Workers

The health of different kinds of workers throughout Florida is a concern with climate change. Because of Florida's reliance on tourism and agriculture for main sources of revenue, the state

relies on low income workers for much of its economy. These workers, however, are being disproportionately affected by climate change and COVID-19. Workers at amusement parks and other tourist attractions are seeing higher rates of infection as the state opens these places too early for financial reasons. Figure 4 illustrates the levels of COVID-19 for mid-2020. Notice how the areas of highest infections are on the coastline, where both tourism attractions and low income communities are located, and in the state's inland tourist areas where Disney World, Universal Studios, and Busch Gardens are located.

Agricultural workers are seeing the effects of the dramatic heat, oftentimes considered dangerous for working conditions. Indeed, "In the 10 Florida counties with the largest populations of agricultural and construction workers, temperatures became dangerous for heavy labor on 92 to 97 percent of summer days" (The CLEO Institute, 2021b).

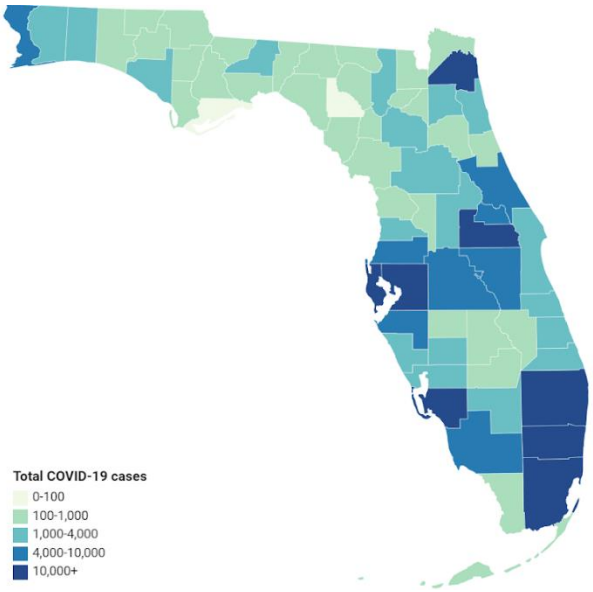

Figure 4. COVID-19 Cases Per County (The Conversation U.S., 2020)

Approach: Improve Transportation

Residents of low income communities have to travel in order to reach places of economic prosperity where they may obtain better wages. Building connections to city hubs in the form of sustainable public transportation allows residents from these communities opportunities they may not have otherwise, while decreasing emissions from vehicles. Specifically, Florida needs to build more transportation connections in the form of affordable electric buses, rail lines, and safe bike paths. Bike paths and lanes will not only allow for a less expensive option of transit, but they will promote health and wellness through exercise.

In addition to the existence of these forms of transportation, the bus stops and bike trails need to be protected from the severe heat. In order to do this, Florida must place trails and lanes in the shade of trees, plant more trees where they are needed, and create shaded bus stops. These bus stops should have solar-powered lighting and legible signage, for energy efficiency and ease of use.

Approach: Special Programs to Assist Low-Income Residents

Low income communities are always the first to be impacted by the effects of climate change, although they have the smallest role in causing it. As temperatures rise, residents of Florida will have to use more energy to keep cool. As lower income communities are affected more by carbon emissions due to redlining, which then leads to higher temperatures, they will need to spend a disproportionate amount of additional money on cooling. State and local governments should develop energy-saving programs to lessen this financial burden on families who cannot afford it, while helping lower overall emissions (Majumder et al., 2021).

The Future and LEED Certification

In order for all of the above mentioned strong suggestions for the improvement of Florida's built environment to be put in place, there need to be knowledgeable people able to carry out the suggestions responsibly. Scientists and engineers will be involved to weigh in, and also architects. The built environment has an incredible impact on the health of any group of people. In Florida, residents are especially in danger.

The educated people who can come to the rescue and carry out these plans can very well come from the group of individuals in the country with LEED certifications. These individuals will be well-versed in how to reduce energy and build strong buildings, which will create less waste. These buildings will have green space, and will take into consideration the surrounding land and water. LEED certified people can be the heroes who build homes that do not add to the risk of climate disasters that Florida is currently facing. Florida needs these people more than ever.

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