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Treading Water

Florida's bill is coming due, as the costs of climate change add up around the globe. Adaptations will buy time, but can they save Miami?

By Laura Parker

Frank Behrens, a gregarious pitchman for a Dutch development company that sees profit, not loss, in climate change, cuts the engine on our 22-foot Hurricane runabout. We drift through brackish water toward the middle of privately owned Maule Lake in North Miami Beach.

It's not quite paradise.

The lake, like so many others in Florida, began as a rock quarry. In the years since, it has served as a venue for boat races, a swimming hole for manatees, and a set for the 1960s TV show *Flipper*. More recently, as if to underscore the impermanence of South Florida's geography, more than one developer has toyed with partially filling in the lake to build condos. Behrens is promoting a floating village with 29 private, artificial islands, each with a sleek, four-bedroom villa, a sandy beach, a pool, palm trees, and a dock long enough to accommodate an 80-foot yacht. The price: $12.5 million apiece.

Dutch Docklands, Behrens's firm, has optioned the lake and is marketing the islands as a rich man's antidote to climate change. As for the risks from rising sea levels, well, that's the beauty of floating homes. The islands would be anchored to the lake bottom with a telescoping tether similar to those that enable floating oil rigs to ride out the roughest hurricanes.

The floating-village plan is part of a frenetic building boom, fueled by wealthy South Americans and Europeans buying with cash, that is transforming Miami's skyline. From our boat we can see construction cranes cluttering the sky along the barrier island of Sunny Isles, where crème de la crème luxury is the hot trend. In a real estate market that celebrates opulence—the $560 million Porsche Design Tower features glass-walled car elevators that stop at every apartment—it was probably inevitable that the greatest threat to South Florida's existence would be used as a promotional strategy.

The Dutch project sounds like one more loopy development in a long history of loopy Florida developments. But its climate-conscious design sets it apart from most of the surrounding high-rises, which are going up with little consideration for the rising seas projected to frequently flood South Florida in the coming decades and to submerge much of it by the end of the century.

These contradictory approaches—plunge ahead, even if only for one more mortgage cycle, or look ahead, preparing for what's coming—reflect a turning point in the discussion about climate change. As warnings about global warming become more dire and the consequences increasingly evident, more and more businesses, and local officials, are factoring climate change into their decisions about the future. They're focused less on reducing the carbon emissions that are warming the planet—that's for political leaders—and more on adapting to severe weather and flooding, which is already occurring as seas rise. And in towns like Miami, where real estate development is an economic engine, businesses are focused on how to keep that growth growing for as long as they can.

Behrens, who spent his boyhood in Aruba, moved to Miami a decade ago. He signed on with Dutch Docklands in 2013, after it became clear that the region's civic leaders were awakening to the depth of their impending disaster.

The firm's visionaries in Delft foster no illusion that their floating village could save South Florida. It's only one innovative water project among many in the Dutch tool kit that has preserved the low-lying Netherlands since the Middle Ages. Still, Behrens says, the project's value as a high-end venture appeals to

investors in a region that will have to be reimagined in the coming decades. And if the floating village succeeds, a range of other possibilities opens up: floating communities with floating parks and floating schools. A floating hospital. “You name it,” says the man whose company built a floating prison outside Amsterdam.

“People only see the negative effects of flooding,” Behrens says, without a trace of irony. “We need to show people there is a way to make money out of this. For the government, there are tax dollars. For developers, their investment is secured for the next 50 years. There is a lot of money involved in this climate change. It will be a whole new industry.”

Florida is a good place to see the costs—and potential profits—of climate change emerging into sharper view. Many coastal places are at risk, but Florida is one of the most vulnerable. While government leaders around the world, in Washington, and even in Florida’s statehouse in Tallahassee dither over climate change, here on Florida's southern tip more than a few civic leaders are preparing. Florida's future will be defined by a noisy, contentious public debate over taxes, zoning, public works projects, and property rights—a debate forced by rising waters.

Along with rising seas, Florida will be battered in the coming decades by extreme weather—dry-season drought and rainy-season deluges—the U.S. government's National Climate Assessment predicts. Heat and drought threaten an agricultural industry that supplies the East Coast with winter vegetables, and they could undermine the three mainstays of Florida farming—tomatoes, sugarcane, and citrus. The rainy season will be stormier, with fiercer hurricanes and higher storm surges.

The most profound disruption will occur along the state's 1,350 miles of coastline. Three-quarters of Florida's 18 million people live in coastal counties, which generate four-fifths of the economy. Coastal development, including buildings, roads, and bridges, was valued in 2010 at two trillion dollars. Already more than half the state's 825 miles of sandy beaches are eroding.

Four southern counties—Monroe, Miami-Dade, Broward, and Palm Beach—are home to about one-third of Florida's population, and about 2.4 million people live less than four feet above the high-tide line. The streets of Fort Lauderdale, Hollywood, and Miami Beach often flood during the occasional “king tides,” which are much higher than normal high tides.

The oceans could rise two feet by 2060, according to the National Climate Assessment, as their waters warm and expand and as the Greenland and polar ice sheets melt. By 2100 seas could rise as much as 6.6 feet. That would put much of Miami-Dade underwater. For every foot the seas rise, the shoreline would move inland 500 to 2,000 feet.

A two-foot rise would be enough to strand the Miami-Dade County sewage-treatment plant on Virginia Key and the nuclear power plant at Turkey Point, both on Biscayne Bay.

“At two feet they will be sitting out in the ocean,” says Hal Wanless, chairman of the University of Miami's geology department. “Most of the barrier islands will be uninhabitable. The airport is going to have problems at four feet. We will not be able to keep freshwater above ocean levels, so we're going to have saltwater intrusion into our drinking-water supply. Everyone wants a nice happy ending. But that's not reality. We're in for it. We have really done a job warming our ocean, and it's going to pay us back.”

Wanless, who is 72, didn't think he'd witness the serious effects of climate change in his lifetime. For three decades he was a lonely voice warning that the warming ocean could inundate South Florida. In the 1980s he documented that barnacles were attaching themselves higher on bridge piers in Coral Gables, where he lives, than they were in the 1940s. In recent years he analyzed the shrinking glaciers in Greenland and concluded that the main scientific modeling used to calculate sea-level rise hadn't fully accounted for accelerating ice melt. Last year the United Nations' Intergovernmental Panel on Climate Change gave greater weight to ice-sheet melt in its calculations, raising its projections for sea-level rise.

Florida's long, low coastline may make it more vulnerable, but no region is immune. In 2012, flooding, wildfires, drought, and storms around the country caused more than $110 billion in damages, the second costliest year in U.S. history. In a foreshadowing of severe weather to come globally, Typhoon Haiyan spiraled across Southeast Asia in 2013 and struck the Philippines, killing 6,200 people. That year also saw crop-destroying droughts on nearly every continent, most notably in Africa and South Asia. The Brazilian Highlands, the center of South America’s monsoon region, experienced the worst drought since 1979, prompting water rationing. Rapid glacial melting in the Andes and Himalaya will exacerbate water shortages in Peru, India, and Nepal.

The coming decades, the World Bank predicts, will see political instability, food shortages, and famine, leading to the displacement of millions of people. South Asia's and Southeast Asia's heavily populated coasts, particularly those in Bangladesh and Vietnam, could be inundated. Worse, rising seas could invade major river deltas, poisoning them with salt water and destroying some of the world's richest agricultural land. The Mekong River Delta in Vietnam, where 17 million people live and half the country's rice supply is grown, is already battling saltwater intrusion.

In South Florida civic leaders have begun to map out their future on their own. Little help has come from the state legislature, which is controlled by Republicans, many of whom remain skeptical of climate science. Rick Scott, the Republican governor, has mostly avoided the subject, repeatedly declaring, "I'm not a scientist." Last summer, after five of Florida's top climate scientists, including Wanless, briefed Scott, he thanked them and said nothing else.

The four southern counties have drafted a general to-do list that would "reengineer" the region, step-by-step, through 2060. A detailed blueprint will be years in the making. But the approach is largely familiar.

"We will do what we always have done," says Joe Fleming, a Miami land-use attorney. "We will dredge and prop everything up."

Harvey Ruvin, a former county commissioner who headed a sea-level-rise task force for Miami-Dade County, lays out the thinking so far: "The whole idea is to do this comprehensive capital plan that would include all kinds of things—desalination plants, the lifting of roads, where to raise land, where to create canals. Part of the future has to be raising some land at the expense of other land."

Ruvin knows what he's up against. Procrastination. Disputes over property rights. Long battles over changing zoning and building codes to prohibit building in areas that can't be protected. And he doesn't want to talk about the cost of all that reengineering. "I can't even give you a real number. Maybe $50 billion?" Ruvin muses, though he knows that's low. He's focused on how to pay for long-term projects in a place that operates on capturing short-term gains. "How do you take this to the voters for a bond issue when the county commissioners are afraid to increase property taxes a hair to fund libraries?"

Now the Miami-Dade County Court clerk, Ruvin, at 77, is one of the region's most skillful politicians. He has tried to use the consequences of doing nothing on climate change to prod footdraggers. It's the same strategy used by Michael Bloomberg, a former mayor of New York City, and Henry Paulson, a former U.S. Treasury secretary; in 2014 they assembled financial heavyweights to catalog the cost of inaction on climate change in every region of the country.

Last year Ruvin invited two executives from Swiss Re, the global reinsurance giant, to brief his task force about Florida's precarious future. The hard-nosed number crunchers created a predictive model that showed the region could expect annual losses from storm-related events to reach $33 billion by 2030, up from $17 billion in 2008. They also said those losses could be reduced by 40 percent if the region acted soon to protect vulnerable real estate. "These kinds of issues cannot just be left for another 10, 20, or 30 years' time," says Mark Way, a sustainability specialist for Swiss Re.

Another factor, Way says, is that subsidized government insurance programs in Florida have skewed the marketplace, leading to underpriced rates that don't reflect the actual risks. "That has the net effect of basically encouraging development directly or indirectly in areas that otherwise don't make any sense."

Already civic leaders are fortifying seawalls and installing pumps. Later come more daunting projects: moving utilities from the coasts and protecting high-value real estate—universities, hospitals, airports, and tourist areas that drive Florida's economy. Their watchwords are "protect," "accommodate," and "retreat," which sound a lot like a civil engineer's version of the stages of grief. But the group is an optimistic one.

"It doesn't do any good to set your hair on fire for something that's 70 years out," says Kristin Jacobs, a former Broward County commissioner and member of President Barack Obama's climate change task force who was elected to the Florida legislature last fall.

She puts her faith in technology. "If you look at settlement across the planet since time began, we evolve to what we need," she says. "Other countries, like Holland, have figured out a way to be resilient. We are looking to be resilient."

The Dutch have been trawling for business in coastal cities from Jakarta to San Francisco. They established a beachhead in South Florida several years ago when Behrens founded a Dutch chamber of commerce in Miami.

In the Netherlands, where two-thirds of the population lives at or below sea level, about 450 companies make water their business, accounting for about 4

percent of the economy. That's on a par with the auto industry in the United States.

Piet Dircke, whose firm, Arcadis, helped New Orleans design new levees after Hurricane Katrina, made his fourth trip from Holland to Miami last summer to participate in a workshop with architects and engineers. Dircke and representatives of four other Dutch firms drew beautiful sketches showing adaptive designs for vulnerable areas.

“Our delta is one of the best places to invest your money,” he says. “Rotterdam is a showcase for the world for being an adaptive city. Singapore, Copenhagen, Stockholm—these are all cities that emphasize their water identity and make it a sales objective. Miami could become a water city.”

It will take technology not yet imagined to overcome the challenges posed by South Florida’s unusual geology: the limestone bedrock that is both a blessing and a curse. Mined, limestone provides fill to build roads and create what constitutes high ground. In its natural state, it's a porous sponge. Water runs through it. It can't be plugged. Seawalls can be raised—as the city of Miami Beach has ordered. But seawalls, no matter how high, can't stop water that bubbles up from beneath.

Even the Dutch would have difficulty protecting the narrow, seven-mile barrier island that is Miami Beach, a top tourist destination.

“Welcome to ground zero of ground zero,” says Bruce Mowry, the city engineer, when I meet him at the corner of 20th Street and Purdy Avenue, one of the lowest points in Miami Beach. He’s basking in the afterglow of success: $100 million and 20 new pumps kept the city mostly dry during the October king tide. A year earlier a kayaker had paddled along Purdy—not exactly the kind of image that attracts tourists.

The new pumps are part of a $300 million overhaul of the city's antiquated storm drainage system. With 80 new pumps, Mowry hopes to buy Miami Beach another two or three decades. By then, according to the Union of Concerned Scientists, the city could face 237 floods a year.

“Miami Beach will never not exist,” he says. “But it will exist in a different way. We may have floating residential areas. We could have elevated roads built up on pilings. We could convert a transportation corridor to water. People ask me, ‘Bruce, can this be done?’ I say, ‘It can be done, but can you afford it?’ ”

The city has begun an experiment in elevating roads and sidewalks, starting with Purdy Avenue, where a building with a café, liquor store, and dress shop flooded badly in 2013. The sidewalk and street will be raised by two feet, which should keep water from sloshing into the shops. Two feet won’t solve the problem. But with funding and community support uncertain, city officials decided to start small. “Two feet buys the life of this building,” Mowry says. “You can’t come in and make radical changes.”

If Miami has a future as one of the world's water cities, it probably will look more like the Florida Keys than Stockholm. And so I make the trip down the Overseas Highway to Key West, past houses on stilts, marine-equipment shops, and pine trees dying from saltwater poisoning. Golf courses in the Keys are now planted with salt-tolerant grass.

The islands are the exposed remnants of an ancient coral reef. Most are less than five feet above sea level. Reefs can protect coastal regions from storm surges. If healthy, reefs can keep up with sea-level rise, growing higher as the ocean rises. But much of the reef off Florida died in the late 1970s from disease.

“When you dive on the reef today, it's an absolute boneyard of dead coral,” says Chris Langdon, a University of Miami oceanographer. Warmer, more acidic oceans are keeping the reef from recovering. Langdon is working to identify a coral that can tolerate those conditions.

“One way to think of their economic value is to imagine if this job went to the Army Corps, and they had to build a seawall 150 miles long, and every few years they had to build it a little higher,” he says. “The reefs do that for free.”

The highway, also known as U.S. 1, strings together the island chain with 42 bridges. The population in the Keys is limited to the number of people who can be evacuated by vehicle within 24 hours, ahead of approaching hurricanes.

Chris Bergh of the Nature Conservancy joins me at Big Pine Key. He arrived in the Keys from Pennsylvania as a toddler in the back of his parents’ 1973 Volkswagen bus and has no plans to move. “I've got a six-year-old,” he says. “I expect I'll live out my days here, and he will not. At some point an economist is

going to say, 'Look, it's going to cost one billion dollars to redo U.S. 1, and that's only going to buy us 20 more years.' The question is, What will it cost us to buy time so we can keep on keeping on?"

The end of the line is Key West, closer to Havana than to Miami. At City Hall we meet up with Don Craig, a planner who's worked for the city for more than two decades. The city has spent millions in recent years to add pumps, construct a fire station at a higher elevation, and rebuild portions of the seawall that nearly encircles the island. But options are limited.

Raising elevations on any large scale is out of reach. "We do not have a nearby source of fill material," he says. "We're 118 miles from the major rock quarries."

When Craig tells people that the Keys' lifeline, the highway, will lie underwater someday, it elicits four responses. "Some become fearful," he says. "Some say, 'Well, I'll be dead, so I don't care.' Others say, 'There is not a consensus that this is going to happen, so why are you telling us this?' The other reaction is mute silence."

Craig's own response: migrate.

He knows something about that. "My parents were Okies," he says. During the Dust Bowl years they lost the family farm in Oklahoma and moved to California, where Craig was born. Some 2.5 million people left the Great Plains in the 1930s to escape the largest man-made environmental catastrophe in American history to date.

There's something surreal about the pace of construction in a region that may be inundated by 2100. On an early morning flight over northwest Broward County, I watch a dredge scooping up fill to form finger peninsulas on a man-made lake in a housing tract being built against the Everglades. On a boat ride up the Miami River in downtown Miami, I pass a 1.25-acre parcel right on the river's edge that sold for $125 million last spring—a record price here. Nearby, the one-billion-dollar Brickell City Centre, under construction on nine acres, is so enormous it has a cement plant on-site. Across town a $600 million convention center with an 1,800-room hotel is planned.

The biggest economic challenge posed by climate change in South Florida may be one that business leaders are loath to discuss—that fear of this slow-speed crisis could stall development.

"It's almost like, 'Shhhh. Don't talk about it,' and so it's not real," says Richard Grasso, an environmental law professor at Fort Lauderdale's Nova Southeastern University.

But privately, quietly, conversations are under way. Last fall executives from the region's big banks, insurers, and development companies convened an invitation-only roundtable in Miami with Lloyd's of London. One insurance executive told the group that homeowners in some vulnerable areas already pay premiums that are higher than their mortgage payments.

"There was concern that rising insurance rates are not sustainable and people may be left with no recourse but to leave Miami or go uninsured, which is not an option for those with mortgages," says Kerri Barsh, a Miami land-use attorney who represents Dutch Docklands. "If insurance costs continue to spiral upward, they could have a negative cascading effect on the South Florida economy and beyond."

Unaffordable insurance could trigger an economic calamity that would make the 2008 housing-market collapse here seem like an inconvenience. If homeowners couldn't get insurance, bankers would stop lending, which would create a shortage of cash, which would cause property values to decline and the region's economy to tank.

One way to keep the building boom going is for civic leaders to not look too far into the future. Thus the four southern counties' focus on 2060 instead of 2100. There's a certain logic to that. The average life span of most buildings is 50 years, and Miami, a mere 119 years old, is continuously rebuilding itself.

"They don't want to look beyond two feet of sea-level rise. This was a deliberate thing not to be too scary," Wanless says. "So there's going to be a lot of throwing money in the ocean before we realize it's time to move on."

Phil Stoddard, in his third term as mayor of South Miami, is one of the few politicians willing to talk about when that time might come. He met me at his house, a one-story stucco bungalow with stone floors (Flood Prep 101), solar panels on the roof, and a large pond that takes up most of the backyard, where he and his wife swim with Lola the koi and an eight-year-old bass named Ackwards.

“I tell people to buy high, sell low,” he says drily, pausing to allow the joke to sink in.

Stoddard, also a biology professor at Florida International University in Miami, came up with his own scenario, doodled during a long, dull meeting about climate change that dwelled on sea oats, a native grass whose roots hold dunes in place. “I said to myself, We're looking at something majorly disastrous here—and we're talking about sea oats?” he recalls.

He drew a graph with three lines that show population, property values, and sea level all rising. Then abruptly, population growth and property values plummet.

“Something is going to upset the applecart,” he says. “A hurricane, a flood, another foot of sea rise, the loss of freshwater. People are going to stop coming here and bail.”

He thinks a real estate sell-off is inevitable. Before that happens, he wants his constituents to be informed. “People ask me this question, ‘I'm X years old. I have X amount of net worth in my house. What should I do?’ I say, ‘If you need the value of that house to retire or to live on, then you want to cash out at some point. It doesn't have to be this year. But don't wait 20 years.’ ”

Not long ago Stoddard attended a meeting where Wanless presented his analysis showing that the accelerating disintegration of the ice sheets will lead to a more rapid rise of sea levels—faster and higher than the federal government's projections. That night, as Stoddard and his teenage daughter walked on moonlit Miami Beach, he shared what he'd heard.

“She went silent, and then said to me, ‘I won't be living here, will I?’ And I said, ‘No, you won't.’ Kids get it. Do you think we should tell their parents?”

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