

Miami's Sea Level Rise and How the King Tide is Outing America's Political and Economic Jokers

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Abstract

This manuscript examines and critically stresses the signs of a looming climate event as sea level rise threatens to drown coastal communities nationwide. Specifically, a detailed focus on risk vulnerability in Miami is investigated in this manuscript. Several causal factors are identified and discussed in depth: the recurring celestial phenomenon known as "King Tide", the natural tidal influence of the cycles of the moon, and the oft debated topic of climate change. A correlation between climate change and human activity is analysed. Past and present governmental responses to sea level rise at local, state, and federal levels and scrutinized. The most flagrantly reckless deniers of sea level risk vulnerability are identified as politicians, real estate developers and investors. Parallels will be drawn between previous market bubbles and our currently surging real estate market. Responsible action is called for as the below following questions are posed: How will sea level rise affect coastal communities as internally displaced persons are forced to seek higher ground? How can the climate event, "King Tide", give rise to politically supported, forward-thinking measures? Are powerful political interests aimed at sinking policy which addresses climate concerns? This manuscript asserts that should looming environmental warnings go unchecked and should those vested parties sidestep the implementation of bold policy moves, the "King Tide's" glimpse into the future can be written: sea level rise will worsen with the absence of human intervention and coastal communities will mimic a mythical past, relegating Miami to suffer a fate similar to the 'Lost City of Atlantis'.

Keywords: Miami; Sea Level Rise; Coastal Zone Management; and Development

Introduction

Travel to the New World by European settlers offered an opportunity to start anew as America was a blank canvas, ready for communities to be drawn up as these pioneers saw fit. Early communities sprouted up along coastal shores and, over time, those communities all took root as economically vibrant and densely populated communities. Early attractors making these sites appealing often centered on their unique location. Abundant sources of seafood, accessible routes for travel and trade, and fertile agricultural lands for farming all factored into making coastal zones lucrative development sites.

Today, counties situated on coastal zones across the United States account for 10 percent of America's total land mass (excluding Alaska); yet, a staggering 39 percent of our nation's population reside within these shoreline counties [1]. All too often, the diametrically opposed push-pull relationship between real estate development and the natural environment becomes apparent, invariably resulting in disasters. Residents in vulnerable, low-lying areas, such as Miami, must weigh risks of sea level rise through climate events such as the October 27th, 2015 King Tide, choosing either to combat rising sea levels or prolong the fate of internally displaced persons. Partisan political pushes at the state level mustn't impede local governments and municipalities from enacting responsive, regional solutions to combat future sea level rise and climate events like King Tide.

Miami: The King Tide and Governor Rick Scott

Nestled on South Florida's Atlantic coast, Miami has blossomed into the international hub to the Americas. From an early port of call for Juan Ponce de Leon to the Magic City, a destination for fleeing Cuban refugees in the mid to late twentieth century, Miami has always captivated international appeal. Much of Miami's appeal has always centered on sunny beaches, warm weather, and a picturesque waterfront skyline. Could that very appeal lead to Miami's Achilles' heel being exposed?

On October 27th, 2015, the celestial event 'King Tide' washed ashore South Florida, sparking conversation and concern about sea level rise. From Fort Lauderdale to the Florida Keys, King Tide flooding extended inland, submerging roads, isolating homes from the 'mainland,' and generating an undisputed awareness for the climate change induced sea level rise. This King Tide caught immediate media attention as reporter's broadcasted footage of fish swimming in the streets [2,3]. Concerns began fermenting like bacteria in sitting water, while policymakers at the federal, state, and local levels were pressed for swirling responses to King Tide flooding. More contrasts than comparisons have been drawn across these three arenas. At the federal level, under President Barack Obama, climate concerns have been hot-button issues. Federal regulations were tightened under President Obama with respect to carbon emissions. The Environmental Protection Agency has led a charge to educate the public on the dangers of continuing down our current (pun intended) path. The EPA, in agreement with the National Oceanic and Atmospheric Administration, contends that today's King Tides are tomorrow's normal tidal activity. "As time goes by, the water level reached now during a king tide will be the water level reached at high tide on an average day," the EPA forewarns on the agency's website. Preceding the October 2015 King Tide, there occurred a supermoon fueled King Tide on September 27th and 28th, which, as if planned, coincided with an international forum aimed towards raising awareness on the effects of climate change hosted in Downtown Miami [4]. The

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forum was led by former Vice President Al Gore, the screenwriter and starring lecturer of 'An Inconvenient Truth,' the 2006 documentary campaigning for global warming education. The following month, on November 30th, 2015, President Obama attended the two-week long United Nations Climate Change Conference in Paris, France [5]. The conference resulted in negotiating the Paris Agreement, a binding global agreement to reduce seemingly accelerated climate change. Though the stage was more appropriate to spark widespread national and international conversation following the September 2015 King Tide, the author argues that a political tipping point was captured in the wake of October 2015's King Tide as media outlets broadcast clips of fish swimming in the streets of Miami. Actors at the federal level when examining these effects of climate change have maintained that a commitment to a policy shoring up the coastline is needed.

Much of the international community has banded together to further this notion. Though, where awareness has progressed at the federal level, much of the push for policy change has been impeded at the state level in Florida after Governor Crist left office. In 2011, a newly elected Governor Scott unabashedly ushered in a new era of climate change denial. How did a progressive and responsive state swiftly pull out all the stops and adopt an ostrich-approach by simply burying its head in the sands of denial? Well, Scott was elected in 2011, ran on a platform of job creation, reducing the size of government, and cutting taxes [6]. Six months into office, Scott was whisked off to a private retreat hosted by billionaire brothers and public-policy-crafting-sugar-daddies David and Charles Koch [7]. The Koch brothers finance political campaigns that champion conservative ideals in league with their personal interests. Each with an estimated net-worth of \$41 billion by Forbes, David and Charles both own 42 percent stakes in Koch Industries, a company historically rooted in fossil fuels [8]. These policy-pimps, the Koch Brothers, have sifted at least \$79 million to climate change deniers since 1997, an influential allocation of personal wealth, suggesting a vested economic interest in the ignominious denial of climate change [9]. Since 2011, Rick Scott has been a stalwart suppresser of state-wide efforts to combat rising sea levels secondary to climate change through legislative or educational pushes. Even as King Tides continue to draw attention towards South Florida's submerged cities, the actors at the state level routinely double-down on denial. Florida's Republican Governor, Rick Scott, when pressed by questions regarding man/woman's effect on sea level rise, prefers to remind anyone within earshot that he is "not a scientist," while systematically reshaping the state's environmental agencies [10]. In a statement issued by a departmental spokesperson and in a move in line with the Scott administration's direction, the Florida Department of Environmental Protection professed that the department won't be "pursuing any programs or projects regarding climate change," seemingly reducing the state Department of Environmental Protection to environmental eunuchs [11].

As governor of Florida, Rick Scott's tenure has been marred by an uncomfortably warm climate of disbelief towards his blithe disregard towards climate change, so much so that even the very terms "climate change" and "global warming" have been stricken from state workers acceptable terms for use [12]. In channelling Orwellian "Newspeak," Florida's governor has attempted to craft the environmentally responsive community's inherent vernacular.

Early (Parochial) Public Policy: The Church and Earth's Evolving Relationship with the Moon

Since the beginning of time, man and woman have looked upward,

into the heavens, and been fascinated with the moon. Whether early man fully understood the relationship and associated the impact our moon has on the earth or not is largely debatable. Early mythology showed a fascination with the lunar cycle's three day period of darkness, postulating that an angered monster or god had either stolen the moon or consumed it, only to later release the moon or regurgitate it [13]. The earliest evidence of (Cro-Magnon) man/woman not only grasping the significance of lunar cycles but also in documenting such understandings was marked with the 1940 discovery of symbolic cave paintings dating back some 15,000 years near Dorgone, France. These primitive Paleolithic paintings depict the moon shifting through its different monthly phases [14]. As early man/woman progressed from mythological stories to help make sense of the moon to documenting the scientific observations of lunar cycles to the perceived heresy of Galileo Galilei and Copernican theory, man/woman showed not only a budding grasp of earth's relationship with our moon but that a newly created void between policy makers of the day and these freethinkers was on the horizon.

Copernican heliocentrism broke from nearly 2000 years of geocentric belief that proposed a stationary Earth as the centre of the universe. Geocentrism was supported by Aristotle and, more importantly, Church doctrine. Galileo, a devout Catholic, found himself in quite the quagmire as the Church Inquisition consultant mandated in 1616 that Galileo not "hold, teach, or defend in any manner" the theory of heliocentrism [15]. Galileo argued that his findings, such as an imperfect sun mottled by sunspots and moons monogamously encircling Jupiter, were not contrary to Biblical passages as the scripture's earthbound vantage point could not account for sciences systematic methodology which was bound by evidence.

The Catholic Church, the leading policy maker of the time period, took swift action to address Galileo's statements governing the gap between their widely accepted and rarely questioned dogmatic principles and his evidentiary based scientific truths. Galileo was subjected to live out his remaining years under house arrest; though, even in this pre-Internet era, his works were published, and his scientific truths began trending, much to the chagrin of the Church. Galileo's greatest crime was that he dared to look up, past the heavens, and into the stars.

Who Declared that Tide 'King?'

In a universe that is seemingly infinite, Earth is merely a pale blue dot in a sea of vastness. We are bound to our G-2 main sequence star, enslaved by her magnetosphere. The Romans called her Sol; to the Greeks she was Helios; she is our Sun. Assigned to the third inside lane, we plod along our trek with our most devoted companion, our moon. Though it appears that the powerless moon is simply lured along on our journey, the moon wields exceptional influence here on earth: she is the master of our tides.

On a planet blanketed by water covering some 71 percent of Earth's surface, our moon's gravitational pull drags water towards her as she revolves on her counter clockwise orbit, virtually on the same plane as the Earth and the Sun [16]. The water being drawn towards the moon causes the tide to rise towards her, peaking with a high tide. Three to four times a year, either during full moon or new moon lunar phases, our earth, moon, and Sun all become aligned coinciding with the perigee of the moon, the point at which the moon is closest to the Earth. It is during this specific celestial event that a high tide reaches new heights.

During a full moon, the perigean spring tide pulls the moon

slightly closer to Earth, giving rise to a more appropriate moniker, the supermoon. As the celestial phenomenon of supermoon summons her high tide, already bolstered up by an added gravitational pull of the Sun, signal is given for a tide fit for a king. This 'King Tide' has the greatest effect on coastal communities as he produces the greatest tidal movement of the year. Certain areas may only observe a minor sea level rise. Coastal communities positioned in low-lying areas are inherently most vulnerable to even a marginal rise in sea level. Whereas King Tide threatens periodic 'nuisance flooding' in vulnerable areas, there is also a springboard effect if sea level rise is compounded by barometric pressure changes coupled with strong onshore winds of an approaching storm. The most recent occurrence of such fortuitous conditions was marked by superstorm sandy in America's north-eastern coastal towns. The presence of a supermoon served as an 'alley-oop' of sorts for a maelstrom of crushing waves to reclaim the natural environment from developed land. Whereas risk vulnerability is greatest in communities where man/woman has chosen to develop land previously reserved for the natural environment, arguably no greater vulnerability to rising sea levels exists than in Miami, Florida.

Miami's Final Real Estate Bubble: Real Estate Investment, Sea Level Rise, and the Great Depression

Miami is no stranger to real estate bubbles. The Florida land boom of the 1920s kicked off Miami's torrid love affair with investor-seducing market booms and the crippling divorce of market busts [17]. The post-World War II era of the 1950s and 1960s conjures images of Miami Beach's golden age: Joe DiMaggio, Humphrey Bogart, Frank Sinatra, and the Fontainebleau Hotel [18].

Though, it was arguably the 1980s that solidified Miami's swagger with iconic television shows like "Miami Vice." The new millennium ushered in a gilded age of economic prosperity for Miamians. In the latter part of the decade, a systemic housing bust sent shockwaves across America, nearly crippling Miami as one of the harder hit housing markets. As families struggled to financially stay afloat, many homes drowned in mortgage debt and were financially 'underwater.' The following decade (2010s) began with real estate turning the tide towards recovery and escaping a nearly subterranean trough; the skies were cleared for an unprecedented crest and a renewed recklessness of "tidal" wave of investment.

To highlight Miami's real estate vulnerability impacted by sea level rise, several studies were considered. A study conducted by CBRE (CBRE), the world's largest commercial real estate firm known for its measures of real estate investment in major global cities. CBRE highlights Miami as a hotbed for investment. CBRE subsequently ranked Miami in the top 10 of global cities for real estate investment with \$7.7 billion in foreign and domestic real estate capital investment in the first half of 2015. Almost \$1 billion of that \$7.7 billion investment is derived from international interests, such as Latin America and China. Chicago based National Association of Realtors cites international buyers as purchasing over \$10 billion of South Florida property since 2008 [19]. Additionally, Miami is presently navigating a luxury-condo market boom as well. More than 15,000 new condominiums are coming to market with a staggering ninety percent being purchased by foreign interests [20]. The London-based consulting firm Knight Frank LLP conducts annual Global Wealth Reports which ranked Miami No. 6 amongst 'cities that matter' to high net-worth investors in 2015 [21]. Reuters conducted a 2015 detailed analysis of coastal communities, estimating the value of property situated within 660 feet of the U.S. coast at \$1.4 trillion. Miami-Dade County boasts \$94 billion worth

of coastal property, itself [22]. Real Estate exposure to sea level rise in Florida extends beyond simply owner-incurred losses. Under the umbrella of the Federal Emergency Management Agency, the National Flood Insurance Program (NFIP) offers flood insurance, often at below-market rates. As much of Florida's urban coastal areas are vulnerable to storm surge and sea level rise resulting from the natural environment attempting to reclaim developed land, flood insurance spreads Florida's risk over a nationwide pool to minimize exposure to loss. Essentially, American taxpayers are on the hook for risk in Florida. How much potential risk exists in Florida? According to the NFIP, Florida carries \$484 billion of the \$1.2 trillion-dollar bubble [23]. At what point must developers look at the natural environment and take nature's hints before developing areas vulnerable to specific environmental risks? Miami faces several interrelated risk factors which augment sea level rise. Many established communities within Miami-Dade County are situated on basin-like, low-lying land. South Florida, itself, is built upon limestone, a porous rock substructure. Additionally, just below the surface rests the Biscayne Aquifer, one of our main sources of drinking water (Figure 1). As sea level rise predictably causes tomorrow's high tide to resemble today's King Tide, the increased sea level will seep into the Biscayne Aquifer. Aside from contaminating our drinking water, which in and of itself is highly concerning, as sea levels seep into the aquifer, water levels will rise, navigating through the porous limestone, and likely settling in low-lying basins.

The acceleration of sea level rise makes a correlation with a changing climate by way of human activity almost irrefutable. The World Resources Institute reported the global average annual sea level rise between 1993 and 2010 was almost double the mean rate experienced during 1901-2010. The World Resources Institute also concedes that Florida's coastline could experience an estimated sea level rise of an additional nine to twenty-four inches by 2060, placing coastal assets in vulnerable positions [24].

Bearish selloffs in asset classes often begin once the music has already stopped. By then, it is too late. Concerns over sea level rise and real estate values in Miami can be quelled through a minor divestment from coastal zones vulnerable to risk. Presently, the real estate market in Miami is booming, with prices at all-time highs. Investors are buying properties in Miami not because the asset class warrants the prices, but because it's perceived that properties will simply be sold at higher future prices to someone else, a greater fool. Home values in Miami are no longer being propped up by demand; values are now figuratively on stilts, and a drastic decline in pricing will occur once the first major financial institution prudently decides that they will no longer offer 30 year notes, as they cannot guarantee an asset collateralized against the loan. In this scenario, the oft predictable sea level rise matching today's King Tide will cause a flooding of uncertainty over real estate deemed coastally vulnerable. Such an event is not too dissimilar from the financial climate surrounding America's Great Depression.

Historians and academics alike have argued the precipitating events leading to our Great Depression. Although a stock market crash and crippling unemployment, amongst other factors, both compounded the effects of financial depression, it is arguably a drying up of liquidity, stemming from bank failures that initiated the Great Depression. Just as the scenario where one major lender is no longer writing 30 year notes will lead to a massive devaluation in the asset class, a parallel event kick-started a massive run on the banks: the failure of the Bank of the United States.

The Bank of the United States was a regional New York bank which endured the Wall Street Crash of 1929. It is rumoured that a

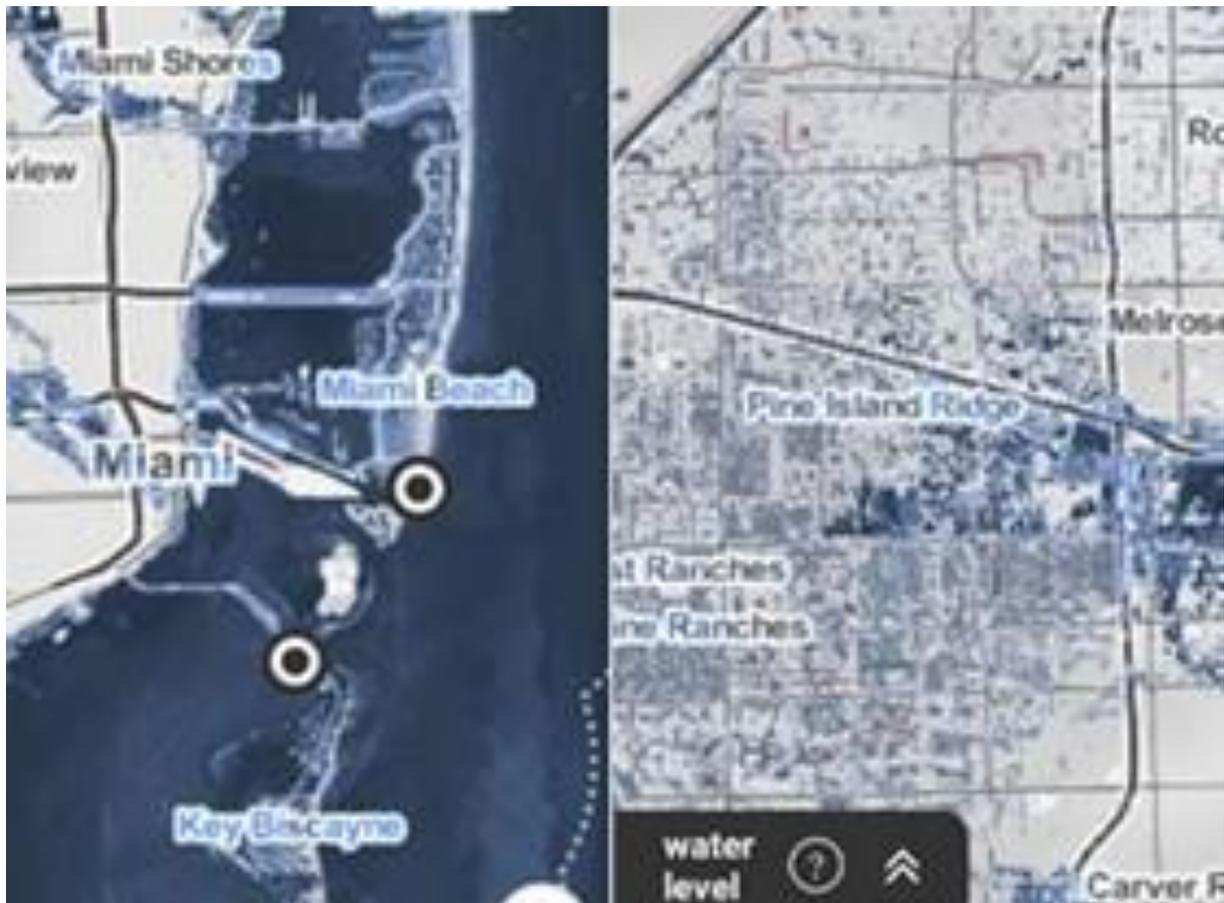


Figure 1: Interactive maps of Miami and Ft. Lauderdale depicting a 5' rise in sea level maps and interactive modelling. Source: <http://sealevel.climatecentral.org>.

local merchant entered the bank's Bronx branch on December 10, 1930 and asked to redeem his shares in the bank. History can speculate his interaction with the bank's manager, but as rumour spread that the bank refused to redeem his shares, a crowd began to gather. By midday, thousands had gathered to withdraw money, prompting closure of the branch [25]. As the already shaky consumer confidence in banking institutions dwindled, many banks, almost encouraged by the lax deposit requirements of the day, faced liquidity struggles. By 1933, of the nation's 25,000 banks, 11,000 suffered the fate of failure [26]. That rumour and subsequent mob produced a financial flashpoint leading to drying up of liquidity and widespread institutional failures, all sparked by the precipitating event outside of the regional Bank of the United States.

Public Policy and Political Pushes in Florida: An Ex-Post Perspective

Governor Rick Scott's policies took an almost-immediate about-faced approach from his predecessor, Governor Charlie Crist. Under Governor Crist, Florida was positioning itself rather progressively in both combating and curtailing risk associated with sea level rise. During Governor Crist's first year in office he assembled a national climate change summit in Miami. Governor Crist also initiated the Governor's Action Team on Energy and Climate Change, and in leaning on research collected by the state's universities made recommendations on tackling climate change [27]. An alliance of moderate Republicans

alarmed by climate change began to form. Crist recalled that back then, Republicans in the (state) House and Senate, while not really enthusiastic, well, it didn't really bother them. So, it wasn't that heavy a lift initially [28].

Even at federal levels, climate change was receiving bipartisan acknowledgement. In 2008, former Republican Speaker of the House Newt Gingrich took up arms with Democrat Nancy Pelosi to record a public service announcement addressing climate change, a move of which Gingrich would come to regret politically [29]. This awareness and bipartisan support led to the U.S. House of Representatives passing a climate change bill. This same legislative push, however, likely sounded an alarm for Big Oil interests. Electric utilities and oil and gas companies doubled down in their lobbying efforts by shelling out over \$500 million between January 2009 and June 2010 [30]. The deepest spender on lobbying and campaign contributions was ExxonMobil. Conservative think tanks began taking positions that climate change was simply a hoax or at the least not proven to be man-made. Successful lobbying efforts achieved their goal as the Senate failed to introduce a bill on the floor. Even as the House bill received industry support by the Edison Electric Institute and the Nuclear Energy Institute, the Senate measure was struck down by a Big Energy's hired guns. Campaign contributions often take much of the guesswork out of industry and company allegiance by elected officials and hopefuls alike. It should come as no surprise that as Republican support for tackling climate change began wilting in 2010, Big Oil and Big Coal each gave nearly

70 percent of their campaign contributions to Republican candidates, respectively [31,32]. Such optics of Congressional harlotry stops short of demonstrative evidence. Though, those beholden to the “pimps” of fossil fuels further fueled the federal divide on climate change. Even as varying policies at the federal level began to polarize along party lines, the state of Florida forged ahead with ambitious legislation under Charlie Crist. Under Crist, an executive order was signed that moved aggressively at reducing Florida’s greenhouse gas emissions, targeting the year 2015 to roll back emissions to 2000 levels and by 2025 to reach back to 1990 levels [33]. Crist’s task force recommended cap-and-trade “market-based solutions” for reducing greenhouse gases, whereby each company’s emissions are limited and may only be exceeded through the purchasing or trading of marketplace credits. After receiving bicameral support, House Bill 7135 was signed into law in June 2008 by Governor Crist. Florida was solidifying herself under Governor Charlie Crist as a hotbed for climate change’s progressive policymakers. Though, progress was derailed in 2010 as Charlie Crist announced he would not seek reelection, rather opting to run for an open U.S. Senate seat. Businessman Rick Scott, who self-funded his campaign, was subsequently elected governor in 2010, ushering in an era of policy regression and climate denial. The ex-post perspective circles around the dichotomy of policy between the two governors: Charlie Crist and Rick Scott. Charlie Crist believed in shifting gears as he saw Florida as being vulnerable to a changing climate. Charlie Crist was focused on risks associated with rising sea levels. Rick Scott’s climate concerns took shape as undoing and undermining Crist’s progressive policy pushes.

The greenhouse gas executive order was figuratively filed away into the circular filing cabinet. House Bill 7135 was whittled down until complete dilution removed the provisions of cap-and-trade. Charlie Crist, retrospectively, was positioning himself as a champion of environmental sustainability. Rick Scott even vetoed \$750,000 budgeted for Miami Beach’s sea-level rise response plan, citing that the project “does not provide a clear return on investment [34].” Miami Beach Mayor Phillip Levine scoffed at such a notion and countered that the budgetary line item being vetoed would help in preparing coastal cities from rising tides. Mayor Levine, weighing in as to why sea level rise cannot be a partisan issue, continued: “The Ocean is not Republican, and it’s not Democratic. It’s a nonpartisan ocean, and all the ocean is going to do is rise [35]”.

In unrelated news reporting as it relates to environmental concerns and in an unprecedented lawsuit, Rick Scott became the first-ever Florida governor to be successfully sued over a violation of the state’s Sunshine Laws which guarantee public access to public government records. Governor Scott settled his most recent “Government in the Sunshine” laws case by agreeing to pay a \$700,000 fine. Governor Scott allocated tax dollars from four state-wide departments to pay his personal fine. Exhibiting a near-sardonic disregard for perceived malfeasance, Rick Scott incongruously withdrew \$447,000 from the Florida Department of Environmental Protection [36]. Realistic expectations of sustainability and conservation pushes begun under Governor Crist were unmet as soiled political laundry under Rick Scott’s Florida Department of Environmental Protection and wrung out over Floridians.

The King Tide, Sea Level Rise, and Regionalized Local Response: An Ex-Ante View

Some sobering realizations were made in Florida during Rick Scott’s tenure as governor. Combating climate change has, at best,

taken a backseat to other state issues. At worst, partisan politics reared its ugly head into this arena and politicians refused acknowledgement of the dangers attributed to climate inaction. Local government cannot curtail climate change on its own. Though, mitigating and combating sea level rise can be regionally attainable. In 2010, four counties, Miami-Dade, Broward, Palm Beach, and Monroe, formed the Southeast Florida Regional Climate Change Compact [37]. This partnership, which accounts for thirty percent of Florida’s population, is intent on changing the world by affecting the future, or at least, keeping certain areas dry. An experiment and initiative is underway on Miami Beach as the city looks to spend as much as \$500 million to install 80 water pumps and raise roads and seawalls throughout the city. Betsy Wheaton, the assistant building director for environment and sustainability in Miami Beach, concedes “we don’t have a playbook for this [38].” The October 27th, 2015 King Tide drew awareness to tidal risks present on Miami Beach. With staggeringly valuable properties, posh shops, and influential residents, the pervasive threat of rising sea levels is being met head-on. An appropriate consideration of ex-ante perspective questions the future impact of pumps and whether any good or bad consequences must be weighed. In September 2016, as NASA scientists recorded the global concentration of carbon dioxide within the atmosphere as surpassing 400 parts per million at the Mauna Loa Observatory in Hawaii, a long-held portentous milestone, prospects for reversing the tide of sea level rise now seems improbable [39]. Surpassing such a milestone prompted Dr. Erika Podest, a carbon and water cycle research scientist, to ominously implore for action. Dr. Podest contests that “CO₂ concentrations haven’t been this high in millions of years. Even more alarming is the rate of increase in the last five decades and the fact that CO₂ stays in the atmosphere for hundreds or thousands of years. This milestone is a wakeup call that our actions in response to climate change need to match the persistent rise in CO₂. Climate change is a threat to life on Earth and we can no longer afford to be spectators [40]. In the absence of an immediate ceasefire by fossil fuels in their assault on our atmosphere, climate change will continue to increase rising sea levels as glacial melting raises our water table. State-of-the-art water pumps, like the ones on Miami Beach, can mitigate flood vulnerability for areas maintaining political favor by pumping flood water out into Biscayne Bay, but at what environmental costs? In response to a 2014 King Tide event, Miami Beach ran four new pumps as flooding threatened communities. Henry Briceno, a hydrologist from Florida International University, sent a team to Biscayne Bay to collect water samples. Briceno’s collected water samples found that mass flushing increased pollution levels six-fold in certain parts of the Bay as phosphorus, nitrogen, and other agents were funneled into the bay. A common misconception about rising sea levels was highlighted by Briceno, “People think that when they see the city flooded by seawater, it’s from the beach. It’s not [41], as groundwater pushes through soil it mixes with fertilizers, animal fecal waste, and debris, before pumps shuttles this untreated water into the bay. The combination of sea level rise and global warming produces more hospitable conditions for bacteria with many unknown variables for human interaction.

Solutions, Conclusion and Scientific Truths

In addressing climate change deniers, astrophysicist Neil de Grasse Tyson recalls that, “The good thing about science is that it’s true whether or not you believe in it [42]”. Climate change is real. Even if natural cyclical events are credited with global warming, the overwhelming majority of the scientific community agrees that spikes in global warming in recent decades are most likely primarily attributed to human activities. The Intergovernmental Panel on Climate

Change released a macabre memo conceding that “Human influence on the climate system is clear, and recent anthropogenic emissions of greenhouse gases are the highest in history. Recent climate changes have had widespread impacts on human and natural systems. Warming of the climate system is unequivocal, and since the 1950s, many of the observed changes are unprecedented over decades to millennia. The atmosphere and ocean have warmed, the amounts of snow and ice have diminished, and the sea level has risen [43]”.

For residents and property owners of Miami-Dade County, such forewarning and uncertainty is terrifying. Sea level rise seems inevitable as carbon dioxide, the greenhouse gas and principal driver of recent climate change, is already baked into our atmosphere at alarming levels. The chair of a county task force on sea level rise, Harvey Ruvin, recently addressed a room full of real estate agents acknowledging that regional leaders need to start planning and acting now. Ruvin, who also moonlights as Miami-Dade County's clerk of courts, said “We have too much at stake to question whether we should embark upon this adaptation mission. We got \$6 trillion worth of built environment [44]”. President Barack Obama, at times disillusioned by Congress fervor for deadlock on climate issues, has received criticism that more should be done to combat rising sea levels. As a backdrop for his 2015 Earth Day speech, President Obama chose the Florida Everglades and South Florida to call for change. In taking a certain shot at Republican Governor Rick Scott, President Obama said, “Climate change can no longer be denied. It can't be edited out. It can't be omitted from the conversation [45].”

As climate change inaction has turned political, evidenced by Rick Scott post-Koch brothers meeting and driven by campaign contributions from special interests, President Obama hoped to galvanize policymakers into action. He spoke of Republican presidents Teddy Roosevelt, who established the national park system, and Richard Nixon, whose administration established the Environmental Protection Agency and the National Oceanic and Atmospheric Administration and further echoed, “This is not something that historically should be a partisan issue [46]”. Our changing climate cannot continue to foster such an environment of partisan political pugilism. In 2013, the chair of University of Miami's geological sciences department, Harold Wanless, told *National Geographic*, “I cannot envision south eastern Florida having many people at the end of this century. Miami, as we know it today, is doomed. It's not a question of if. It's a question of when [47]”. In that realization it must be recognized that disappearing wealth from investment properties, though most unfortunate, is not as devastating as losing a primary residence to an environmental disaster. Internally displaced persons affected by rising sea levels will be forced to migrate inland. The security provided by elevation and mountain communities will likely send displaced persons heading for the hills. Those unable to unload valuable real estate in coastal zones vulnerable to sea level rise become the ‘greater fools,’ and may be forced to watch nest eggs and accumulated wealth eroded by rising sea levels. Florida's topology undeniably underscores its vulnerability to sea level rise and storm surge. A 2013 *Rolling Stone* article on sea level rise reminds us that a mere three feet of rising waters submerges “more than a third of southern Florida; at six feet, more than half will be gone [48]”.

Consider a forecasted risk potential from surging seas to Miami and Ft. Lauderdale, illustrated in Appendix A. By utilizing an interactive map and measuring vulnerability at 5 feet of sea level rise, these two cities become virtually unrecognizable. Miami's economically vibrant downtown area, Miami Beach's tourist draw, and Key Biscayne's historical charm (once President Nixon's private retreat) are all virtually

wiped off the map. Miami Beach's greatest vulnerability is exhibited on the low-lying western edge, an area dredged up by pioneering developer Carl Fisher and unintended for development by the natural environment. Both cities' international airports would become inoperable as planes would be grounded, respectively. The Port of Miami and Port Everglades, the infrastructures respectively housing the two largest cruise ship ports in the world, are cut off from marshy main lands. Curtailing sea level rise falls under a broader umbrella of reducing or, albeit overly optimistically, reversing the human factors which contribute to climate change. However, such a drawn out process will not safeguard Miami from seeping damages washed up by King Tides of 2016 onward. Beach erosion will continue. Twitter feeds will flood with pictures of sunny-day, settling tides. Safeguarding the built environment will be dependent on pumping rising sea levels away from assets. Right, wrong or indifferent, asset protection of real estate wealth via risk transference will disproportionately shift risk towards communities occupied by those of lower socio-economic demographics. As rising sea water is shuttled away from Miami Beach and deposited into Biscayne Bay, some water could flow through the mouth of the Miami River, causing increased flooding in many historically marginalized neighbourhoods, politically speaking. Even as we fight to save our built environment by pumping water elsewhere, we must contend with effects of saltwater intrusion into the Biscayne Aquifer. The underground basin that supplies one-third of Florida's population with drinking water is at risk. Even as certain coastal communities are salvageable, certain risks must be weighed. When man/woman chooses to develop the natural environment, often times that choice comes at the expense of rewriting nature's land use model. At what point will man/woman heed Mother Nature's response to irresponsible land usage of the natural environment? Are pioneers unwilling to listen? Perhaps we may reflect on Atlantis, an ancient seafaring, colonial power.

Over 2000 years ago, the Greek philosopher Plato told an account of Atlantis, an ancient island superpower, an advanced civilization. Atlantis ruled the Atlantic Ocean, with kings descended from Poseidon himself. As Plato's myth unravels, Atlanteans began extending their empire by conquering and enslaving other civilizations. As the island nation powerful flourished, subjugation of others led to the societal decay of their moral turpitude. After a failed bid to invade Athens, the City of Atlantis, according to the tale, incurred the wrath of the gods. “In a single day and night of misfortune,” the island was plagued by ripping earthquakes and crushing floods which plunged Atlantis into the pit of the sea [49]. Historians speculate as to whether the myth was based on Plato's political theories or whether a real historical disaster had dealt Atlantis a fateful blow.

To view the fate of the Lost City of Atlantis as a political allegory of an ‘advanced’ civilization that attempted to extend its reach beyond its naturally provided boundaries draws many parallels to today's coastal challenges. Though, whereas Atlanteans lacked the mechanical and societal capacities to mitigate against a smiting by the gods, Miami, as she has done throughout her history, can survive, but not in the absence of audacious policy moves and political buy-in at all levels of the populous; the onus is on Miami's local, state, and federal policymakers as well as the inhabitants. Without embracing academically-accepted scientific truths; enacting and adhering to stringent environmental regulations and international agreements; without creating buy-in amongst the business community with public/private sustainability partnerships; ensuring that through responsible resiliency planning that all stakeholders in Miami are considered, including those most vulnerable to sea level rise; and the tempering of the politically divisive denial-rhetoric, which serves only to decrease environmental

consciousness; then Miami's die is already cast. Regional resiliency cannot be categorized as a quixotic project and most certainly not as a fiscally unsound investment. For as Plato reminds us that "both wealth and concord decline as possessions become pursued and honoured and virtue perishes with them as well [50]." Above all, our elected leaders must heed that warning. Miami, as we know her today, depends on it.

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