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'Don't count on living in Miami': a human geographical approach to understanding the ramifications of sea level rise for urban Miami

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'Don't count on living in Miami'[1]: a human geographical approach to understanding the ramifications of sea level rise for urban Miami

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Introduction: Analyzing ramifications of sea level rise

In a recent *New Yorker* piece, Elizabeth Kolbert noted that 'the siege of Miami' by the rising sea levels has recently accelerated[2]. Again, in *Vanity Fair*, David Kamp discussed the various adaptation measures that can help Miami Beach survive the effects of global warming and the resulting rising sea levels[3]. These examples from the popular media highlight the vulnerable position of America's 'Latin Capital'. Both within and outside the United States more and more organizations and institutions agree on the causes of climate change and sea level rise (NASA, n.y.). This fact however does not directly help Miami which has the largest amount of exposed physical assets, such as buildings, transport infrastructure, utility infrastructure and other permanent structures (OECD, 2007), as well as the fourth-largest population vulnerable to sea level rise in the world (Tompkins & DeConcini, 2014). With the vulnerability of the city in mind, it is thus interesting to step away from the discussion what causes the sea levels to rise but instead analyze the ramifications of sea level rise for the urban area of Miami

In our recent research project, conducted in December 2015 and January 2016, the aim was to comprehensively understand the ramifications of sea level rise. We conducted qualitative research in Miami based on the perspectives of several key stakeholders. We also contribute to recently (popular) literatures on the topic (see for example Cox & Cox, 2015; Kamp, 2015; Kolbert, 2015) by

[1] This quote is derived from the interview with Dr. Ulrich Oslender who cited Philip Stoddard, the mayor of South Miami.
[2] http://www.newyorker.com/magazine/2015/12/21/the-siege-of-miami (Accessed February 18th, 2016).
[3] http://www.vanityfair.com/news/2015/11/miami-beach-global-warming (Accessed February 18th, 2016).

not only describing the different perspectives of the various key informants, but also general narratives found when combining these perspectives. This research approach allowed for a critical perspective in contrast to the journalistic lens adopted in most other cases. However, important to note here is that this research project is not based on an extensive literature review or a close examination of all associating government policies. Rather, our findings are derived from a relatively short field visit, which was guided by information gathered during a desk research phase in December 2015. In total, the project included ten days of fieldwork in Miami during which we conducted six semi-structured interviews with academics and government officials and performed participant observation at three events. The combined findings of the interviews and participant observations were used in order to formulate an answer to the following research question:

What are the environmental, political and economic ramifications of sea level rise for the urban area of Miami according to academics and government officials?

The goal of the course at the University of Amsterdam of which this research project was a part of was twofold: On the one hand, the aim was to make sure students get acquainted with conducting fieldwork in a foreign setting and, on the other hand, students were encouraged to become familiar with the interdisciplinarity of the field of human geography. For this reason we made a framework that consists of the same three dimensions of human geography that make up the master program of human geography at the University of Amsterdam to ensure the interdisciplinarity of our research approach. This approach led to the incorporation of environmental, political and economic ramifications of sea level rise in relation to the urban landscape of Miami. Environmental issues include environmental justice and environmental degradation, but also discussions about climate mitigation and adaptation. Political perspectives relate to the consequences of the political climate for the handling of sea level rise issues, as well as the responsibilities of different governmental agencies. The effects of community building and social cohesion are also included here. Lastly, economic consequences refer to the business structure and taxation and insurance systems in Miami. While at first sight these issues all seem quite unrelated, there is one evident issue that binds them together: *space*, and in particular, *urban space*. The spatial aspect allows the human geographer to connect all these elements and derive a comprehensive framework that incorporates the various ramifications of sea level rise for Miami's urban area. The following sections present data obtained during the field research period in Miami, which is supported by a synthetic narrative as well as a conclusion and some policy recommendations.

Data assessment

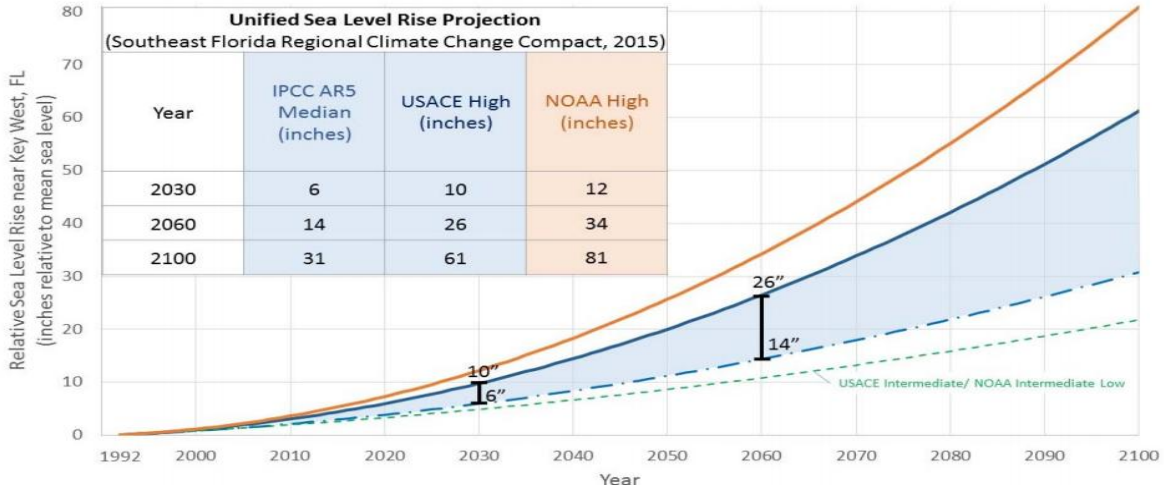
Our key informants agreed that everybody living in Miami, including residents, business owners and politicians, is currently dealing with the ramifications of sea level rise and will encounter those more often and more seriously in the future. According to Dr. Harold Wanless, the trend of sea level rise is two feet by 2048-2066, four feet by 2074-2099, and six feet by 2093-2121 (Interview with Dr. Harold Wanless, 2016). There is discussion between academics about the time at which these exact levels will be reached, but the general consensus is about two feet of sea rise level in the next several decades.

Urban environmental dimension

This dimension consists of the discussion on the projections of sea level rise, the impact and how it should be addressed. Our urban environmental approach is situated in the 'middle ground' between physical and human geography (Demeritt, 2009). Moreover, in this case, environmental geography forms the bridge between the physical impact of nature (sea level rise) and the ramifications for the human geographical components of our research, e.g. urban political and urban economic.

Figure 1 shows the projections of sea level rise from different institutions. Most of the academics we spoke to, especially geologist Dr. Harold Wanless, use the higher projections of two feet by 2060 that are in line with the high projections of NOAA. Whereas many government officials, such as Jim Murley and Isabel Cosio Carballo (Interview with Jim Murley & Isabel Cosio Carballo, 2016) use the much lower projections of two feet by the end of the twenty first century which are in line with the ARS Median projection used by the IPCC in figure 1. The discrepancies in the projections are primarily due to the use of different parameters. The higher projections for example include the 'land-ice uncertainty' parameter (Rahmstorf *et al.,* 2007). Moreover, according to Rahmstorf *et al.* the rate of rise for the past 20 years of the reconstructed sea level is twenty five per cent faster than the rate of rise in any period of the same length in the 115 years before. To strengthen the story of Dr. Harold Wanless, the largest contributions to the rapid rise come from ocean thermal expansion and the melting from non-polar glaciers (Rahmstorf *et al.,* 2007). These processes are accelerating, also with the contribution from the ice melting of Greenland and Antarctica.

Figure 1: Projections of sea level rise



Source: Southeast Florida Regional Climate Change Compact, 2015

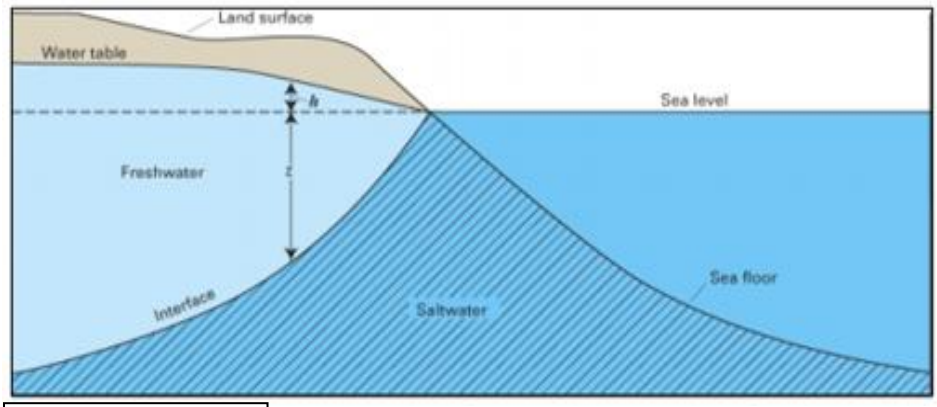
Despite the uncertainties presented in the different projections, a two feet rise of sea level will already have severe ramifications for the urban area of Miami. This argument is supported by the evidence displayed on figure 2, which was provided to us during the interview with Dr. Harold Wanless.

Figure 2: Environmental ramifications of projected sea level rise

Source: Interview with Dr. Harold Wanless, 2016

As seen in figure 2, freshwater resources and sewage plants will be strongly affected in a scenario of two feet sea level rise. A rise of approximately four feet will be destructive for airports and road connectivity. A six feet rise by the end of the twenty first century will lead to a loss of the tax base system and will make it impossible to protect from storm surges. Although some people's homes might be safe for a little longer as they live on higher grounds, a loss of infrastructure, including food and water supply, would be devastating and make southeast Florida unlivable for many residents. Furthermore, sea level rise not only affects the coastal area of Miami but also the lower lying inland areas such as parts of the Everglades. As the sea level is rising, the pressure on the freshwater below the land surface will also increase. This process is visualized in figure 3.

Figure 3: Explanation of sea water intrusion



Source: Bolter, 2014

As illustrated in figure 4, as freshwater pushes the water table upwards in the inland area, it becomes possible for saltwater to reach the surface in the coastal area. Because the urban area is built on porous limestone, water can reach the surface quite easily (such as pointed out by Dr. Ulrich Oslender in his parking garage in figure 4). The implications of higher water levels include tidal flooding, erosion of the beaches, and a higher storm surge that moves further inland (Bolter, 2014).

Figure 4: Salt water intrusion as experienced in Miami Beach

Source: Author's picture, 19 January 2016

How to deal with sea level rise in Miami will likely boil down to how well the city can adapt to the changing environmental situation. Specific strategies are proposed to address key climate change stressors of sea level rise, tropical storms and hurricanes affecting South Florida's natural systems. These strategies include engineering solutions, water conservation, and environmental restoration of the Everglades (Bolter, 2014). In the case of Miami, there is little discussion about focusing on adaptation or mitigation measures. Adaptation measures are concerned with protection such as building sea walls, redesign of structures and relocation of power plants. Moreover, adaptation is specific to agriculture, energy and transports sectors and often target local actors, whereas the benefits of mitigation fall on all sectors and are discussed by national and international decision makers (Tol, 2007). Furthermore, adaptation and mitigation consider different time frames that make direct comparisons difficult (Tol, 2007). Adaptation measures primarily focus on the here and now, while mitigation concerns the future of our planet and future generations.

To return to the discussion about the focus on adaptation or mitigation measures, Dr. Keren Bolter (2016) states the following: "*If I had five million dollars to spend, I would not spend a single dollar on mitigation".* By saying this she acknowledges the importance of taking action now as the ramifications cannot be mitigated or be reversed in the longer term. Water pumps in Miami Beach are helping in the short term, but in the future the entire city's infrastructure should be elevated to adapt to a new situation with higher water levels of a minimum of two feet by 2050.

Urban political dimension

As discussed in the section above, sea level rise will have evident consequences for the entire population of Miami's urban area. People will be directly affected by the rising water levels in the form of both regular flooding, which will damage the built environment thereby disrupting city life, and periodic disasters such as hurricanes. People can also be indirectly affected through relocation of Miami's coastal population to higher grounds, which can lead to displacement of the original population of these higher elevated neighborhoods.

Yet, there seems to be little support base for the issue, such as the absence of grassroots organizations that aim for political influence. The transient nature of Miami's population is one of the possible explanations for this (Nijman, 2011). Many Latin American immigrants use Miami as a gateway to other parts of the US or as a temporary home whilst one's own country is not stable. Moreover, many Americans see South Florida as a location to retire or as a location for a second home (Nijman, 2011). Since there is no stable number of residents, community feeling is hard to develop, which in turn results in the fact that a slowly evolving long term problem such as sea level rise is not high on the priority list. Why should one worry about the future of Miami if he or she will not live there in ten years anyways?

This short-term thinking is exemplary of Miami's governmental ethos as well. Our respondent Ted Gutsche Jr. referred to this problem as being part of the *"Miami tradition"*, by which he means that the people of Miami are rather focused on their own success than on the common interest. Elected officials only seem to look as far as their next electoral campaign, which makes sea level rise an unpopular topic to address. Politicians look at short-term economic prosperity as something that wins votes and therefore tend to focus on matters related to immediate economic development. While sea level rise is hardly a popular topic in public debate anywhere, the issue is most pressing in South Florida, which makes it hard to understand how the issue can be ignored by top down as well as bottom up organizations and institutions.

On the local level, there are some communities that do make an effort to address the issue, such as in the case of the municipalities of Pinecrest, Coral Gables, Miami Beach and South Miami. One example is a plan in Pinecrest to designate so called 'Adaptation Action Areas', which are areas that *"experience coastal flooding due to extreme high tides and storm surge and that are vulnerable to the related impacts of rising sea levels for the purpose of prioritizing funding for infrastructure needs and adaptation planning*" (Village of Pinecrest, 2015: 16). These vulnerable areas were subsequently mapped for a visual risk assessment. Actions that have to be taken regarding these Adaptation Action Areas in Pinecrest *"may include but not be limited to: a. Protection b. Accommodation c. Managed Retreat d. Avoidance (Village of Pinecrest, 2015: 16)*." Pinecrest is preparing for the future and is even considering retreat from the area, which is quite radical. Mayor Cindy Lerner is also viewed as a leading figure in Miami's sea level rise debate (Interview with Dr. Keren Bolter, 2016). Lerner recently flew to New Hampshire to confront Republican presidential candidates on their climate change policy (Valentine, 2016), and was also present during our participant observation at a film screening

organized by the Cleo Institute, which is a NGO concerned with climate change and sea level rise (The Cleo Institute, n.y.)

Another example of action on the local level is the city of South Miami which has made a *"resolution [...] calling for a South Florida Sea Level Rise and Climate Change Congress that will include local, state, and federal elected officials meeting to propose constructive solutions to sea level rise and climate change"* (City of South Miami, 2015: 4). Here, South Miami is making an effort to bring the various scales of government together to come up with a plan that is shared by many decision makers.

Yet some of our respondents argue that the actual adaptation measures taken by these municipalities are not structured enough. Miami Beach has installed water pumps on its streets to pump out water after flooding events, which seems to help in the short run but is ineffective in the long term (Interview with Dr. Harold Wanless, 2016). Furthermore, the aforementioned municipalities are the most affluent in the urban area of Miami, which can result in both selective awareness of the issue and selective participation in the public debate. We therefore find that poor communities with little adaptive capacity should also be informed so that they can plan for the future themselves. Unfortunately, their priorities are likely limited to sustaining their short-term livelihood and are thus may not be interested in a long-term problem such as sea level rise.

The fragmentation of political scales in the United States also plays a role in the lack of response to the changing reality. In the case of Miami, Tallahassee, the state capital of Florida, has a lot of influence on the matter but has showed little support for tackling the issue. Our respondent Isabel Cosio Carballo mentioned that there is a cultural divide between Tallahassee and Miami. The former is culturally more similar to conservative southern US states like Alabama and the Carolinas. This coupled with the fact that Tallahassee is an inland city, means that the state is not supportive of issues related to climate change because they either do not believe in the issue or do not feel the need to address it since it does not directly impact them. Republican governor Rick Scott has even banned language that refers to climate change in state documents (Korten, 2015). The four South-Florida counties of Miami-Dade, Broward, Monroe and Palm Beach on the other hand have joined forces together in the form of the South Florida Regional Climate Change Compact. The Compact however is not something many people know about and lacks decision-making power (Interview with Jim Murley & Isabel Cosio Carballo, 2016 & Keren Bolter, 2016). It works as an advisory collaboration and hopes to attract federal and state funding.

To summarize, even though there are some initiatives and governance structures in place, their reach and support base appears to be very small. Furthermore, most of the work the government is doing seems to be involved with consulting, recommendations and advising tasks instead of actual actions or physical adaptive measures. Examples of this include those in Pinecrest, South Miami and the CLEO Institute has discussed above.

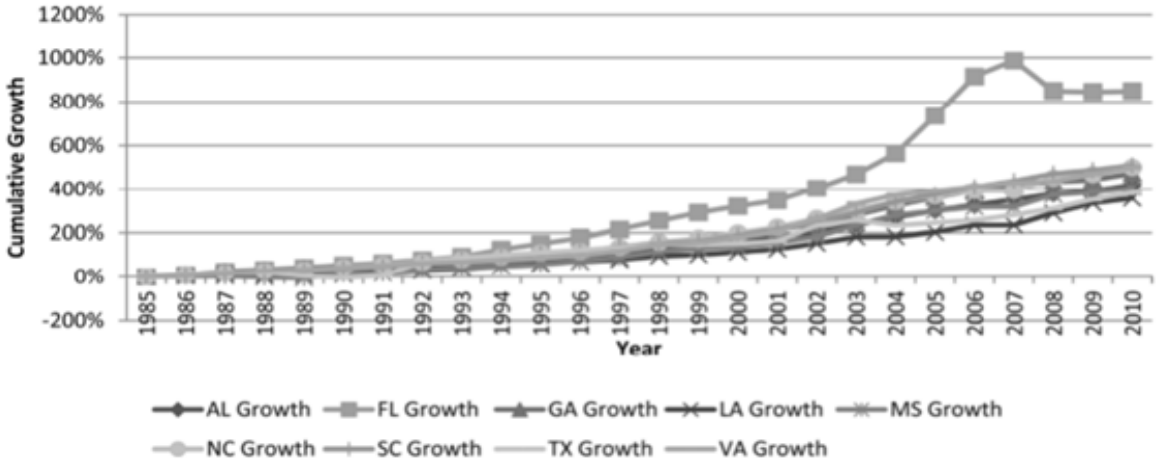
Urban economic dimension

The urban economic dimension is closely associated with the other dimensions as the political system and the economic system are inherently interconnected through laws, regulations and the influx of money. The economic dimension is also connected to the environmental dimension since adaptive measures will need to be financed in some way. It is therefore important to reflect on Miami's particular economic system and the implications of rising sea levels for it. One particularity is the way in which Miami's tax system is structured. Florida is one of only seven states in the US that has no state income tax (Tax Foundation, 2015). Instead, Florida is heavily dependent on corporate income taxes and property taxes, from which the average state rates are higher than the average rate in the United States (Tax Foundation, 2015). Property taxes are disproportionately important for Miami, with an expected revenue of nearly $230 billion for 2015 and a rise of 8.6 percent compared to the year before (Miami-Dade County Property Appraiser, 2015; Hanks & Dixon, 2015). Property taxes thus make up a large share of local government's overall taxation income, which causes a vested interest in the continued development of Miami's urban area.

The overdependence on property taxes fuels the building boom primarily financed by investors from South America, Europe and China (Croft & Shindell, 2014). It was South American investors that allowed Miami's real estate market to recover, which is illustrated in the following quote from real estate developer Jorge Perez: *"South Americans are the game changers — they are the ones that allowed the housing market to bounce back"* (Croft & Shindell, 2014). These foreign investments in commercial real estate have risen steadily since the global financial crisis, amounting from $74 million in 2010 to nearly $900 million in 2014 (Bailey, 2015). The building boom, driven by the foreign investments, is especially apparent in all waterfront areas as the top five jurisdictions in Miami with the highest rises in property values are all in these areas (Hanks & Dixon, 2015). Dr. Harold Wanless summarized this development as *"building like there is no tomorrow"*— investors want to make profit while it is still possible as demand for real estate in Miami is currently very high.

The present economic situation in Miami, characterized by its particular taxation system and the building boom driven by foreign investments, is already quite vulnerable. On top of this, government officials face a delicate balance between protecting society against the rising sea levels and the ongoing need to attract foreign investments and generate income through property taxes. Finally, the role of insurance companies is another major economic factor in this discussion. As displayed in figure 5, insurance premiums in Florida are high compared to other hurricane prone states. Even though the figure shows some stabilization in Florida's insurance premium rates over the last three years, the cumulative growth is still twice as high (Nyce *et al.*, 2015).

Figure 5: Property insurance premium growth 1985-2010, hurricane exposed states



Source: Nyce *et al.*, 2015

While the premiums are high, the overall narrative we found in our interviews is that it is currently not a pressing issue. Dr. Shivangi Prasad noted that: *"At this moment I don't see this as too big of an issue, but in the future it might be a problem"*. That future might be near, however, as rising sea levels exacerbate the impacts of hurricanes and storm surges, insurance premiums will become even more expensive. In the future, insurance companies may no longer be able to provide homeowner's insurance to certain areas in Miami because of exceedingly high flooding risks. The rising premiums might also have a positive side effect as this could potentially raise awareness among the public since it directly affects their livelihoods. This trend was also recently mentioned by Leigh Needelman, CEO of Florida Assurers, Inc.: *"property owners will start getting wind of this increase (of insurance premiums red.) shortly as the new rates and surcharges begin to appear in the mailbox for April 2015 renewals*" (Needelman, 2015). The cost-benefit analysis here is whether one thinks living in a lovely condo close to the beach is worth the risks and costs that come with it.

It is clear that Miami will likely have to deal with some environmental-economic problems in the near future. This is primarily due to the building boom having not taken into account a sustainable adaptive approach as well as rising insurance premiums. However, there are also economic chances for private companies in the adaptation sector, which is currently underdeveloped in Miami. Dr. Keren Bolter, who we interviewed, told us about her work at *Coastal Risk Consulting,* where she is conducting sea level rise risk analysis for the general public (Coastal Risk Consulting, n.y.). These types of private companies could provide new economic opportunities for Miami and lower the burden attributed to rising sea levels.

Conclusion: Tipping points have not yet been reached

The ramifications of sea level rise in Miami, such as rising insurance premiums and loss of the freshwater supply, are real and here to stay. Three possible tipping points that will result in more awareness among citizens and elected officials will eventually lead to actions that have not yet been reached. The first tipping point is concerned with the urban environmental dimension, i.e. the

relationship between physical and human geography, as there has not been a major hurricane since Andrew in 1992. The next severe hurricane that causes billions of dollars of damage might reshuffle the priority lists of the elected officials (interviews with Dr. Keren Bolter & Dr. Robert Gutsche, 2016). Other national calamities such as the hurricanes Katrina and Sandy have changed the national discourse and also the local discourse in Miami, but not yet to a significant level (Interview with Jim Murley & Isabel Cosio Carballo, 2016).

The second tipping point is concerned with the urban economic dimension. Residents of the Miami urban area already pay a fair share of their income on insurance premiums to cover wind and water damage. When sea level rise becomes a more pressing issue, premium rates will rise or insurance companies will back out completely. Unfortunately, in an indirect way people will then become more aware of the issue as they cannot afford to insure their assets anymore.

A final potential tipping point is related to the political dimension and is associated with the current efforts of NGOs to raise local awareness. During our research project, we found that the majority of people who live in the urban area of Miami were not aware of the future consequences of sea level rise. Awareness generation is therefore necessary to support adaptation measures that have to be implemented in the near future. Public officials such as the group of South Florida mayors working on climate change are at the moment still facing problems with widening their reach. From our participant observations we noticed that the audience at awareness raising events primarily consists of students and older people with the time and money to dedicate to such an important topic. It would however not be surprising if efforts to generate awareness increases in the near future, as more and more citizens begin to experience the effects of the rising sea levels and pressure politicians to start discussing the issue (Valentine, 2016).

Some believe that increasing sea levels will eventually lead to more technological advancements to solve the problem (Interview with Jim Murley & Isabel Cosio Carballo, 2016). Nonetheless, it is important to start taking adaptation measures, such as securing energy power plants, before it is too late. Unfortunately, based on our field research, it seems as though tipping points need to be reached before real actions are implemented. In this report, we have outlined these potential tipping points in hopes of contributing to and expanding on the literature on the issue of sea level rise in urban Miami. We believe this report will contribute to awareness creation and catalyze solutions for addressing this issue.

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Appendix 1

List of appointments in chronological order

18/1: Robert (Ted) Gutsche Jr. (Ph.D., Professor at the School of Journalism and Mass Communication, FIU).

19/1: Jim Murley (Chief Resilience officer) & Isabel Cosio Carballo (Executive Director South Florida Regional Council).

19/1: Ulrich Oslender (Ph.D., Professor at the Department of Global and Socio-Cultural Studies, FIU).

19/1: Seminar by Elizabeth Plater-Zyberk on Climate Change: A South Florida Perspective at the School of Architecture, University of Miami.

20/1: Shivangi Prasad (Ph.D., Department of Geography and Regional Studies, University of Miami).

20/1: Cleo Institute: Film Screening & Panel Discussion (NGO).

21/1: Keren Bolter (Ph.D., Policy Analyst South Florida Regional Council (SFRC) and Research Coordinator for the FAU Center for Environmental Studies (CES)).

22/1: Harold Wanless (Ph.D., Chairman and Professor at the Department of Geological Sciences, University of Miami).

23/1: Dutch Consulate (Dutch Wave Festival).