

Adaptation Tools, the Potential Implementation of American Resilience Strategies in Alexandria, Egypt

Aya Mohanna
La Sapienza University

Martha Kohen
University of Florida

Anna Irene Del Monaco
La Sapienza University

Abstract

This paper is an introductory analogy between Alexandria's socio-environmental and urban reality and the United States' methods of adaptation and mitigation in the light of the recurrent climate phenomena, related to water bodies. The study aims to identify a set of similarities between the singularities of the selected locations to propose efficient tools, specific to the question of climate change risk mitigation coupled with the uniqueness of the place.

Introduction

Water is an economic and social capital. It has always shaped policies, societies and urban form. Recently, interest in environmental events, some of which are connected to water, has resurfaced world-wide. International concern is growing in rapport to climate change and its fateful symptoms on the main urban agglomerations in the world.

Several countries are employing research and projects to attenuate and limit the results of sea level rise, with the introduction of innovative architectural and urban tools to avoid flooding. Most of these interventions are usually costly and are prominent in developed countries, ones that are advanced in terms of environmental legalization and study.

Alexandria is projected to face serious flooding problems in the future (Shaltout et al., 2015), both coastal and pluvial, due to factors that are natural and man-induced. The scenario of a worsening climate situation coupled with a decaying infrastructure and a sensitive Delta is

one that poses serious threats to Alexandria's well-being. So far, very scarce research and intervention has been executed in the city, with minimal focus on the creation of a long-term plan to mitigate the damage bound to occur in the city. (El-Hattab et al., 2018)

The case of Alexandria presents a difficult challenge, given the vernacular nature of many of its regions, with the general reluctance and the incapacity of investing in high-price big-scale interventions.

Throughout a field visit to Alexandria, accompanied by a thorough study of the Alexandrian individuality and followed by a 5-month research stay in Florida, it was possible to detect some common aspects connected to this topic and prevalent in three main locations: Alexandria as a base, and New Orleans and San Juan (Puerto Rico) as case studies. The mission was to introduce a basic map with guidelines relevant to Alexandria and inspired by the policies applied in the base study locations, in order to insure a more efficient strategy.

Methodology

In order to acquire the needed data for the study, a 2-week field visit was first conducted in December 2018 to Alexandria, throughout which an extensive archive including photographs, maps, interviews and other resources was gathered. These resources are directly connected to the studied issue. This phase permitted an assessment of the quality of the available information, and the obtainment of a multidisciplinary understanding of the situation in Alexandria archeologically, environmentally, politically and architecturally.

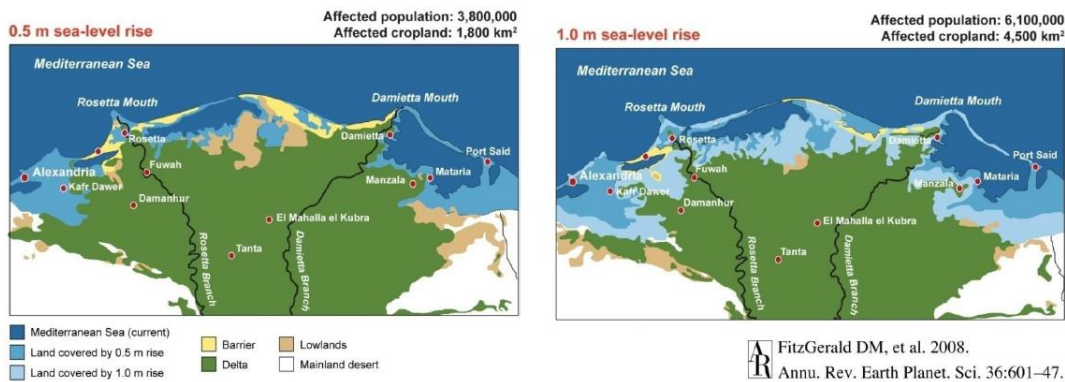


Figure 1. Projected Scenarios for Sea Level Rise at the Nile Delta. Retrieved from El Hattab et al., 2018.

This visit was followed by a 5-month research period in the University of Florida as a visiting scholar, affiliated with the CHU, Center for Hydro-generated Urbanism, under the supervision of Prof. Martha Kohen. Aside from the substantial expertise and the diverse team of international scholars connected to the center, this establishment is singularized by its incessant activity in the domain of design and climate change, and holds an unmatched archive depicting American knowledge in the aforementioned topic. Fieldwork was conducted throughout this process in all of the designated timeframe.

Familiarization with both the American and Egyptian experiences allowed the extraction of a number of shared aspects connected to climate resiliency and architecture. This subsequently could allow an elaborate analogy that would ultimately inspire a set of interventions that would be more efficient than others in the case of Alexandria, by picking certain projects specific to a chosen singularity in America, and that might present efficiency in Alexandria.

Hence, the comparative method is conducted in this study. This paper is a preliminary analogy for a more elaborate research.

Alexandria, a Dark Horizon

Main Environmental Predictions

In discussions about climate change worldwide, dense coastal cities face the highest rates of damage due to sea level rise. A number of factors makes Alexandria one of the most vulnerable cities to climate change, and probably the first threatened city in Africa. With a population of 5.2 Million; 40% of which residing in informal and decaying structures, a main urban and historical mass existing on the

city's lowlands, and with the main economic and touristic attractions located 200-300 meters away from the shoreline, it's clear to presume that Alexandria would face major damage due to sea level rise and pluvial flooding. (Holder et al., 2017)

A report by the Intergovernmental Panel on Climate Change (IPCC) confirms these concerns, predicting the dislocation of 8 Million people throughout the Nile Delta, 4 Million of which in Alexandria alone, in the scenario of a 1m sea level rise. This is due to Alexandria's predominantly low-situated land and to its lagoon landscape. The city is threatened by beach land erosion, loss of heritage due to saline water damage, "inundation, waterlogging, increased flooding, and salinization under accelerated sea-level rise" (IPCC, 1997). This is coupled with a set of geo-environmental singularities, both man-induced and naturally present, that is expected to worsen and speed up the effects of the afore-mentioned climate events.

The Nile Delta consists 66% of the national agricultural land. (Lewis, 2011) This area is cultivated through direct irrigation from the many ramifications of the Nile, and historically received yearly sedimentation from the river. In the last few decades, following the construction of the Aswan dam, sedimentation has ceased to reach the Delta, and the land has started to subside with an annual rate of up to 8mm in some areas (El Askary et al., 2009). This, coupled with the aforementioned factors, promises a future of salt water intrusion to the Delta, a devastation of agricultural land, a decay of historical buildings and a displacement of a substantial population.



Figure 2. Alexandria's Informal Population is the Most Vulnerable. Photo Credits: Sameh Abou Hassan

Risks for Alexandria are further amplified; located on the Edge of the Nile Delta, delimited by the Mediterranean Sea and the Mareotis Lake, facing major construction and population developments in the last century, the city needs a thorough study and intervention plan to help mitigate the projected damage.

In spite of a general academic consensus of the fate of Alexandria, with a threat to be partially submerged by 2070, the local population seems almost completely oblivious of this scenario. In parallel, efforts by the successive local authorities have been largely ineffective; projects regarding water issues have been restricted to breakwater structures specific to some predominately wealthy areas, dedicated to the touristic aspect of the city, with little attention to popular zones, those hosting the big majority of the population. In addition, any interference in the informal aspect of the city has been leading to a flagrant surge in real estate rates in a pure gentrification scene.

America, a Case Study

The USA and its associated districts have a history of dealing with climatic events all across the country. Specific attention and research is ongoing to increase the resiliency of some locations that are notably more vulnerable to

these happenings; this includes New York, Louisiana, Florida, and the district of Puerto Rico. The common aspect of these locations is the fact they are at constant risk of climatic events such as hurricanes, inundation and pluvial floods.

New York's extravagant intervention projects revolving around Manhattan, and Florida's topography and geographical wetland nature are somewhat remote to the nature of Alexandria as a subject for comparison. However, environmental similarities are directly spotted in many aspects connected to Louisiana and the Nile Delta; specifically given the case of New Orleans.

New Orleans sits on the foot of the Mississippi, one of the largest sweet water bodies in the world, overlooking the Gulf of Mexico. The Mississippi Delta in Louisiana provides a diverse landscape of water bodies and a rich Eco agricultural system for the region. It is the gateway for 25% of the nation's exports and irrigates 40% of its water needs.

However, due to both pre-existing factors such as New Orleans' low altitude and susceptibility to storm surge, and man-induced works such as over-construction, river management and pumping, the city today faces concurrent



Figure 3. Adaptation Interventions in New Orleans. Retrieved from <https://www.nola.gov/>

phenomena of erosion, subsidence, salt water intrusion, loss of islands and low lands, and repetitive flooding.

An interview with Prof. Jeffrey Carney, Associate Director of FIBER, Florida Institute for Built Environment Resilience, confirmed this analogy; both Alexandria and New Orleans being high-density coastal cities on the edge of a fertile delta for a major river. Professor Carney stated that some engineering interventions caused a recession of the coastal line and a major drowning phenomenon for much of the delta's lands. Much like Alexandria, New Orleans faces very similar flooding patterns due to storm surge, inundation, and salt water intrusion. In addition, both cities possess the lagoon landscape nature; having both of them delimited by lakes, wetlands, salt water, and crossed by Canals.

The strategies that are being executed and experimented within New Orleans are quite diverse and range in scale; from mega-mechanical pumps drawing the flooded water outside of the towns, to living levees, along with social awareness strategies targeting equity and social justice in the distribution of projects. Additionally, a project titled "Gentilly Resilience District" is working on a prototype neighborhood to adapt residential units to climatic events. This project is set to present a pilot prototype for future urban works in New Orleans. (Kincaid, n.d.)

Decades of trial and error in the city of New Orleans have established the performance or the lack of thereof of some policies that have been implemented with time to avoid major loss due to flooding. Experience has shown that

continuous aggressive interventions on the natural landscape have led to further issues such as "bowl effect" floods and additional subsidence. In parallel, new location-sensitive strategies such as the multi-canal outfall system, residential retrofitting, and ecological regeneration of now-discarded wetlands are proving to have a better social, economic and environmental effect altogether on the city.

On the other hand, Puerto Rico's socio-economic reality, coupled with its susceptibility to hurricanes, made it a subject for research in the last few years. Several workshops and research initiatives are directed in hopes of regeneration. Many of these ideas have been implemented in a number of affected coastal cities that were previously harmed by hurricanes and floods. This is the case of La Perla, San Juan's informal coastal neighborhood.

A research Conducted by Gabriella Colon of the UF demonstrates the inclination towards a resilient revitalization of La Perla, to improve the quality of life through sustainability, multiplicity and environmentally conscious decisions. A thorough study of the chosen settlement was conducted and signs of social injustice, negligence, and a general negative attitude towards the inhabitants. The research's main recommendations were to limit house demolition and people relocation, to introduce public space and the strategy of urban acupuncture when adding emergency unit such as water and eco towers, to include the local community in the processes of design and execution and to profit from their knowledge of the site, to densify the urban nucleus in order to restrict urban sprawl, and to improve housing units and accessibility to the area, in order to



Figure 4. La Perla Revitalization Project. Retrieved from <http://puertoricorestart.org/>

diminish the social stigma and loosen the social contempt directed towards it. (Colon, 2012)

Synthesis

Lessons to be learnt

The multi-scale approach to the city of New Orleans, from the infrastructure to the housing unit, and the socially sensible recommendations towards San Juan’s informal settlements, come in parallel with what is witnessed in Alexandria.

Following the guidelines of these case studies, an area in Alexandria is to be selected and studied, with its results spread out in the future. The historical Peninsula is the best compact

representation of the general Alexandrian theme, while being the most economically vulnerable area in the city.

Due to the extensive diversity of land use and the heavily hierarchal nature of the region, the main strategy to tackle these aspects would be to identify the main chapter to intervene in, and to assess the convenient strategy.

This map shows a preliminary distribution of the proposed strategies to be applied to Alexandria’s Peninsula area based on each neighborhood’s needs and conditions. The interventions would range from big-scale

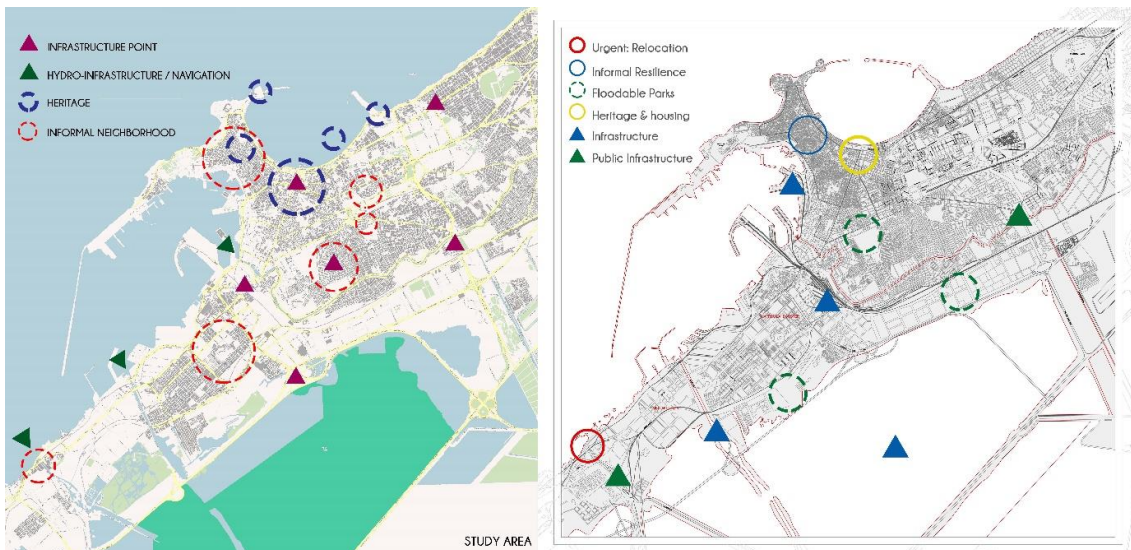


Figure 5. Identification of the Main Focus Points & Proposed Strategies. Personal Construction.

projects to minor repairs and additions to existing buildings. In informal settlements such as El-Agamy and El-Mex, urban interstices are to be located and invested in the creation of emergency pods and public spaces. In the zones closer to the floodable lake of Mareotis, floodable park, outfall canals and wetland regeneration could potentially enhance the quality of the area under the title of public infrastructure.

Alexandria needs a wholesome infrastructural plan, to improve the road system and to renew the century-old decaying drainage system that's currently incapable of accommodating to the ever-growing population. These interventions should be done with the participation of the people, with a system of open data to spread awareness to the predicted risk.

Limitations and Future Steps

The author is aware that this study is of a preliminary nature, and is in dire need of many parameters and studies to help predict the efficiency of the proposed interventions in Alexandria. This paper's scope is to introduce an analogy between the case studies and the selected location, and aims to shed light on some strategies that would be effective for the chosen place in the mitigation process of Egypt's Alexandria.

Conclusion

Any adaptation plan to Alexandria needs a quantitative study targeting social equity, infrastructure systems and local authorities. The American experience in this domains offers a new and colorful perspective to the issue, and might inspire a set of strategies that would hold a participatory nature and present certain considerations to the dwellers' lifestyle. This study is a part of an ongoing dissertation studying Alexandria's urban and climatic reality, which should be proposing a set of proposals and recommendations for the area, inspired by the available literature on the topic.

Endnotes

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