Aut ubi non mors est, si iugulatis aquae? Or where is not Death, if you too, Waters, kill? Martialis, Epigrammata IV 18,8

# "Convegno: Strategie di adattamento al cambiamento climatico"

Accademia Nazionale dei Lincei Roma, 8 novembre 2016

### COASTAL SETTLEMENTS ADAPTATION TO SEA LEVEL RISE

UNESCO World Field Laboratory - Stage 1/ New York, Miami and Gainesville, March 2016 - Stage 2 / Rome, Fall 2016. Directed by Lucio Barbera and Martha Kohen

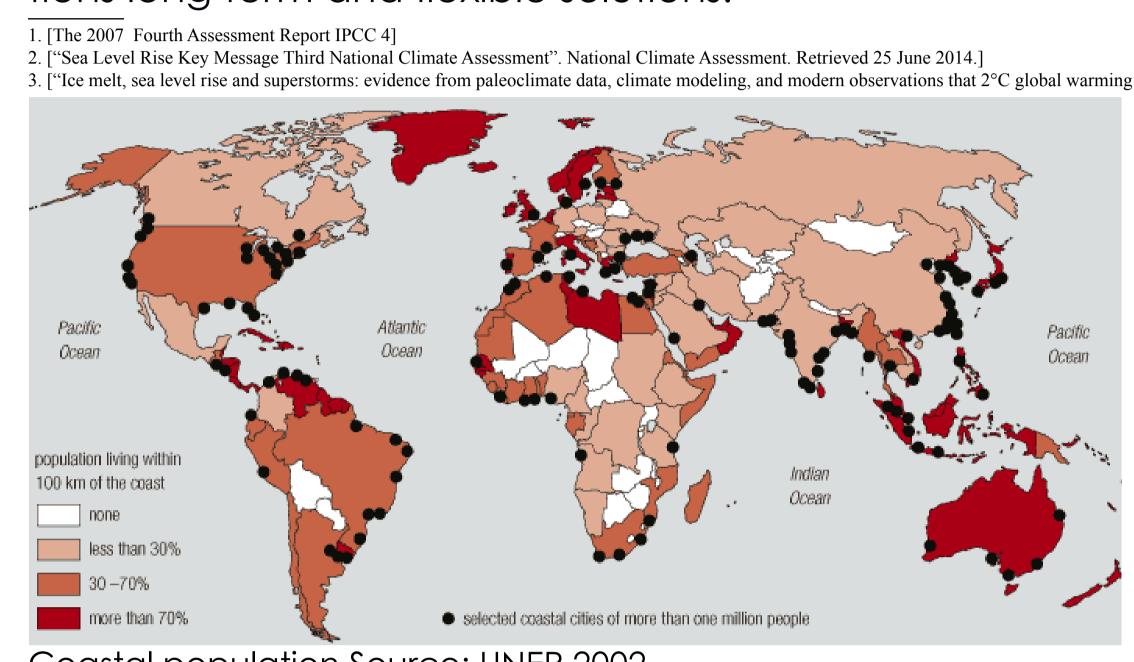


The UNESCO World Field-Laboratory is an applied Collaborative Research Laboratory established by the UNESCO Chair in Sustainable Urban Quality and Urban culture, notably in Africa, Department of Architecture and Design (DIAP) Sapienza University of Rome and the Consortium for Hydro-Generated Urbanism University of Florida. The purpose of the UNESCO World Field-Laboratory is to deal with a critical issue of global interest – the Sea Level Rise in urbanized areas - for transmitting and sharing between countries of different scientific and technical development the most relevant perceptions and experiences of it as well as the most advanced methodological know-how to promote an informed, aware and efficient Human Settlements adaptation to the critical effects of the climate change.

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#### **MOTIVATIONS**

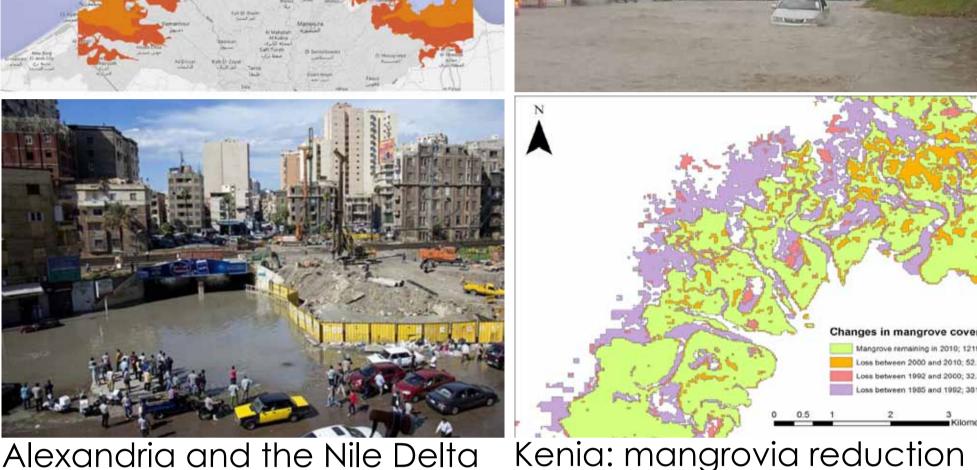
The issue is widely scattered along almost all the urbanized coastal lines of every Continent, including the greatest score of both developed and emerging countries. All the studies on the people distribution show that at least 3,2 billion live within 120 miles from the sea while an ever growing masses of people, in every Continent, from internal to coastal areas. On the other end, almost all the scientists, though fiercely discussing upon the dimension and the speed of the phenomenon - as well as upon the rate of the human responsibility for it - acknowledge that the mean level of the sea waters is persistently rising as a major consequence of the Climate Changes and is already perceptibly threatening one billion people living the coastal cities or low-lying areas such as Bangladesh, Mediterranean lowlands, large portions of the United States eastern coast and of the north-east China plains. The different scenarios for the end of the century (2100), often proposed in contrast with each other, span from an expectation of a rise of 18 to 59 centimetres (7.1 to 23.2 in)<sup>1</sup>, to an expectation of a rise of 1 to 4 feet (30–120 cm), while decision makers, who are particularly susceptible to risk, may wish to use a wider range of scenarios from 8 inches to 6.6 feet (20-200 cm)<sup>2</sup>, not to consider the most severe scenarios assessing: "Humanity faces near certainty of eventual sea level rise of at least Eemian proportions, 5–9m, if fossil fuel emissions continue on a business-as-usual course, e.g., IPCC scenario A1B that has CO2 700 ppm in 2100". Anyhow, it is demonstrated that we are already committed to a sea-level rise of approximately 2.3 metres (7.5 ft) for each degree Celsius of temperature rise In this framework we believe it is urgent to give interdisciplinary design and engineering answers to the question: to what extent and how can we **adapt** the coastal human settlements to the dramatic evolution of the coastal regions while reducing their vulnerability? The research has to start immediately; there are still some decades in front of us for 1) making an inventory of the different critical situations and of the partial or organic solutions already proposed, 2) searching the most suitable answers for each situation, 3) experimenting and starting to apply in the different situations long term and flexible solutions.

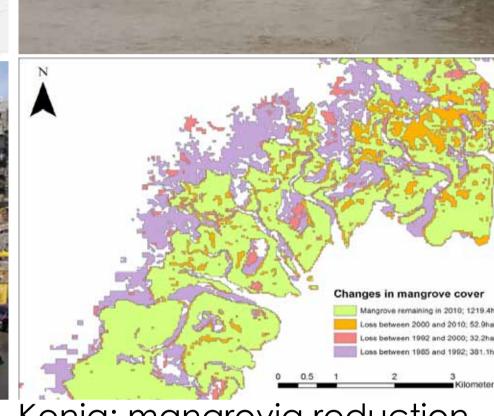


ng is highly dangerous" J.Hansen and others, Atmos. Chem. Phys. Discuss., 15, 20059–20179, 2015] Many of the factors that influence and accelerate these processes (subsidence of the coastal areas, the sea level rise, the reduced transportation of sediment to the delta regions, the reduction of natural defences and – in general - the human activity) have influenced the evolution of the low land urban and rural area all around the world.



Venice

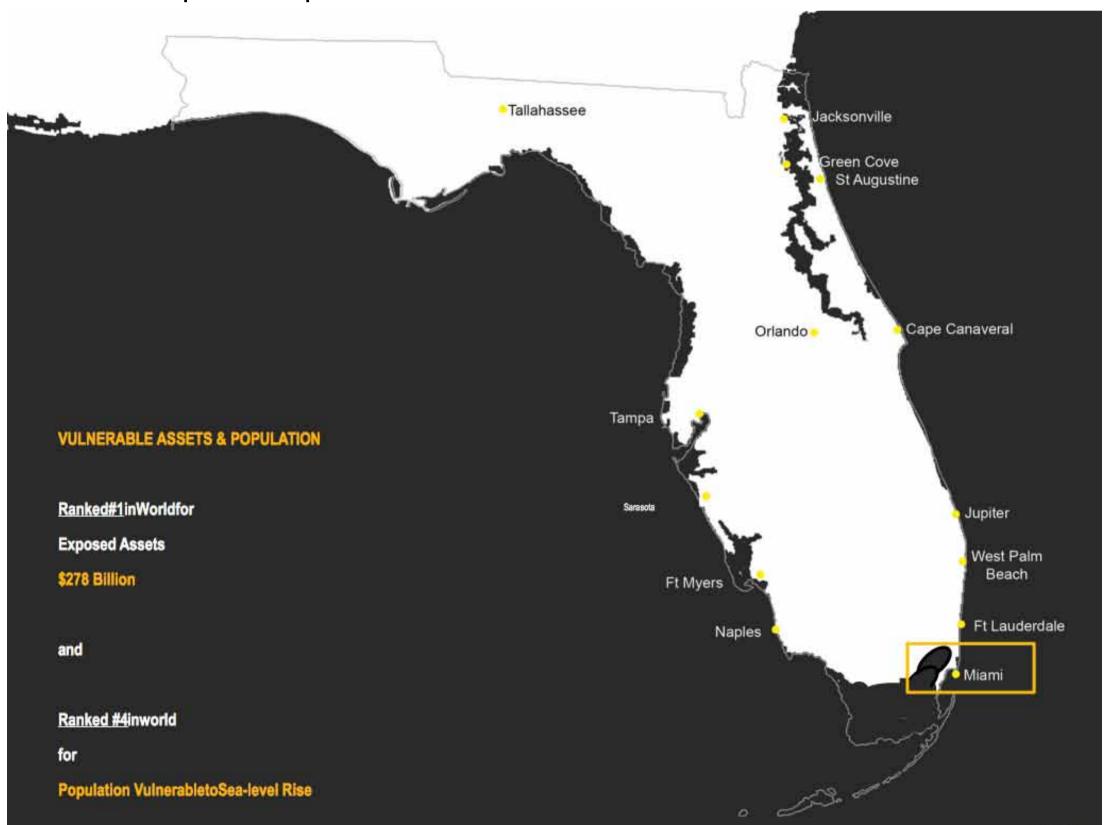




Rock Revetments

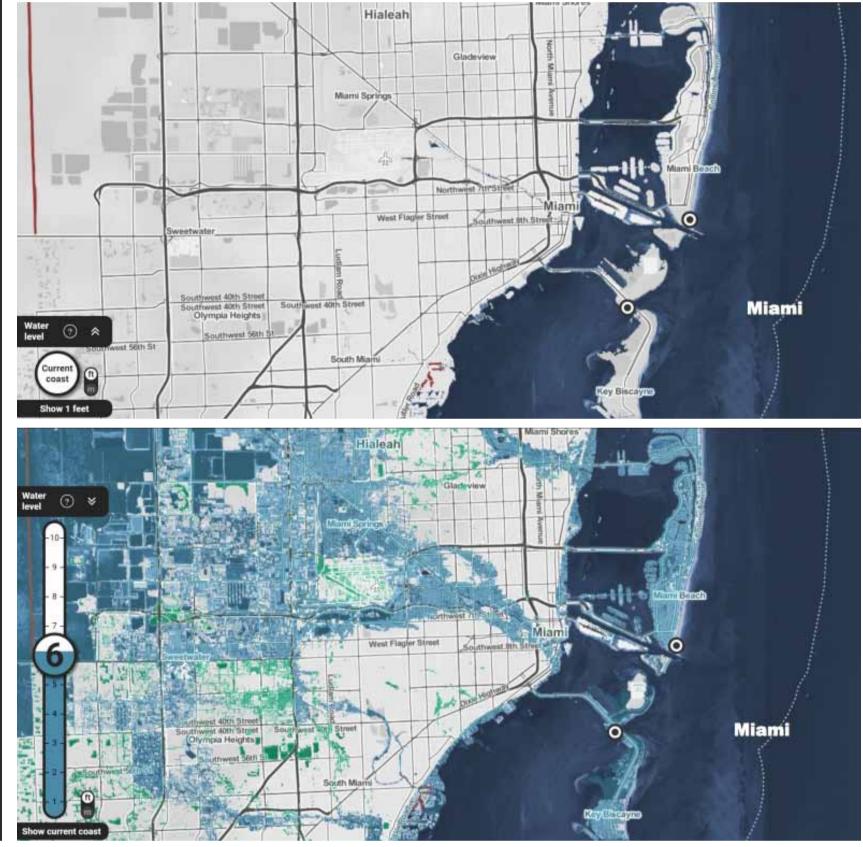
Coastal population Source: UNEP 2002 Lagos: Makoko

**SCENARIO** With the participation of scientists and the local administrations we started with the scenario of 6 feet sea-level rise within the year 2100 applyed to the multi-problematic example of Miami

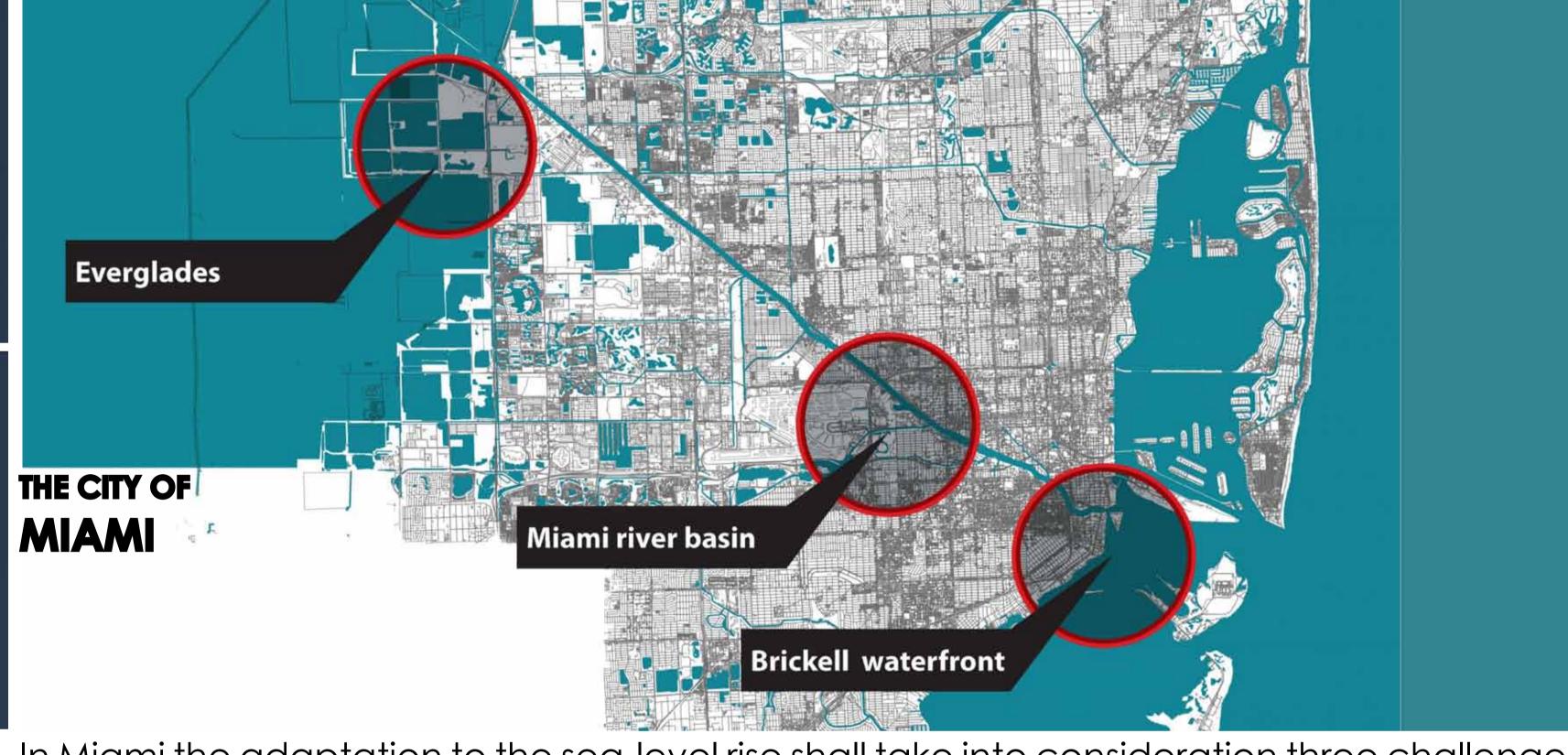


With a sea-level rise of 6 feet, the area of Miami will be reduced to a very narrow peninsula, similar to the Florida Keys.

Everglades



The Miami River will be transformed in a sea-channel while the Miami Beach shores will not bar anymore the ocean waves.



In Miami the adaptation to the sea-level rise shall take into consideration three challenges: the defense of the present urban waterfornt (Brickell waterfront), the adaptation of the low density urban fabric (Miami River Basin) and the building up of a new West Sea-front (Everglades).

The defense of the waterfront will be

taken on by new breakwaters; they

should be realized as new public green

Brickell waterfront

## PROPOSED SOLUTIONS

Beyond the adaptation and mitigation strategies for flood risk in urban area, summarized here by, a number of specific design and engineering solutions have been elaborated for the three MIAMI challenges. Some sample of them are here presented.

ging the minimum surface, thus reducing the number of families to be rilocated. For this purpose

a simple algorithm was elaborated and tested by design. The action could be an opportunity for

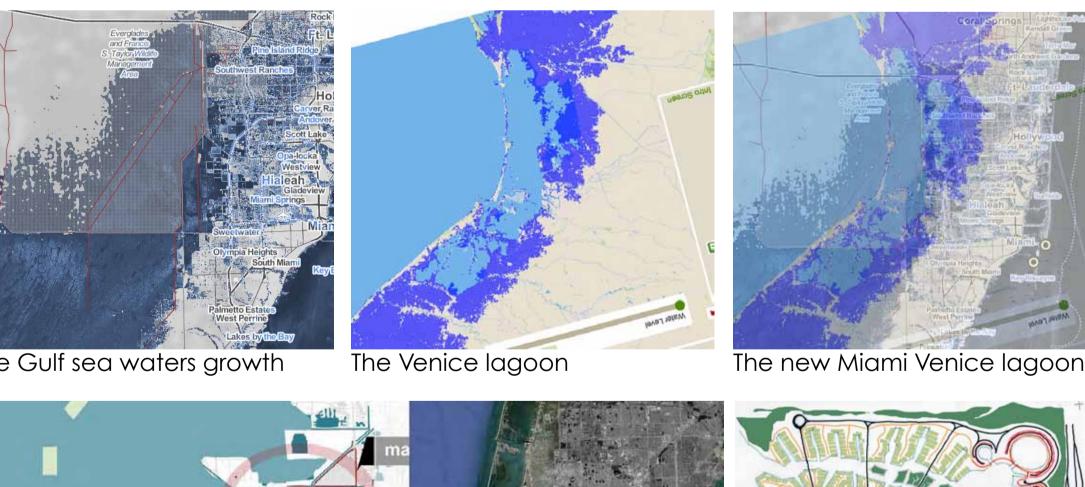
### Miami river basin

The adaptation of the low density urban areas to the sea-level rise shall be a gradual, long term action involving the people living in the areas. Taking in mind that the very simple timber houses The West outskirts of the city will be reached by the Gulf waters. A new artificial used in those areas have a life of only some decades, the aim is to find within each urban block shore to protect the city should be considered an opportunity to enrich Miami (aprx 700m x 700m) the fill necessary to elevate, when needed, the soil of the residential plots dig-

1) the aim is to save the maximum quantity of built soil elevating i

up to 7' above the present Sea Level

improving and transforming the accessibility and infrastructural public system.



with a new, fascinating semi-urban shore, facing a shallow lagoon.

