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a cura di Maria Valeria Mininni, Ester Zazzero

The impacts of climate change in the city. For a new geography of risk

Michele Manigrasso

"The future of civilization will be determined by your
city and in its cities"
R. Rogers

The problem is global, and it is clear, with the same evidence, the greatest concern with respect to climate change, address risks to man and his city, because it is in them that will carry out the main human activities and thickens the population.
Urban settlements are key drivers of climate change and at the same places where the effects are more severe for the human species. Urban settlements are those where there is less natural, and therefore where the impact strength shall be provided to an almost exclusively by men. The assessment of their vulnerability, the consideration of the risks to people and property, the formulation of conscious strategies to tackle the problem are, therefore, an important test, likely to affect the quality of life portion of the large majority the world's population.
Currently almost half the world's population lives in cities and it is expected that during the next few years the urban population will continue to rise steadily. The city, although involving small portions of the earth's surface (between 2 and 4%), consume 3/4 of the world's energy resources and materials, producing an equivalent amount of waste (UNEP, 2005). City immense, complex, different and larger than the current ones, will become the environment in which many people live. Many cities, such as Mexico City, Tokyo, Sao Paulo, Shanghai, Mumbai and Lagos are likely to grow to 20 million inhabitants. If the city is the habitat in which man finds the best conditions for their development and evolution and where it tends to reproduce a continuous settlement, at the same time, the current rate of urbanization is leading to many cities worldwide growth abnormal which may lead to the loss of those characteristics that make it attractive not only the city, but which are the basis of human life (Guess et al., 2005).
Globally, it is estimated that 75% of the world's energy consumption is due to the cities, and that they are responsible at the same time 80% of the emissions of greenhouse gases. Therefore the city itself is a source of heat production and energy, which can be summed to that of the incident solar radiation. The lighting, transport, heating and cooling of buildings, have non-negligible impacts on the urban climate both directly, due to the heat that comes from the production of energy and that is going to add to the natural one, and indirectly, because emissions of greenhouse gases and other pollutants, and to everything, add some aspects of the construction of the city (the materials, the density, the guidelines wrong, etc..) which will be discussed later specifically, about the waves heat.
In the light of these arguments, it is clear that the city has a major role on climate, both globally and locally, contributing strongly to the "quality" of their own microclimate. More generally, we can recognize the city:

Active - negative role _ The gradual and steady increase in the population living in urban areas will increase the energy required to operate the city, increasing the impact of urban areas to climate change.
Passive - negative role _ cities suffer directly the effects of climate change, especially those related to rising sea levels, intensification of the weather or the gradual rise in temperature.

Active - positive role _ cities and local governments in the broadest sense, can play an important role as laboratories for experimentation with new policies for adaptation to climate change. In this sense, the scale

of urban action must be addressed to actions of mitigation procedures on the one hand and on the other adaptive capacity, with particular relevance of the latter. (F. Musco, 2008).
In order to capture a snapshot of the main impacts of climate change on urban areas, were selected in the first place, also making reference to similar transactions in "Adaptation Plans" of some national realities, changes considered most likely to produce significant impact. Are assumed to be of particular significance: rising sea levels, changes in rainfall regime, the increase in temperature. With regard to raising the level of the sea, there are two components vulnerable to the effects exhibited receding of the coastline:

- coastal settlements made to the modest height from the level of the sea, exposed to possible flooding and erosion;
- coastal infrastructure (roads, railways), the artificial defenses of the coast and port facilities, exposed to the resurgence of marine erosion, with consequences for their efficiency and their functional characteristics.

With regard to the change in the rainfall regime, in particular the increased occurrence of heavy rains and concentrated in time we consider vulnerable:

- settlements located in the vicinity of surface water bodies, which will see the changing conditions of exposure to the risk of river floods currently calculated with calibrated hydraulic models of time series of rainfall in perspective may not be the most representative of reality;
- the urban sewerage system aimed at collecting used and dispose of rainwater, subject to changes in load conditions and now sized according to historical series of meteorological events are no longer reliable.

And then, the temperature increases in urban areas, vulnerable components invest directly the quality of life of people and in the places of residence and work (within buildings) and outdoor (or in public spaces). As well as the sealing of urban green areas, which in large part are maintained artificially (such as by irrigation), but that in the case of large surfaces run more natural (large urban parks, parks agricultural etc.), May suffer of 'rise in temperature, especially if associated with long periods of drought, losing quality of the vegetation cover and reducing the multiple functions (Contribution to air pollution and climate peaks, ventilation, recreation) that currently provide.

FLOOD RISK_ An urban planner Italian, Paolo Sica, years ago, wrote these words:

"There are cities on the river, Paris, London, Rome, a thousand others, and city by the sea, Naples, Odessa, and Tokyo, and the city on the lake Constance, Chicago, the city on the lake and the river, Geneva, city of lagoons, Amsterdam, Venice. There are cities that have no river or sea or lake or lagoon. But no city is lacking relationship, perhaps secret, with the water. "

Can be defined as a city of water, all those urban settlements, complex structure and of significant size, which keep the water in its various forms, a report visible important aspects which could also highly problematic. These cities have, by the very presence of water, in or near the urban fabric, an extraordinary added value, depending on the intelligence and capabilities of their citizens and subjects planners can play a crucial role, not only on plan aesthetics of the city but in a strategic urban development (R. Bruttomesso, 2007). The relation between the city water is obviously an ancient relationship, because the water has always represented a vital resource for humans and for the performance of his field activities. The water sprayed at times has even designed the urban landscape, change and evolution, and supporting, by virtue of its adaptability perception even more than physical, all practical needs, aesthetic and symbolic urban structure required. So it was, from time to time, an element of communication or separation instrument of defense and security, a factor in promoting aesthetic and vital support of the community (L.Ferrari, 2004). There is no civilization that has contributed to this issue, because there is no civilization without water and the use of this right demands that there be a place to collect and a system to deploy it. The presence of water has strongly contributed the definition of urban form, and if the presence of water has, in fact, influenced and structured definition of landscape structure and land contributing to the uniqueness and specificity of the different conformations morphological and different plant associations, even more intensely, the water broke into the mechanism of systemic urban phenomenon to become generative factor as well as evolutionary, not only of form but also of activities, lifestyles and relationships that have gradually deposited on the ground.
The theme is sensitizing much research, particularly the need to understand how you can change the level of the water and how much will be frequent extreme events such as tsunamis, the tsunami waves, etc.. For example, the Natural Resource Defense Council (NRDC), a large non-governmental organization American, published in August 2011, the report said, "Thirsty for Answers: Preparing for the Water-related Impacts of Climate Change in American Cities," in which attention is focused on the coastal areas of the United States more vulnerable to situations that enhance coastal risks, such as rising sea levels and events concurrent increase in precipitation and extreme marine phenomena. This report identifies major U.S. cities most vulnerable to coastal risks: New York, Boston, San Francisco, Los Angeles, Miami, New Orleans, Homer, Seattle, Norfolk, St. Louis, Chicago, Phoenix and urges municipalities to prepare than U.S. future challenges that climate change, in the field of water resources, present (fortunately some of these cities have moved in

this direction creating interesting adaptation plans). Most of the city in question is threatened by floods and storms, which concern both coasts, east and west: the projections of rising sea levels compared to 2000, indicate, by mid-century, an increase of 12 to 18 inches (31 to 46 cm) to Los Angeles and San Francisco and from 3 to 22 inches (8-56 cm) to Seattle. All three cities have a frame transport infrastructure, ports, airports and railways vulnerable to mutations of the seas and, in this, add the issue of the threat to the reserves of fresh water. For example, in New York City, due to rising sea level, the water could "make their way" along the Hudson and Delaware rivers and thus "contaminate" the water sweet, concern regarding many other cities.
Architecture 2030, an environmental organization founded in 2002, USA by architect Edward Mazria, to raise awareness on the issue of global warmig USA, has developed a series of maps on how the city could be flooded by rising seas coastal USA. The maps were calculated using the elevation data and combining government together with the maps of Google Earth (see the pictures on the next page). Many cities on the planet would be totally disrupted even by a relatively small rise in sea level. Please note that according to the IPCC report rising seas due to melting of continental glaciers, thermal expansion and a small contribution from melting of the Greenland could reach about 59 cm, the complete melting of the Greenland ice would result in a rather a rise of about 7 meters. The volume of the Greenland ice sheet is about 2.85E6 km³. Fusing completely would be equivalent to a volume of water of 2.26E6km³ (assuming for the ice an average density of 0.92 and for the water of 1; the density of water is actually a little 'less, because the oceans are well warmer than 4 ° C. The figure given is therefore an underestimate). Dividing this value by the area of the oceans and seas you get a level increase of 7.25 m.

THE RISK FOR INTENSE RAINS _ respect to changes in the rainfall regime, the increase in frequency and intensity in many regions, another risk for the city is flooding, the effects are even more likely to occur in acute and those cities crossed by water bodies.

"Today, floods are more numerous and the banks of rivers
are wiped out faster.
There is no place to go,
my land is in the river, I have nothing. "

Intsar Husain, Antar Para, northwestern Bangladesh, 2007

If climate change is "external factors", the way cities are built, their shape, the materials they are made of spaces and buildings, underground services and technology systems, represent the "internal factors" (Gisotti, 2007). At the base there are significant distortions of the hydrological cycles, the model in question is that of large areas waterproofed, maximum extension of collection of water to facilitate the rapid through the territory of the water used. With the effect of having reduced the waterproofing of the large sponge that is the soil, thus increasing the risk of flooding of areas which in the meantime have been the subject of settlement. The management of water in urban areas is entrusted to a complex system consisting of a set of works such as surface drainage, pipes for the conveyance of stormwater and sewage and wastewater treatment plants dedicated to civil and / or production products outbuildings which drains , storage tanks and pumping stations. In Italy, for example, the majority of the sewer does not provide for the division of civil and industrial wastewater by rainwater, and consequently an increase in frequency and intensity of weather events may cause, as a possible system responses, is insufficient capacity for drainage of the sewer system, and a lowering of the efficiency of the purification treatment plants, with a risk of spillage of untreated water in surface water bodies. The problem becomes even more important in the presence of water bodies, due to rising sea levels, precipitation intensity, are likely to be characterized by floods that exceed the capacity of the riverbed, flooding portions of land, more or less extensive. The hydraulic works on rivers, have always been made with respect to parameters almost constant, which does not take account of "tears" in the rainfall regime and thus the most important natural disasters. Often engineering projects and sector plans (in Italy the Basin Plans), were made with purely geometric and hydraulic methods.
So in summary, the flooding can occur for two main reasons: to flooding of a stream of water (rainfall that exceed the capacity of the riverbed, or storms) the failure of the drainage system of the lamianar rainwater. The scope of the waterways that run through urban areas tend to have higher peaks and lower outflows full basic compared to the size of the contiguous rural areas, also the frequency of floods along the rivers that drain areas Urban has a tendency to increase significantly over the period in which the urban area did not exist (Leopold, 1968).
Changes in the "delay" between the peak (point or maximum value) daily rainfall and peak flow are crucial aspects of urban water balance as they affect the distribution of peaks in full and the occurrence of flooding. The presence of areas artificially waterproofed not only tends to increase the volumes of water intended for the collector, but substantially modifies the distribution over time. Runoff on these areas began almost immediately, when in fact the original natural permeable surfaces (or with greater permeability than the artificial ones), a good deal of rain infiltrated into the ground before it innescasse the phenomenon of the provision of water collector: which means that the response to rain in a river basin as amended will be much

faster. This is accentuated by the improvement of stormwater drainage networks that accompany the development of an urban area and accelerate the conveyance of water downstream even at the expense of the basic flow. Thus, due to the sealing of the soil and of the increase of hydraulic efficiency of drainage networks, is changed substantially, as a result of a specific event of rain, that parameter is critical that the "delay time". Of changes in delay time, resulting from the expansion of urban areas, have dealt with several authors which show that, at equal "relationship of the basin", the delay time decreases proportionally to the degree of urbanization and development of drainage networks (Blows, 1984). The combined effect of the increased volume of runoff and reduced time to waste water consists in the increase of flood peaks is perhaps the most striking effect of the urbanization process (Kibler et al., 1981).

HEAT WAVES AND EFFECTS OF THE URBAN ENVIRONMENT CLIMATE LOCALE_ Heat waves have become more frequent and intense in recent years, according to scientists, would be one of the ways in which global warming would occur wide weather, which in the short period. It 'a period of time during which the temperature is unusually high compared to the average usually experienced in a given region at that time and persistence characteristics. The term is therefore not objective meaning, but refers to a region (or rather, a local climate) in the sense that what is perceived by the population as an excessive temperature in a temperate climate may not be in a climate more hot. By way of example, the Netherlands Royal Meteorological Institute defines wave of heat over a period of at least 5 days with maximum temperature above 25 ° C of at least 3 with temperature above 30 ° C. In Europe this summer heat waves are usually linked to latitudinal shifts sub-tropical African normally stationed at sub-tropical latitudes, while in other parts of the world are always the sub-tropical anticyclones matrix to its calculation.
A study of Legambiente 2007, has analyzed one of the most critical periods in recent years (remember also the heat wave of 2003), in which the temperatures in many Italian cities were out of the media and very clearly, were monitored nine cities, from Palermo to Turin, via Trieste, Milan, Bologna, Florence, Rome and Naples, all, with the exception of Bari, did record a record heat in the first six months of 2007, a year which represents an anomaly yes but at the same time a worrying sign of continuity, together with past extreme events.
A study, published online on GaiaNews in June 2011, compared the summers of 2003 and 2010 in Europe. The results indicate that the extreme temperatures in 2010 affected an area twice the size of the affected area in 2003. Many Eastern European cities have experienced very high daytime temperatures, for example, Moscow has experienced daytime temperatures warmer than 38.2 ° C (about 14 ° C above normal). This has resulted in deaths, loss of crops and an economic loss of $ 15 billion. Research has shown that for Europe in 2010, there was a period of record high temperatures in July that was maintained until the second week of August and in many parts of Eastern Europe, the weekly average temperatures and seasonal were respectively 12 ° C and 5 ° C above the average. It 'has been estimated that more than two million square kilometers (an area 50 times the size of Switzerland) recorded temperature peaks unprecedented.
Beyond the alarming data recorded during these events, the concern comes from the scientists' projections that involve an increase in the frequency of these phenomena. And then, the big problem of the "Hot in the City", is that these external factors acting on welfare and urban climate, and which can be mitigated in the long term on a global scale, you add internal factors, intrinsic, identified in the physical structure of the city (in materials, technologies, emissions of greenhouse gases in the urban form). In fact, compared to this specific problem, the city shows more than ever, the active role of negative-as we discussed earlier, not only passively by an external factor, such as the heat wave, due to global warming, but actively participate in the overheating of the city and the occurrence of the phenomenon known as "heat island effect".

A NEW GEOGRAPHY OF RISKS_ **The city is faced with a new geography of risks related to climate change, with processes that have yet to be studied and evaluated in particular with respect to how we can accelerate processes of hydrogeological already present and at the same time establish new dangerous situations related to extreme weather events.** To come up with a mapping of climatic hazards in urban areas need to go beyond traditional territorial and environmental analysis, with specific and more complex studies in which the same reading of ecosystems, natural resources and aspects of weather-climate will become more complex and dynamic. This map is the precondition to rethink planning at different scales, so that they take the issue of adaptation to climate change as the design theme, and identify strategies and actions to increase the resilience of open spaces and upgrade with energy and environmental objectives tissues urban (Zanchini, 2012). **The comparison with a future not always predictable, because dependent on a plurality of parameters of which many variables and not controllable, criticizes the traditional luggage analysis and planning tools and design, according to the need to search for information, data and constraints, not only in the past and in the present, but also in the future, because it is in relation to it that you have to stand up and answer questions.** This results in the creation of MORE AND MORE SPECIFIC STUDIES, which will cross the traditional analysis to make choices valid over the years, thanks to a system of knowledge, skills and technologies.
This produces new tools to service planners and architects to plan the "WHERE TO BUILD", but also "WHERE NOT BUILD" and more importantly, for the search "HOW TO BUILD" because it calls into question the whole city, one built, consolidated, its shape, its spread within and squeezing the

margins between land and river basins. The new geography of risk and the degree of vulnerability of the areas involved in it, laying the groundwork for the questioning of materials, technologies and forms through which they are constructed: at the same time, guide the choices of action by accepting the presence activities and living those spaces, minimizing the possibility of relocation, in favor of processes and flexible structures, to improve resilience to possible impacts. The many maps produced in several cities that have addressed these issues, we show that, by analyzing through this new lens tissue, the risk of producing A NEW FORM OF THE CITY and context assumes different characteristics, contributing to the occurrence of the problem and suffering it, so heterogeneous. It is this new city, latent and invisible, the result of climate change and the conditions of employment land, the place of the adaptation project, for which, and the URBAN ARCHITECTURE, can and should play a major role, reinterpreting the theme of uncertainty and flexibility to capture the value of innovation in the space in which they operate and take shape.

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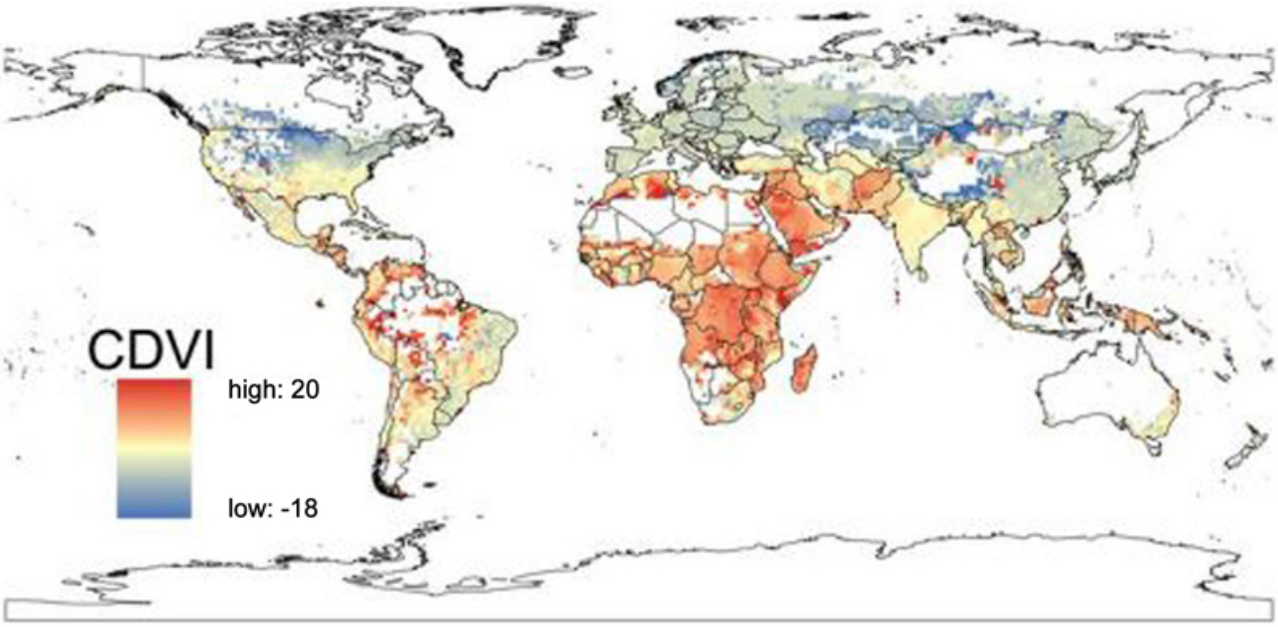
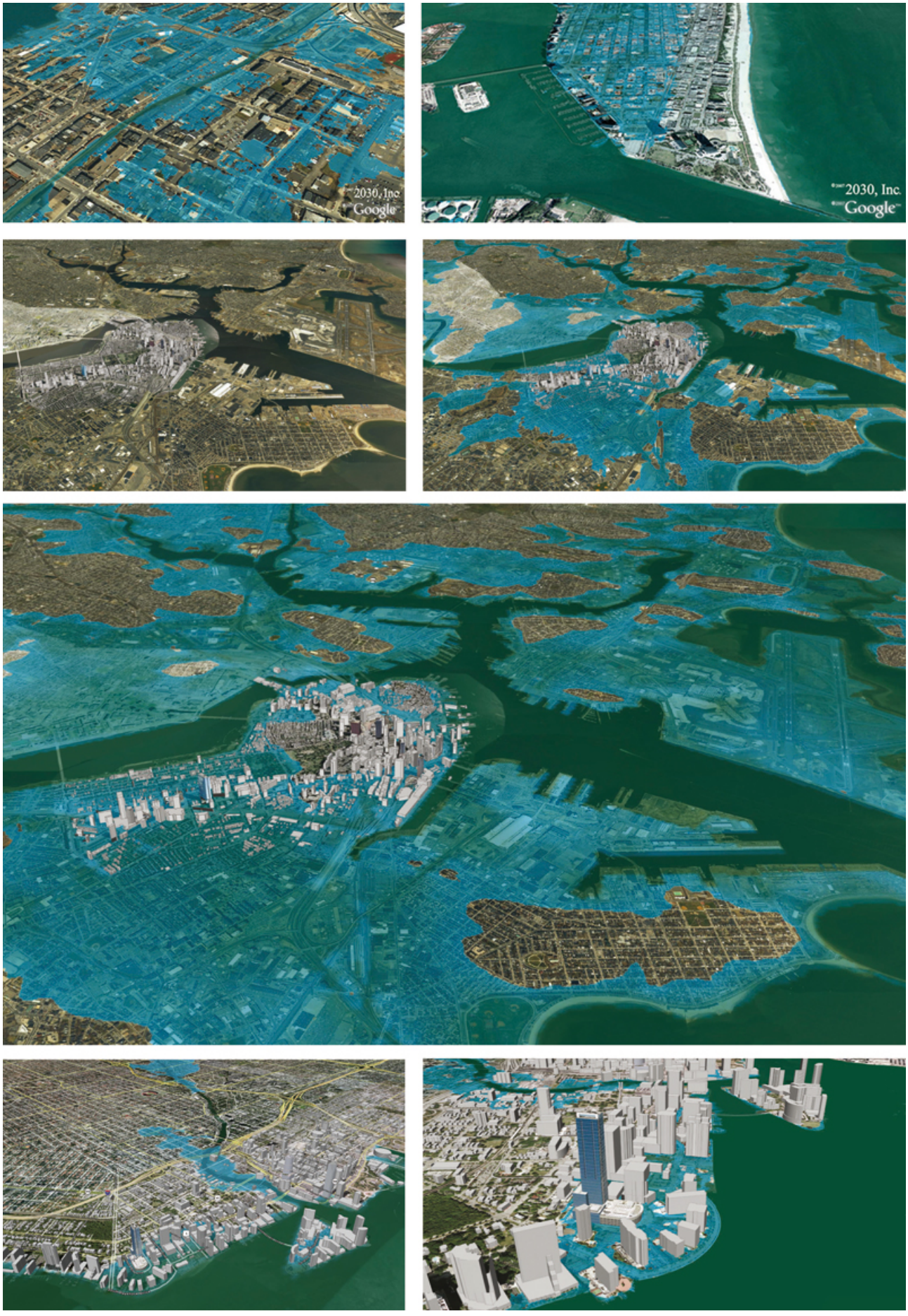
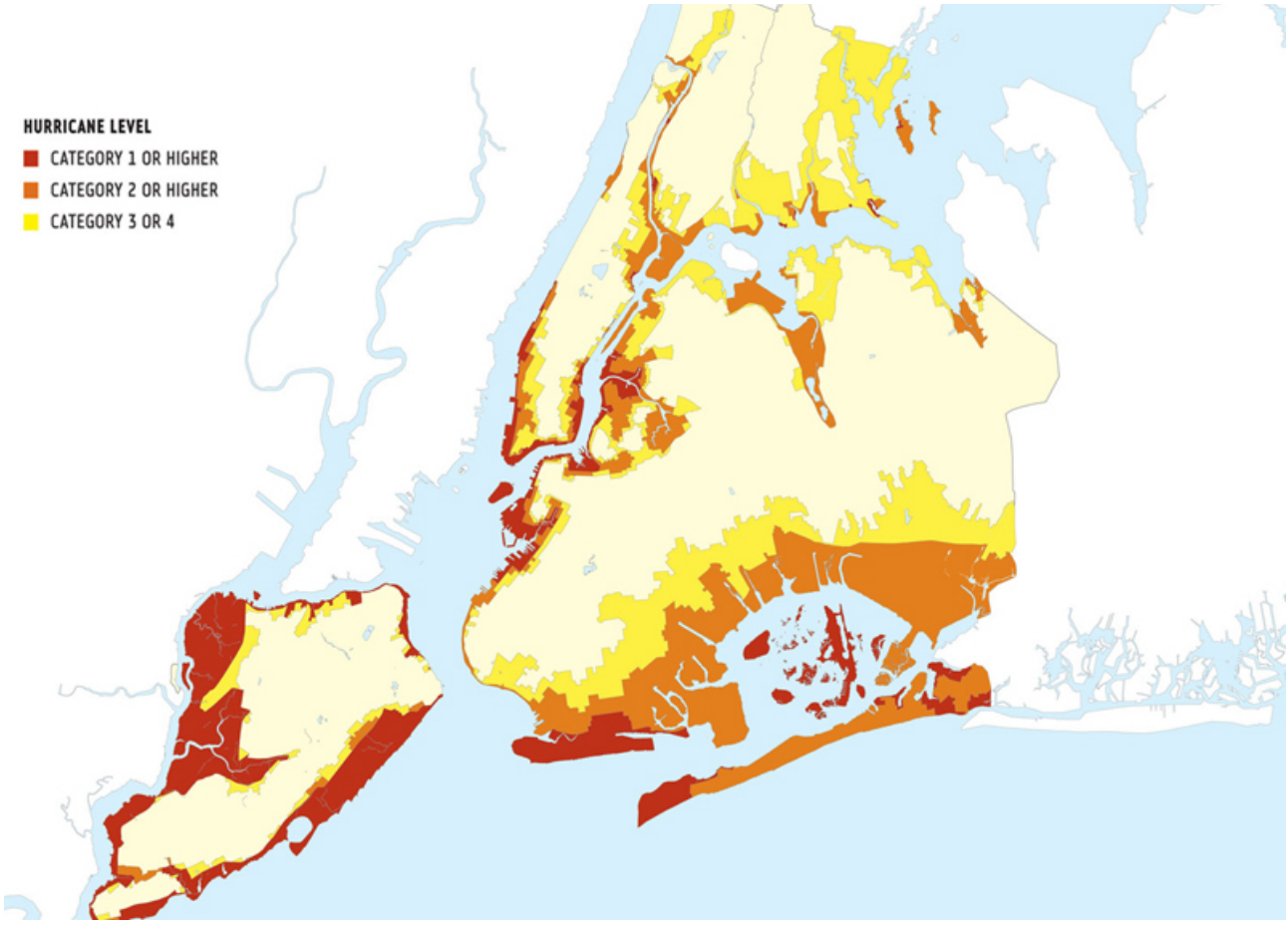


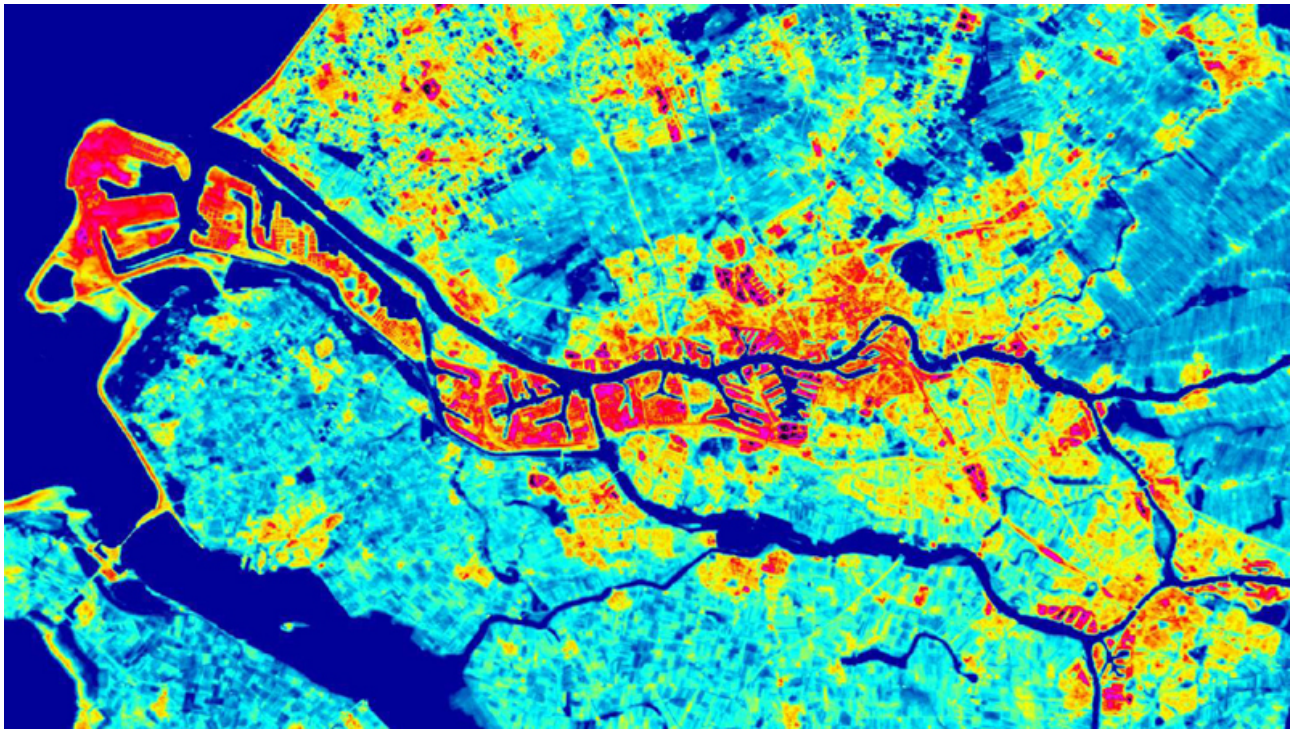
1 - Map of level of human vulnerability to climate change produced by a graduate student at McGill University, Jason Samson (2011).



2 - Maps produced by the association environmentalist Architecture 2030: have been calculated using elevation data government combined with Google Earth maps



3 - Map of areas at risk of flooding in New York. Source: PLANY2030



4 - Rotterdam, map made with the thermal camera. The image shows how the artificial parts and denser overheating much more than the permeable areas, therefore more subject heat island effect.