

Design of Cities at the time of resilience and climate change. Experiments in Rome and Puerto Rico looking at Africa

ANNA IRENE DEL MONACO¹

Abstract: This paper collects design experiments elaborated in research and teaching activities developed on case studies in Sudan, Italy and Puerto Rico. They propose comparable design solutions for different conditions with respect to scale, geography and climate. At least, they try to define design methodologies useful in other design contexts with similar economic conditions. This paper represents a preliminary reflection which deserves further and more extended analysis.

Keywords: resiliency, climate change, Puerto Rico, Sudan, Isola Sacra (Fiumicino).

Design issues crossing different contexts

This study is focused on experimenting resilient² principles and approaches – intended as “the capacities of cities to help absorb future shocks and stresses to its social, economic, and technical systems and infrastructures” – for the design of new settlements and the transformation of existing urban areas to prevent climate change and natural risks. The design experiments have been elaborated on case studies in countries like Sudan, Italy and Puerto Rico, and have the challenge to propose comparable design solutions despite the different conditions of scale, geography and climate and in other architectural design contexts with similar – or partially comparable – economic conditions. The idea is to try to preconize the impact

1. Anna Irene Del Monaco, Assistant Professor in Architecture and Urban Design, Sapienza University of Rome, email: anna.delmonaco@uniroma1.it.

2. As definition of Resilient City we consider the two following ones: 1) The Rockefeller Foundation's 100 Resilient Cities programme is designed to promote urban resilience around the world, the programme will award grants to 100 cities that “have demonstrated a dedicated commitment to building their own capacities to prepare for, withstand, and bounce back rapidly from shocks and stresses”. (<https://www.rockefellerfoundation.org/blog/33-resilient-cities-announced-by-the-rockefeller-foundation/>); 2) A Resilient City is one that has developed capacities to help absorb future shocks and stresses to its social, economic, and technical systems and infrastructures so as to still be able to maintain essentially the same functions, structures, systems, and identity.” (<https://www.resilientcity.org>). Those definitions are not so different from the one that John Todd and his wife Nancy Jack Todd provide of the term “sustainability” the capacity of a system to preserve an equilibrium in the book by Nancy Jack, *From Eco-cities to Living Machines*, North Atlantic Books of 1993 (Jack 1993). (<https://www.oceanarksint.org/about-us/>)

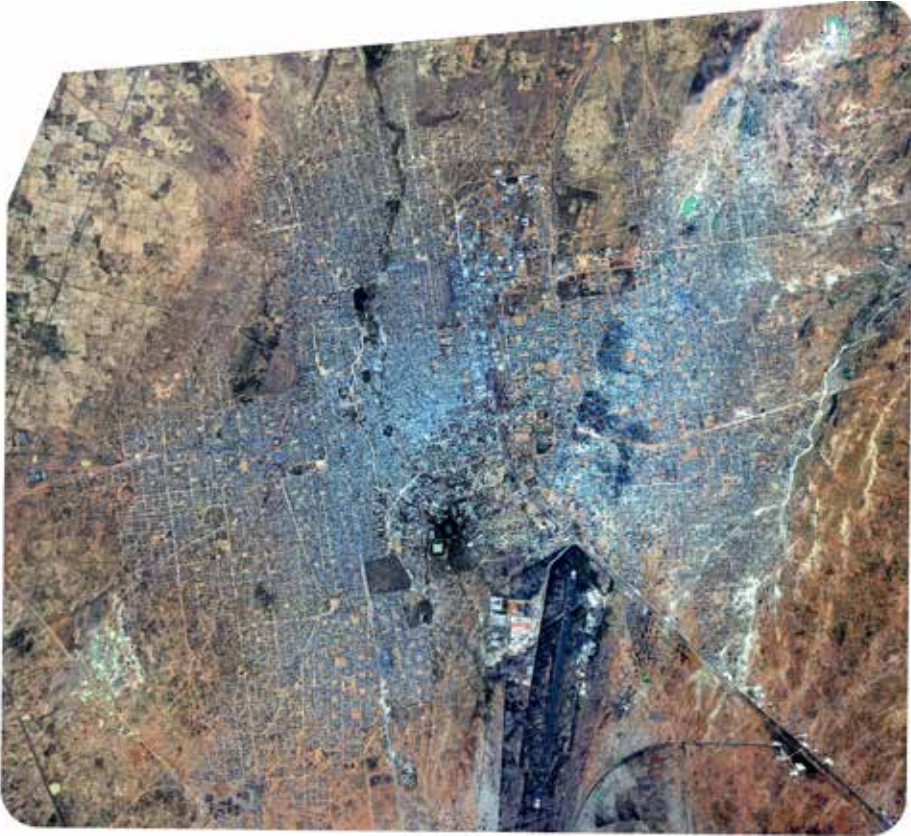
of major problems as climate change, sea level rise, natural hazards on the process of designing architecture at all scales, and consider the lack of the economic resources and infrastructural upgrade which affect several urbanized and overpopulated areas.

My first encounter as designer with the problem of natural hazards within urban settlements was the flooding seasonal issue recurring in El Obeid, the capital of North Kordofan (Sudan, today Sud Sudan), caused by the flooding of the *wadi*³ during the raining season and damaging the existing self-built settlements. Between 2005-2006, infact, I spent some days within two survey-trips in North Kordofan (and several other field trips in Khartoum), as assistant project manager in the framework of the design and planning activities of the Joint Venture MEFIT Sudan/Sapienza University of Rome – established after winning an international competition – lead by Lucio Barbera with the involvement of the School of Economics, the School of Medicine, the School of Geology, the School of Anthropology of Sapienza. The work was developed at the initial stage and was abruptly suspended between 2009-2010 for political reasons. Then, the Sudanese office continued the elaboration with local actors. But the outcomes produced by Sapienza team (jointly or for specific tasks) – although suspended at a very initial stage – produced highly qualified inception and research reports, surveys, etc. Among them there were also some initial design schemes as the sketches (arch. Corrado Giannini, project leader prof. Lucio Barbera), the thematic maps (arch. Anna Irene Del Monaco) and the flooding analysis (Consulting firm involved by Mefit Sudan) (Fig.1) presented.

The second experiment I had chance to follow on flooding problems came through the graduation thesis (2013-2014) of Claudio Gatta, a design topic in Paraguay, *An urban project for Costanera of Asunción*⁴ (Fig. 2),

3. *Wadis* are located on the gently sloping, nearly flat parts of deserts; commonly they begin on the distal portions of fans and extend to inland sabkhasor playas (see Wikipedia).

4. Claudio Gatta, *An urban project for Costanera of Asunción*, in L'ADC "L'architettura delle città – The Journal of the Scientific Society Ludovico Quaroni" n.3-4-5, 2014. "Progetto Urbano Costa di Asunción – P.U.C.A." (Urban Project of Asunción's Coast) is the title of the undersigned's (awarded the cum laude honor) master's thesis, developed between July 2013 and June of 2014, under the supervision of Prof. Anna Irene Del Monaco from Sapienza – Università di Roma (Rome, Italy) and Prof. Ricardo Meyer from UNA – Universidad Nacional de Asunción (Asunción, Paraguay). The thesis project has been awarded the Sapienza Foundation scholarship and honor on June 20th 2013, allowing for a three month (July-October 2013) in-situ stay, during the initial phase of the investigation. Visits – even dealing with situations of relative risk – and established relations with local occupants of the project's area gave the operative guidelines of the work: designing with social compromise, involving the recipients concretely in the construction of the project in an attempt to interpret their wills and expectations. The objective was to return a project capable of generating what seemed to be, to the eyes of whom is writing, often missing



El Obeid, Nord Kordofan.

conceived to face the progressive erosion of the coastline caused by the actions of the waters of Paraguay River. This thesis was running in parallel and soon after the final elaborations of a long-term on-field research work and two design studios abroad on Hangzhou (a Chinese water city) started in 2010 and ended up with a publication on 2017.⁵ The strategy proposed was to separate the local traffic and major urban flows by superimposing the last ones on elevated roads destined to heavy traffic, arrange floodable parks, terraces at different levels to shape the orography of natural elements and constructed embankments. Therefore this approach intended to reduce the 30% of soil movements with respect to the 2004 preliminary project and to reduce costs for hydraulic filling and environmental impact on the bay's ecosystem.

in the thoughts and looks of the local inhabitants: confidence in one's capabilities, hope in a better future, expectations that things will go better."

5. DEL MONACO, DAI, YU 2017.



Fig.1. El Obeid, Nord Kordofan. Sketches and studies on the definition of the urban lots and the proposal of defining a park in correspondence of the wadi flooding area (arch. Corrado Giannini, project leader prof. Lucio Barbera), 2006-2007.

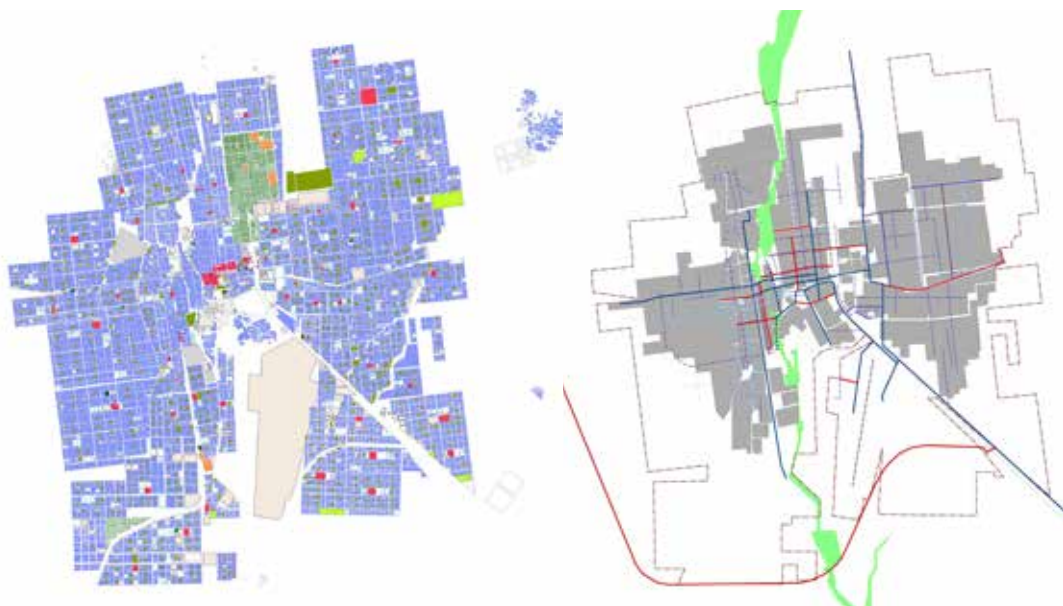


Fig.1. El Obeid, Nord Kordofan. Analysis and studies on the urban lots (green areas, functional programme, roads hierarchy, etc.) arch. Anna Irene Del Monaco, project leader prof. Lucio Barbera). 2006-2007.



Fig.4. Graduation Thesis by Claudia Miconi. "Puerto Rico Restart - Untapped economic development opportunity, San Juan" (October 2018). The urban development proposed the possibility to reconstitute the Isla Grande morphology remodelling as it was in the past and increasing high density neighborhood to relocate inhabitants of for new inhabitants: according to geologist before or after the water will take over again.

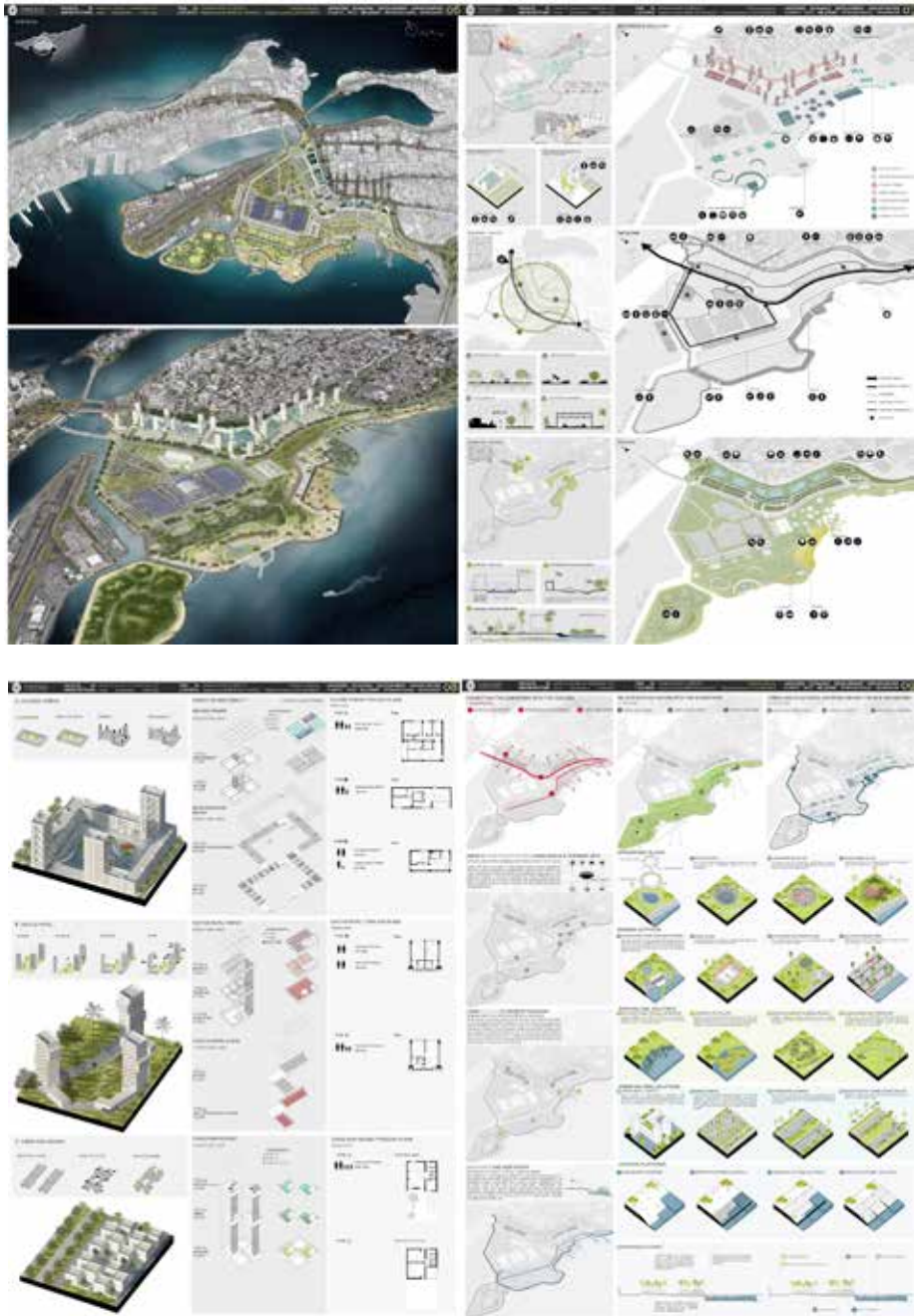
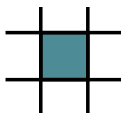


Fig.5. Graduation Thesis by Rosa La Brocca. "Puerto Rico Restart - Untapped economic development opportunity, San Juan" (October 2018). The project propose alternative solutions to improve the infrastructural lacks especially in proximity to the bridges connecting Santurce and Old San Juan.



Flooding area = 50 he



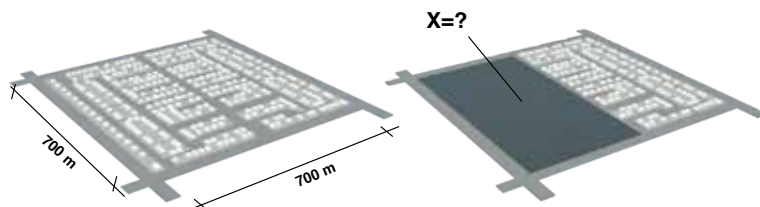
Population involved= 50 he x 30p/he = 1.500 people



Dug Area = ?



People to relocate=?



Hypotesis:

- 1) the aim is to save the maximum quantity of built soil elevating it up to 7' above the present Sea Level
- 2) the built areas are grouped in two cathegories:
 - a) blocks and plots with an above sea level average height of 3'
 - b) blocks and plots with an above sea level average height of 5'

general formula
(A-X)*h1=X*h2

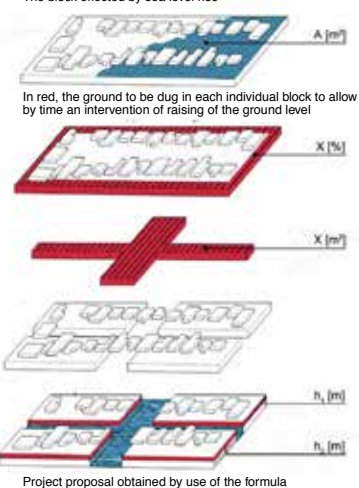
A = Part of the urban block affected by flooding

X = Area of A to be dug

h1= Refill Hight

h2 = digging depth

The block effected by sea level rise



In red, the ground to be dug in each individual block to allow by time an intervention of raising of the ground level

Plots and Blocks affected by 4' Sea Level Rise flooding

$$(A-X)3'=X4'$$

$$A=100$$

$$h1= 3'$$

$$h2= 4'$$

$$x= 42,8\%$$

Plots and Blocks affected by 6' Sea Level Rise flooding

$$(A-X)3'=X6'$$

$$A=100$$

$$h1= 3'$$

$$h2= 6'$$

$$x= 33\%$$

Fig.3. Experimental "algorithm" proposed by Lucio Barbera for the Miami river basin during the Miami Workshop (2016).

Advisor and Co-Advisors for a Graduation Thesis Seminar on Miami Urban Future.

prof. Lucio Barbera;

prof. Francesco Napolitano,

prof. Anna Irene Del Monaco

Tutors: Silvia Aloisio, Dario Orlando, Alessandro Romano, Valentino Matteis;

students: Alessandro Stracqualursi, Teresa Pagano, Marta Rigato, Luca Pozzati.

In the meanwhile, the UNESCO Chair in “Sustainable Urban Quality and urban Culture, notably in Africa” was established at Sapienza (Chair-holder Lucio Barbera; Secretary-general Anna Irene Del Monaco) and a strong collaboration was initiated with the University of Florida, in particular with the Consortium for Hydrogenated Urbanism (prof. Martha Kohen, prof. Nancy Clark), initially, with lectures in Italy during UF students residency in Vicenza, followed by the invitation of Lucio Barbera in 2015 at University of Florida for a conference on Africa (*Schools of Architecture/Africa: Connecting Disciplines in Design and Development*). Then, on March 2016 with the involvement of the UNESCO Chair in the Design Studio Abroad *Miami Urban Future* held in New York (conference stage) and in Gainesville (design stage) with US and Italian students. On the Miami design topic at least six graduation thesis followed in Rome by Italian students. The results of these applied design experiments focused on the Miami urban areas – Brickell, Everglades and the Miami River Basin – have been presented in Rome during the conference *Sea Level Rise and the Future of our Coastal Settlements: Evolving Concepts in Urban and Cultural Adaptation to Changing Environments* (2016) and are being published within 2019 by Nancy Clark. Although the context and the general condition of the cases discussed up to here were deeply different and geographically far, that methodologies and design approaches were considered also for other studies. Both the one more traditional briefly tested in Sudan and those experimented in Miami inspired by more recent studies on climate change as the one of Kristina Hill⁶ and the newly tested experimental “algorithm” by Lucio Barbera (Fig. 3) to define the quantity of earth removed and remodeled to raise the level of the new houses. Then, in line with some outcomes of the Miami workshop design themes on October 2018 other students – Claudia Miconi (Fig. 4), Rosa La Brocca (Fig. 5), Maurizio Zerella (Fig. 6) – graduated on different topics, with similar problems in Puerto Rico. These thesis on Puerto Rico were focused on a design intervention of urban densification and infrastructural improvement in Santurce (a typical historical tourist area which had been losing inhabitants in the last decades and is under the attention of developers and private local investors). La Brocca and Miconi worked close to Old San Juan – recently renovated – and to the private airport. Zerella worked in proximity of the line of the Tren Urbano in Puerto Rico, an almost unused,

6. HILL 2002.



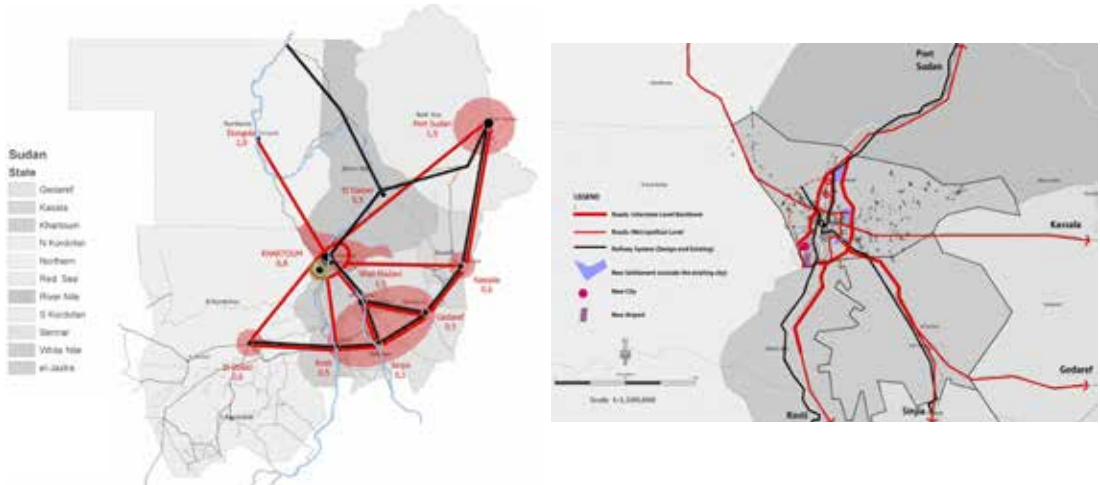
Fig. 8: Francesca Petrucci. Graduation Thesis, "Living with water, the future of Isola Sacra", Roma. Advisor: Anna Irene Del Monaco, Co-Advisor: Francesca Giofrè. Ordinary and compact residential units, low density, located in a periurban context is organized to coexist with the water (Graduation thesis to be discussed in early 2019).



Fig. 9. Luca Gentili. Graduation Thesis, "Living with water, the future of Isola Sacra", Roma. Advisor: Anna Irene Del Monaco, Co-Advisor: Francesca Giofrè. Ordinary and compact residential units, low density, located in a periurban context is organized to coexist with the water. (Graduation thesis to be discussed in early 2019).



Fig. 6. Above: Graduation Thesis by Claudia Miconi and Rosa La Brocca: Analysis of the infrastructural system in Puerto Rico, abandoned railway tracks along the island perimeter (former sugar cane industry railway tracks). Below: Graduation thesis by Maurizio Zerella. The railway track of the Tren Urbano crossing only some of the urban territories of San Juan, Puerto Rico.



160

and dysfunctional infrastructural line with higher potentiality than the actual line in use which recalls, because of the abandoned railway tracks around the island of Puerto Rico (used for the former sugar cane industry) – and the need for different economic conditions – the disabled and almost abandoned railway tracks in Sudan (although the scale and the conditions are different), built during the British Colonial phase to transport grain. It represents an old infrastructural scheme that, with the adequate investments and economic-political objectives, would still be effective in current times (Fig. 6-7). Other two thesis to be discussed in the early 2019 by Francesca Petrucci (Fig. 8) and Luca Gentili (Fig. 9) with the title *Abitare con l'acqua, il futuro di Isola Sacra* (Living with water, the future of Isola Sacra), in a flooding area (along the Tiber River Delta) near Fiumicino Airport and Ostia, propose the strategy to relocate the inhabitants living in abusive houses into the few near non-floodable areas selected by the web site Sea Level Rise viewer (<https://coast.noaa.gov>). The relocation is organized in new houses stocks – either amphibious houses or standard houses with the uninhabited ground floor – which are conceived to “coexist” with the raising water. The new housing interventions proposed by the two projects elaborated for the graduation thesis by Petrucci and Gentili, in completion, have been conceived as compact and small urban interventions, suitable for affordable economic investments by small enterprise. In the relocation process-project for the existing inhabitants an additional number of houses and apartments has been considered to make the project attractive for developers, as it was, for example, with the intervention at Via Giustiniano Imperatore (2010) designed and built by ABDR Studio in Rome. The study area of Isola Sacra, which already attracted the attention of several scholars for years (planners, archaeologists, sociologists), had been selected together with Nancy Clark and an official of Lazio Region, engineer Paolo Lupino with a long-term experience on the coastal risks, during the Conference *Urban Adaptation Initiative* held in Rome in June 2017 attended by all the graduating students. A relevant aspect which I have been considering is that in the majority of bad urbanization cases (formal, informal, distressed urbanization), – beside the topic of resiliency and climate change –, deal with the *open* issue of *rethinking city limits*,⁷ which includes, as a consequence, the rethinking of infrastructures (physical/non-physical) and the *nature* of settlements

7. DEL MONACO 2012.

(urban, non-urban, rural). This kind of condition, going back to Africa, is evident in Khartoum (surrounded by informal ring of settlements), and is also evident in Durban, South Africa,⁸ where the downtown is not any more inhabited while the constellation of the “informal” settlements⁹ surrounding the “formal” city are the most alive and vibrant *social entity* of the overall urban community. Similar observations, carefully differentiating, could be elaborated for the “Toponyms” in Rome¹⁰ (the second generation plans for former abusive areas approved during 1980s).

Bibliography

DEL MONACO 2012

Anna Irene Del Monaco, *Città e limes, Rome, Beijing, New York*, Nuova Cultura 2012.

DEL MONACO, LIU, LUCKAN, TECLE 2018

Anna Irene Del Monaco, Liu Jian, Yashaen Luckan, Belula Teclé (eds), *Durban. A Cogent African City*, L'ADC UNESCO Chari Series#4, Nuova Cultura 2018.

DEL MONACO, DAI, YU 2017

Anna Irene Del Monaco, Xiaoling Dai, Wen Bo Yu, *Hangzhou: from Song Dynasty Capital to the Challenge of Cultural Capital in Contemporary China*, L'ADC UNESCO Chair Series#2, Nuova Cultura 2017.

GOUVERNEUR 2015

David Gouverneur, *Planning and Design for Future Informal Settlements*, Routledge 2015.

HILL 2002

Kristina Hill, *Ecology and Design. Framework for Learning*, Island Press 2002.

JACK 1993

Nancy Jack *From Eco-cities to Living Machines*, North Atlantic Books 1993.

PIETROLUCCI 2017

Marco Pietrolucci, *Verso la realizzazione delle microcittà di Roma*, Skira 2017.

QUILICI 2007

Vieri Quilici, *Roma capitale senza centro*, Officina 2007.

8. DEL MONACO, LIU, LUCKAN, TECLE 2018.

9. GOUVERNEUR 2015.

10. QUILICI 2007, PIETROLUCCI 2017.