WATER RISK CONDITIONS AS PARADOX

Water risk condition as catalyst for future challenges:the strategic, cultural and designing dimension of Green and blue Infrastractures for the resilient design of the contemporary city.

Gaustra

CASE STUDY OF THE ELBE RIVER IN DRESDEN, GERMANY

Daniele Caruso

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DOTTORATO IN URBANISTICA

XXXII ciclo

Anno accademico 2019/2020

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Abstract

The thesis of research on the relationship between water and the city is configured in his entirety as an opportunity of study that aims to the comprehension of historical dynamics which have put in tension over the time the role of the water and the relationship with the urban design within the city. Particularly, the purpose is to shed light on those aspects of physical and social and cultural character that have been retained of relevant interest for the identification of mechanisms of control and water management before effects induced by climate change.

The structure of the research is articulated in different sub-chapters, whose scope is those to explicit with a certain clarity the attention to the theme of water-related risks which in particular contexts does not want to be brought to the light as a consequence of recent events, but rather as a testimony of a sensibility towards the ecological questions along a many centuries-old period.

In a first phase, the aims are to intercept those risk conditions historically associated to the water by reconstructing articulated relationships between this resource and the city, as well as the "hydraulic culture" (Viganò, 2012) that within specific contexts has permitted to domesticate this resource also in the light of more extreme conditions. This first stage allows to focus the attention on more or less conscious historical processes of adaptation of the city to the water and to reconstruct sceneries of daily coexistence, as well as the conscious use of spaces by resorting to iconographic sources.

Following, the attention is given to specific processes that starting from the XVIII century have given birth to a series of dynamics of transformation in order to pursue specific purposes. The third chapter permits to make evidences of consequences already mentioned and the recognition of a fundamental role of open spaces of ecological-natural value. This allows to attribute a specific interest to temporary uses that community and users make of them, by emancipating that hydraulic culture above mentioned as an acquired characteristic on the basis of direct experience.

The case study of Dresden in his extraordinary and his contradictory conditions represents an important reference to understand the perspectives of these constant behaviors in the light of recent episodes of flooding and climate change-induced effects. The conclusion of the research dedicates a substantial space at the comparation of the case study with other cities, in particular in Germany, by highlighting innovative aspects in certain cases that demonstrate an absolute awareness compared to the necessity to return to conditions of major coexistence between ecological conditions and the city. In the last chapter of the case study the research focuses on the wide debate on "Green and Blue Infrastructures", which is configured in the last years, in particular in Europe, as one of the strategical responses to flooding and the increasing "environmental question", but also as well as an instrument of spatial reorganization in terms of the equitable offer of new and qualitative public spaces.

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Abstract

La tesi di ricerca sul rapporto tra l'acqua e la città si configura nella sua interezza come un'opportunità di studio che mira alla comprensione delle dinamiche storiche che hanno messo in tensione nel tempo il ruolo di questa risorsa e il rapporto con il disegno urbano all'interno della città. In particolare, lo scopo è quello di far luce su quegli aspetti di carattere fisico, sociale e culturale che sono stati ritenuti di rilevante interesse per l'individuazione dei meccanismi di controllo e di gestione in tempi non sospetti, e comunque prima degli effetti indotti dai cambiamenti climatici.

La struttura della ricerca si articola in diversi sottocapitoli, il cui scopo è quello di esplicitare con una certa chiarezza l'attenzione al tema dei rischi legati all'acqua che in particolari contesti non vuole essere portato alla luce come conseguenza di eventi recenti, ma piuttosto come testimonianza di una sensibilità verso le questioni ecologiche lungo un arco di tempo plurisecolare.

In una prima fase, gli obiettivi sono quelli di intercettare quelle condizioni di rischio storicamente associate all'acqua ricostruendo articolati rapporti tra questa risorsa e la città, nonché la "cultura idraulica" (Viganò, 2012) che all'interno di specifici contesti ha permesso di addomesticare questa risorsa anche alla luce di condizioni più estreme. Questa prima fase permette di focalizzare l'attenzione su processi storici più o meno consapevoli di adattamento della città all'acqua e di ricostruire scenari di convivenza quotidiana, nonché l'uso consapevole degli spazi ricorrendo a fonti iconografiche.

In seguito, l'attenzione è rivolta a specifici processi che a partire dal XVIII secolo hanno dato vita a una serie di dinamiche di trasformazione per perseguire scopi specifici. Il terzo capitolo permette di evidenziare le conseguenze già citate e il riconoscimento di un ruolo fondamentale degli spazi aperti di valore ecologico-naturale. Ciò consente di attribuire un interesse specifico agli usi temporanei che la comunità e gli utenti ne fanno, emancipando quella cultura idraulica di cui sopra come caratteristica acquisita sulla base dell'esperienza diretta.

Il caso di studio di Dresda nelle sue condizioni straordinarie e contraddittorie rappresenta un importante riferimento per comprendere le prospettive di questi comportamenti costanti alla luce dei recenti episodi di inondazioni e degli effetti indotti dal cambiamento climatico. La conclusione della ricerca dedica uno spazio sostanziale alla comparazione del caso studio con altre città, in particolare in Germania, evidenziando in alcuni casi aspetti innovativi che dimostrano una consapevolezza assoluta rispetto alla necessità di tornare a condizioni di maggiore coesistenza tra condizioni ecologiche e città. Nell'ultimo capitolo del caso studio la ricerca si concentra sull'ampio dibattito sulle "Infrastrutture verdi e blu", che si configura negli ultimi anni, in particolare in Europa, come una delle risposte strategiche alle inondazioni e alla crescente "questione ambientale", ma anche come strumento di riorganizzazione spaziale in termini di equa offerta di nuovi spazi pubblici di qualità.







Map: Grundriss Von Dresden - Nebst Einen Theil Des Daran Stosente Teran, 1765.



Water risk condition as paradox. The extreme water risk condition as increasingly ordinary approach in the practices of urbanism: the role of green and blue infrastructures.

This research focuses on the condition of water risks within cities, in particular the complex and dynamic relationship between water and the city as an ordinary condition that describes the contemporary city.

The sequence of projects and urban policies that have been realized in recent decades has shown a consistent change of paradigm in dealing with the theme of vulnerably caused by the presence of water in cities, as well as by the numerous complex relationships that are involved.

The term 'paradox' is therefore in this thesis not intended as an extraordinary dimension within the field of scientific research, but rather as expedient to reinforce this tendency by demonstrating that in some cases the ability to adapt to extreme circumstances and thereby responding adequately to climate change is connected to a mature awareness that has been developed over the centuries. What the adjective until a few years ago describes as an anticipatory process of design plans in extreme geographic areas is nowadays a tool that justifies the more general use of these resources to deal with the phenomena caused by climate change and proved a concrete response to social-ecological requirements.

The historical adaptation processes and urban planning dynamics demonstrate that values and roles attributed to water in unsuspecting times compared to climate change have contributed to generate a virtuous resilient mechanism that allows today to respond to harmful phenomena on the basis of ordinary approaches. Within this thesis, these processes aim to shed light on questions that has characterized the dynamic relationship between water and city in terms of social and ecological relationship, and on aspects that have determined specific spatial metamorphoses and characters for the construction of the city.

Processes and dynamics, as well as adequate use of waterscapes (the iconographic sources in the case study prove an important deposition compared to intelligent and flexible uses of these landscapes), result in questions about the capacity of cities to respond to these events, which despite their continuous presence in the history of cities, are today exacerbated by the pressure of climate change emergencies.

In this emergency condition "Green and Blue infrastructures" assume to have a relevant role, both in comparison with the capacity to find a central position, in the history of cities, in the phases of adaptation and in the light of recent phenomena that have a strong capacity in this network of spaces to deal with critical circumstances. The case study highlights the tendency to see the relationship between water and the city and all the risks that follow as an opportunity that has occurred in history, and in the light of the latest extreme events of 2002, 2003 and 2006, the ability to interpret instruments, plans and common use of places that are under the continuous threat of flooding. The already difficult situations which is due to geographical and climatic characters, together with a cultural approach towards the presence of extreme events, have consolidated a model for planning which can give birth to interesting trajectories of urban planning that still today delineate, which are ecological, spatial and social orientated for designing cities to be more sustainable and more resilient.

The important theme about the temporary and contemporary use of spaces that are normally addicted to the collection of water in excess (surplus) or flooding areas puts in tension the complex relationships between risk and social, ecological need, by emphasizing the capacity of these spaces, working both as a structured and multi-scale network or public spaces and resilient space in occasion of always more frequent extreme events. The delicate relationship between the Elbe river and the city confirms nowadays that the risk conditions have incentivised the city to activate resilient and resistance processes and to practice over time a certain ability to deal with the theme of water in the contemporary city. Important is the comparison with other international practices, particularly in Germany, which deals with the theme of water risks by approaching more to instruments of Urban design that relies on green and blue infrastructures. This demonstrates not only the great capacity of these instruments to cover multifunctional roles, but it also attributes a value to the case study, which includes the great capacity to construct a model of urban resilience over the history, that is today extremely valid and innovative.

Starting from several assumptions, which are the unavoidable circumstance with which the construction of a process has to deal with. The main objective of a research methodology is to build in an incremental process that is able to eliminate, or at least reduce the lack of knowledge, which should instead be a crucial prerequisite for the comprehension of multi-factorial aspects of water-related risks. In fact, these contribute to consolidating a specific "flood experience" (Kienzler et al., 2015). The research is collocated within a cultural

context in which urbanism has to deal with historical processes and a "new urban question" in which "environmental emergencies" and "ecological crises" already started in the XX century. However, the thesis intersects also relevant issues that are usually associated to the production of public spaces and that are "seeking spatial justice" in a context that are even more characterized by an increasing distance between social, economic, ecological spatial capital and individuals (Soja, 2010).

The emergent condition always leas to the acceleration of a complex risk phenomenon of various kinds, which are impoverishing spatial structures within urban ecosystems and notably modifying the "urban metabolism of cities" (Wolman, 1965). The theme of water management within the field of Urbanism today requires a step backwards towards the recovery of a "hydraulic culture" (Viganò, 2012) that has been superseded in several cities in favour of an expansion of urban fabrics and industrialization modelling processes. Returning to the past to manage the complexity of the contemporary city in the future is a necessity and can be achieved through what is proposed as "return of landscape" (Valentien D., 2010) in issues related to the management of several risks including water, as well as future challenges for the creation of "democratic urban spaces (Parkinson, 2012). The tendency of the project of Urbanism already welcomes ecological emergencies and economic or social exigencies, by suggesting to work as an operating system in which the complexity of biodynamic processes and resources are visualized and deployed in the footprint of urban design and the life cycles of infrastructure (Bèlanger, 2012).

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Key scopes of the research

As has already been said in several field of scientific exploration, water has always played a central role within processes of construction of cities, as well as it has been object of interest for the realization of ambitious projects of political, social, and economic nature. Today, these processes have created in different cases conditions for the generation of risks (Beck, 1986) and numerous conflicts that become a privileged observation point for observing and studying vaster themes that progressively move away from water to invest other dimensions of politics, of society, of knowledge" (Secchi, 2010).

The key scope of the research is not so much to emphasize the role of ecological and spatial relationships between the water and the city as panacea of these numerous critical aspects, as to put the attention on the coexistence of multiple issues that are influencing the resilience of cities. However, Urbanism can play a role of utmost importance within those cities that today appear to be particularly affected by major vulnerability conditions. Thus, "cities are at the center of our environmental future" and they conserve the capacity to transform negative environmental impacts to positive ones (Sassen, 2009).

The attention of the research considers the historical condition of water risk within an environmental and cultural framework dominated by critical issues as opportunity to invest toward the complexity of the contemporary city. In particular, the attention is given to multifunctional and multi-scalar capacities of green and blue infrastructures to play a crucial role in designing strategies of urban resilience and to cope with challenges posed by climate change. In the last decades in Europe these themes, in light of mutation of social and ecological condition, as well as processes of economic transformations, have assumed a strategical role for the construction of strategic guidelines, which orient in different ways urban strategies.

The solicitation of these themes, together with the pressure exerted by climate, shed light on European differences and in many cases related to different cultural backgrounds to deal with water risks, as well as climate/ geographical exposures.

However, the research on Green and Blue Infrastructures is also an occasion to invest, at local scale, theme of large conflicts, which are triggered by neoliberalist trajectories and by an enlargement of injustices in terms of access to public spaces. Green and Blue Infrastructures work as catalysator not only to look at the design and constructing culture of cities in condition extreme vulnerability, but also to challenge the future by offering a multi-scalar and multifunctional frame of public space largely accessible (Gasparrini C., 2017).

Expected outcomes of the research are to be found within assembly and disassembly of those processes of adaptive intelligence that drove cities to have to respond to water related risks over time, by highlighting cultural and design approaches that today turn out to be of great interest in light of the abovementioned conditions. The final outcome of this operation of assembly and disassembly of these processes is, on one side, to examine the fragility and virtuosity of operations of adaption to water risks, in which sometimes historical efforts also for those cities culturally and technically prepared to exposure at risks, appear to be inefficient to contrast the effects of the current mutation.

On the other side, the purpose is to highlight characters of resilience and multifunctionality of Green and Blue Infrastructures constructed through consolidated processes of adaptation, which can be used as benchmark in other contexts to design both control strategies of natural processes (e.g. natural hazards) and a new urban network that can ensure the openness of open spaces (Lynch, 1972).

The case study of Dresden is not unintentionally, since its centuries long history of adaptation to water related risks and, the relationship between the city and water and green spaces, also in light of processes of reconstruction of the entire city post II World War, and for an ever increasing "multi-community" (Bauman, 2007) city.

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Grundriss Von Dresden - Nebst Einen Theil Des Daran Stosente Teran, 1765.

Research questions

The research questions aim to define a knowledge base on particular conditions that have influenced over the centuries the relationship between water resources and the city, by shedding light on criteria adopted for its construction and modification over the time.

In particular, the questions pursue the scope to put in tension those historical, cultural and geographical aspects that is supposed to be fundamental for the progressive as well as gradual processes of adaptation of the city to water-related risks.

In the light of accelerated processes of spatial metamorphoses and social ecological modification, these questions aim to verify the efficacy of previous experiences in terms of resilient adaptation to risks and to inspect the increasing use of Green and Blue infrastructure to deal with future challenges, including climate change induced effects.

Questions connected to historical existing conditions:

1 Quali differenze storiche, culturali, ma anche quali differenti condizioni climatiche hanno condizionato il modo di progettare città in contesti diversamente dipendenti dalle acque?

EN What historical, cultural, as well as geographical differences have influenced the way to design cities in different contexts and to adapt them to water risks?

2 In cosa si differenzia il caso studio in termini di condizioni climatiche, e perché le regioni dell'Europa centrale hanno adottato nella storia approcci così differenti per affrontare la convivenza con le acque fluviali?

EN What differentiates the case study in terms of climatic conditions and why cities in Central Europe have adopted in history different approaches to deal with the coexistence of river waters?

3 Che tipo di ruolo ha avuto il paesaggio nell'area di studio osservata? **EN** What was the role of the Landscape within the area of study?

4 Che tipo di rapporto città-paesaggio ha determinato la funzione più o meno tecnica assunta da quest'ultimo per affrontare la questione dei rischi e dell'adattamento?

EN What kind of relationship between the city and the water-landscape has determined, more or less, the technical function assumed by this latter to deal with water risks?

Questions connected to processes of adaptation/construction of the city:

1 Qual è stato il ruolo che l'acqua ha ricoperto nella costruzione della città, in particolare a partire dal XVIII secolo, e nel processo di adattamento ai rischi legati all'acqua?

EN What was the role that the water covered in the construction of the city, in particular starting from the XVIII century, and in the process of adaptation to water-related risks?

2 Quali approcci hanno prevalso in contesti storicamente colpiti da rischi legati all'acqua?

EN What kind of approaches have prevailed in contexts that have historically been affected by water related risks?

3 In che misura la percezione di uno status permanente di rischio influenza la cultura locale e quanto una dimensione dannosa può portare allo sviluppo di una cultura resiliente?

EN How much does the perception of a permanent status of risk influences the local culture and how can this condition lead to the development of a resilient culture?

4 Esistono altri valori e differenze connesse all'acqua, rispetto al caso studio, che spostano il dibattito su altre questioni? produzione di spazi pubblici/emergenze ambientali /usi temporanei coerenti con il rischio/ inclusione sociale **EN** Are there other values and differences connected to the water issue in the case study that move the debate to other important questions? production of public space/ environmental emergencies/ temporary uses coherent with the risk/ social inclusion

Questions connected to emergent conditions:

1 Rispetto al modificarsi di condizioni climatiche, oggi la città è in grado di rispondere alle nuove sollecitazioni in termini di adattamento a condizioni di rischio connesse all'acqua accelerate?

EN Based on the modification of climate conditions, is the city today able to respond to new solicitations in terms of adaptation to accelerated critical water risks?

2 Quanto le condizioni di rischio mettono in tensione la politica urbana della città per affrontare rischi e opportunità?

EN How much does the water risk condition put in tension urban policies and the water to deal with risks and opportunities?

3 Quali sono ad oggi gli usi consentiti lungo queste aree fragili, anche sotto un profilo normativo, e come i piani interpretano la temporaneità degli usi in questi spazi?

EN What are the permitted uses that are allowed within these fragile areas, also under a normative profile, and how urban strategies interpret the temporality in these spaces?

4 Esistono i presupposti che possano far pensare che la città abbia ereditato una cultura idraulica che possa tornare utile nei processi di gestione delle acque in un futuro sempre più caratterizzato da pressioni dovute ai cambiamenti climatici?

EN Is there any evidence that the city has inherited a hydraulic culture that can be useful in water management processes in the future that will be increasingly characterized by pressures from climate change?

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Research







The main purpose of the research methodology

The research methodology retains, on one side, essential in order to build a knowledge basis that might be able to dispel doubts on aspects and established relationships between water and city over time. On the other side, to understand roles and purposes that water resources covered into the field of planning. The final goal is to verify the presence of case studies in which is reasonable to highlight aspects that can be considered interesting in the light of recent urban dynamics, as well as climate change-induced phenomena.

In fact, the methodology of the research adopted for the analysis of the case study aims to delineate a matrix of approach to the study of contexts dependent on water. Furthermore, its scope is to represent itself as a hypothesis of contemporary study for a knowledge transfer compared to emergent and extreme conditions of water risk.

How to collocate the research methodology within a specific cultural framework.

The research methodology is expected to be applied in a cultural context which is characterized by aspects and specific phenomena associated with a particular historical period.

It consists of the individualization of instruments and tools for the examination that aim to be pertinent, as well as relevant and that can construct a basis for the following phases of the study.

The general purpose is to identify the existence of a historicized culture within this incremental process of knowledge that might have paved the way for the consolidation of a more recent culture associated with Green and Blue Infrastructures over the centuries. The subject of debate is the water risk condition as an occasion for the comprehension of historical relationships between cities and water resources over the centuries, and of processes of progressive and gradual adaptation to risks. The comprehension of these relationships and historical dynamics between cities and water nowadays allow to put in tensions contexts and to verify the effectiveness of planning compared to the acceleration of dynamics within the contemporary city and pressures of climate change.

1st phase of research:

Research methodology applied to the first phase of examination associated with the identification of a historical condition of water-related risk. In this stage, the research methodology aims to make understandable those characters of historical vulnerability, due to already existing geographical and natural conditions and to focus on the process of adaptation led by cities in time. Object of interest are various natural risks that may occur when these areas come in touch with communities, or when living conditions have been developed in these specific contexts, as in the case of Dresden. Cities located in Central Europe present obviously different geographic and topographic characteristics and the presence of *large rivers*¹ that go through territories constitute both a resource to manage for a qualitative urban ecosystem but also a possible threat when these organisms enter a situation of conflict that generate a reduction in terms of *water breath*^{[2} within the space (Gasparrini, 2018).

Historical, geographical and cultural questions associate to water-related risks:

1. Study of general questions emerged over time in the study of the planning and role attributed to the water. The use of the scientific literature, as well as of iconographic sources, aims to witness and to describe adaptive or resistant behaviour towards specific and geographical conditions (e.g. historical risks conditions within Central Europe). This leads also to the identification of a Taxonomy of extreme historical floods associated with atmospheric conditions and to the creation of a chronology of events territorially representable. The purpose is to reproduce an illustrative and comparative framework of extreme floods, by identifying causes and effects, water stages and Flood stages registered over time. Consultation of the literature allows the research to trace back to the typologies of persistent climate and meteorological condi-

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¹ According to the EEA "European Environment Agency" Large rivers are rivers that have a catchment area large than 50,000 km2 or other rivers and tributaries that have a catchment area larger than 5,000 km2. Cfr: https://www.eea.europa.eu/data-andmaps/data/wise-large-rivers-and-large-lakes

² The theme of water breath of a river within cities represented a research issue in which the Department of Architecture of Naples is strongly interested. In 2015, the international workshop "Rome 2025" had shown results of a work of the Riverscape of Rome and its tributaries coexistence within the suburbs of Rome: Cfr.: Gasparrini C., Terracciano A., 2018, Rome 2025 Resilient Osmotic Metabolic Ecological. Listlab, Trento-Italy.

tions that have influenced the morphological and spatial development of contexts in history.(Fig. 1A and B)



2. Construction of a historical and comparative framework for recorded extreme events over time, as an instrument that is able to respond to mechanisms of progressive adaptation/ management of water-related risks. This methodology starts with the identification and the systematization of available historical data about extreme flood events in the history of the city. In this stage, the research aims to collect sources of similar nature through which construct qualitative and quantitative indicators that are supposed to be relevant for following analysis purposes (Fig. 2A and B).

Furthermore, the systematization of these data leads to the definition of a process whose scope is to make these comparable over time (e.g. digitalization of historical sources, systematization of similar data, construction of quantitative/qualitative indicators).

The construction of the "comparative framework" is associated with the realization of comparative maps that can be overlapped in order to identify the following aspects:

> Identification of fixed boundaries of water risk due to specific natural condition (geomorphological, geographical, hydrological)

- Recognition of possible changes over time due to the modification of already anthropized contexts.
- Identification of areas with particular intensity in terms of vul-

Figure 1 (A) Classification of flood magnitudes (1, minor; 2, strong; 3, exceptionally strong) using linear regressions between flood stage and inferred runoff. Elbe, runoff (m³ s⁻¹) in Dresden monitoring station, 1852-1892. Source: Weikinn C. and by CLIMDAT, representation of Mudelsee M. (B) Daily runoff time series. (a) Elbe, station Dresden, covering the interval January 1852 to November 1999. Flood magnitude class bounds (Figure 4) are shown as horizontal lines. Source: Weikinn C. and by CLIMDAT, representation of Mudelsee M.

nerability associated with the presence of flood areas reached over time.

Delimitation of critical areas in which urban and infrastruc-_ tural modification have determined a higher water risk condition over time.





3. Collection and digitalization of historical and cartographical representation, as well as technical maps, that give testimony of extreme natural hazards in the past. This work aims to systematize spatial representations and to provide them with qualitative information, by associating the realization of a database with the spatial source.

In particular, the case study has expected the use of technical cartographies drown in extreme flood circumstances. As an example, the georeferenced maps of 1820-33, 1845, 1890 correspond to the three most important floods in the history of Dresden (Fig. 3).

Figure 2. (A) Digital perimeter of the flooded area during the extreme event of the 31 March 1845 and overlapping with the historical cartography, (B) Digital perimeter of the flooded area during the extreme event of the 6-7 September 1890 and overlapping with the historical cartography. Source: Maps realized by the author with the following data: "Karte des Elbstromes im Königreich Sachsen: enthaltend die Situation bis zur Überschwemmungsgrenze des Hochwassers vom 6/7. September 1890"; "Karte des Elbstromes innerhalb des Königreichs Sachsen: mit Angabe des durch das Hochwasser vom 31sten März 1845 erreichten Ueberschwemmungsgebietes", "Karte des Elbstromes und seines Hochwasserbereiches; CLC Corinne Land Cover 2018, EEA Copernicus Land Monitoring Service; Water courses- Elbe River section; OSM Openstreetmap, for the Buildings feature.

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overlay of historic flood in Dresden



Figure 3. Overlay of geo-referenced historic data for flood in periods 1820-33, 1845, 1890. Data realized by the author with the following sources: "Karte des Elbstromes im Königreich Sachsen: enthaltend die Situation bis zur Überschwemmungsgrenze des Hochwassers vom 6/7. September 1890"; "Karte des Elbstromes innerhalb des Königreichs Sachsen: mit Angabe des durch das Hochwasser vom 31sten März 1845 erreichten Ueberschwemmungsgebietes", "Karte des Elbstromes und seines Hochwasserbereiches / [Königlich Sächsische Kameralvermessungsanstalt unter Direktor W. E. A. v. Schlieben]. - 1:4 800.Datierung: 1820-1833". Sections of historical maps are included in the following source: SLUB / Deutsche Fotothek.

4. Use of GIS software for spatial analyses of data and for the construction of qualitative attributes, as well as for geo-referencing processes of printed cartographies.

The main purpose of this phase is to provide a useful source which is normally not comparable with recent maps of water-related risks.

- Meticulous handmade works realized in sections for transects of flooded areas.
- Technical cartographies realized by experts of that time for city authorities.
- Detailed maps of areas identified as historical subjects to flooding.

5. The construction of quantitative indicators (measures in m² of flooded areas, flooded areas for a historical time frame, identification of etc.) obtained by the digitalization of the above-mentioned cartographical sources. Purposes:



- To transform the printed information into digitized data which can be provided by an own informative "database"

- To use this digitized and geo-referenced basis for the construction of spatial data which are more comparable with the latest information about flooding, e.g. in the case study in 2002, 2006, 2013.

- To design a digitized informative profile of the water network within a specific time frame.

- To overlap these data and to produce new information that was not available at the time the document was produced, and that today are considered extremely relevant (Fig. 4).

Figure 4. Sequence of flooded area over the time along the Elbe river valley. The image shows the sequence of events over the centuries and the modification of the Elbe river profile. A major focus is reserved to the Ostragehege area, which was in history particularly hit by floods. From 1845 to 2013 is represented the synthesis of the spatial transformation of the water basin, as well as the perimeter (in negative) of the flooded zones. Source: Maps and schemes realized by the author with the data of Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie, OSM Openstreetmap CLC Corinne Land Cover 2018, EEA Copernicus Land Monitoring Service; Water courses- Elbe River section Perimeters of flooded area for 1845 and 1890 are realized by the author with the superimposition of historical section of official maps.



6. Visual Urbanism: the use of iconographic sources and artistic representation as a tool for the examination of social-ecological interactions between the users and water resources (this is relevant in the case of Dresden). Thanks to the use of these sources, it is possible to trace back to historical/ traditional uses of spaces dominated by water and to classify a set of temporary uses in periods of not extreme conditions (Fig. 5).

The use of the work on the visual experience in contexts of extreme vulnerability is useful to identify episodes which are retained to be significant at research purposes. In fact, these iconographic representations furnish an explanatory framework of several types of relationship generated between citizens and the waterscape.

Purposes:

- Overcome limits of examination posed by the use of zenithal maps.

- Identify over the centuries the presence of a "hydraulic culture" (Viganò, 2012) consolidated that has helped the domestication of water resource.

- Read out the physic spaces by focusing on the nature of them in terms of the perception of the landscape through the sensible sight of artists and photographers.

Figure 5. Das Große Gehege, auch Ostra-Gehege, ist ein um 1832 entstandenes Gemälde von Caspar David Friedrich, Galerie Neue Meister im Albertinum, Staatliche Kunstsammlungen Dresden. Source: Google – Wikimedia.

- Observing iconographic sources represents a way to interpret different typologies of interactions (social, ecological, spatial) that have occurred within spatial structures characterized by extreme risk conditions.

Purposes related to this methodology are to show how, trough the construction of spatial and visual narratives, the community was related to space they have established for themselves. It is not only meant to document physical properties but also to show social-ecological relationships that individuals have strengthened over time with fragile ecosystems.

The solicitation of the gaze of the spectator on these sources permits to identify which criteria were at the basis for the use of these places, which specific reasons have brought the community to use largely or not these spaces and how they have transformed these vulnerable spaces of the city into "places of participation"^{[3} over time.

2nd phase of research: morphological and spatial dynamics associated to temporary historical purposes.

The methodology of research applied in this stage aims to observe the synthesis of spatial and ecological metamorphosis occurred over the centuries as consequences of social-economic dynamics. Particular attention is reserved to those that have and been the response to military, political and engineering purposes which were not exclusively dependent from climate conditions. The observation of modification of the spatial structures associated to the water network allows to shed light on consequences and particular aspects that have modified over the time the metabolism of the city (Wolman, A., 1965).

Deconstruction and reconstruction of Elbe river dynamics within the Dresden river valley.

This will lead to the construction of a comparison framework through which several attempts to domesticate the river over centuries can be observed and verified together with purposes that were behind it. The comparation of this framework of water network profiles within the city turns out to be an efficient tool for the implementation of a deductive process carried out by the researcher, which is extremely useful to obtain major awareness about cultural declinations attributed to the water over time (Fig. 6).

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³ The preface of Anna Casaglia in "The right to the city" furnishes an interesting explanation about the image of the city as "place of participation", that aims to be the place of encounter and of the interaction. Cfr: Casaglia A., in: Lefebvre H., (ed. 2014) Il diritto alla città. Ombre corte/culture, 2014, Verona.



Figure 6. Sequence of transformation due to the realization of the Alberthafen and the improvement of the Railway network. (A) Riverplain within the Friedrichstadt district in 1813, focus area: Ostragehege, Friedrichstadt district. Presence of flood channels within the area of intervention (Elbe river valley). (B) Riverplain within the Friedrichstadt district in 1845, focus area: Ostragehege, Friedrichstadt district. The water basin of the Elbe river valley was completely flooded during the extreme event of 31 March 1845. (C) Riverplain within the Friedrichstadt district in 1813, focus area: Ostragehege, Friedrichstadt district. The image shows the spatial condition in the same year in which the works for the realization of the Alberthafen (Commercial Harbour) began. All the representations are realized by the author.

Phases:

1. De-construction of physical processes that led to the adaptation to water risks and to transformations associated with transient cultural declination about the role of the water resource. The purpose is to verify in which way these processes have affected the ecological, social and spatial relationships between the city and the water network over time:

- Identification of phases in which main cultural processes have led towards the modification of the hydraulic system.

- Interception of behaviors of "resilience or resistance" associated with a spe-

cific culture, and to the presence of an ascertained water risk.

2. Systematization of historical official documents that determined (especially in the modern city) criteria of use of water resource.

- Identification of milestones such as historical Directives, Agreements, Regulations, Mandates that have led influenced with roles the modification of urban metabolism of cities over time

- Identification of roles and criteria of use of water resource at a local level. - Identification of solutions that aimed to adapt the city to permanent conditions of water risk.

- Realization of strategies and great plans for the use of a water system as a "Landscape Infrastructure".

3rd phase of research: emergent conditions and climate change effects.

This phase expects the study and the comparison of a complex series of international strategies, urban projects, as well as urban policies associated with water and recently adopted, in particular after recent extreme events. This study aims to understand in which way cities have combined in history the coexistence between risk conditions and sustainable developments. The risk is, in fact, an expedient to verify positive or critical aspects associated to the history of cities, as well as virtuous element in the light of emergent conditions. Within this framework, a particular attention is given to the increasing role attributed in the last decades to Green and Blue infrastructures in terms of both ecological/ environmental networks and spatial structure fora better re-design of cities. Furthermore, this methodology aims to verify the effectiveness of latest projects, design orientations and responses thought to adapt cities to increasing risk conditions.

1. Analysis of the emerging conditions in relation to the coexistences of multiple risks, some of which belonged to a consolidated nature of places, and to the acceleration of phenomena associated to impacts and effects of climate change.

2. Study of strategies at European, national, regional, local level, with a particular focus on correspondences of Directive, Principles, which are focused on impacts and effects induced by climate change, as well as on the study of new approaches to apply in contexts extremely fragile (Fig. 7). These are in particular:

- Mitigation of impacts induced by climate change effects.

- Identification of criteria of the use of Green and Blue infrastructures as fer-

tile fieldwork and as strategical tools within urban planning and urban design strategies.

- Assessment of an acquired acknowledgement of historical risks conditions that threaten the contemporary city and ascertained of a specific flood experience (e.g. in the case study) directly related to a progressive and gradual process of adaptation to water-related risks for centuries-long through the examination of trajectories of research within urban contexts.

Identification of specific cultural directions technically or more integrated and ecologically oriented.

Subtypes of resources required:

- Historical written sources represent fundamental and introductory documentation that aimed the reconstruction of a precise and irrefutable version of historical facts in sequence and suggest a rational hypothesis for a better reconstruction of spatial and designed documentations.

- A repertoire of historical cartography allows to identify the precise configuration of spatial structures of a trans-scalar entity over the years, compared to the presence of a morphological, spatial-ecological relationship between the river with its tributaries and the city. Moreover, they offer the opportunity to identify the general organization of a city and the ecological, spatial, functional role that was reserved for the water network within a particular time frame. - Iconographic sources as lithography and artistic depict represent a tool of synthesis which enclosed within it a set of information of various nature about the relationship between spaces conceived as water basin/ drainage system/ flood channels/ and river breath space¹⁴/ and the city. In the case study, for example, the collocation of the river within representative images or panoramic views allows the research to collocate at the centre of the debate the landscape dimension. In this way, the study aims to guarantee those "Return of Landscape"^{[5} (Valentien D., 2010) which permits at the iconography to transmit information of emotional character and social aspects about customs and

traditions of that time in the use of water resource.

- Gis Geographic information system database and spatial features as a support for the construction of official data and for the conduction of the research by design. The realization of analysis Interpretative maps expects the use of official source (EEA, Copernicus Land Monitoring, Corinne Land Cover, Openstreetmaps, Saxony region Portal, etc.) for the design and for the realization of Data spatial analyses.

- Official documents of Institutional matrix for the evaluation of impacts and results of efforts made in these years in order to adapt to water-related risks to promote more integrated planning of Green and Blue infrastructures. - Photography as an instrument for the narration of phenomena associated with natural hazards occurred in cities, with a particular focus on the last 100 years.



⁴ Cfr. Gasparrini C., Terracciano A., (2018) "Rome 2025 Resilient Osmotic Metabolic Ecological". Listlab, Trento-Italy.

^{5 &}quot;Until recently, the construction of the cityscape tended to entail the subjugation of nature and landscape; the consequences of this approach have been climate change, water shortages and the loss of biodiversity. The twenty-first-century city must abide by a new model that deploys creative, sustainable solutions and a more holistic approach to urban development. On the occasion of an interdisciplinary exhibition at the Akademie der Künste in Berlin, Return of Landscape probes the future of the city, not only as a living space but also as the creative center of tomorrow's society". Cfr. Valentien D. (2010) Return of Landscape, Jovis, Berlin.

Green and Blue Infrastructures



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La dimensione storica e culturale, e la condizione emergente come cornice entro cui guardare il rapporto città acque: la dimensione strategica delle Infrastrutture verdi e blu per il progetto della città contemporanea

Premessa

La ricerca sulle condizioni emergenti che descrivono "la nuova questione urbana" (Secchi, 2010) sta cercando di farsi spazio non solo nel campo dell'urbanistica, ma nella dimensione contemporanea generale del vivere quotidiano, attraversata da crescenti produzione di rischi sociali, non solo, la cui origine sembri coincidere con la stessa produzione di benessere all'interno dei sistemi urbani (Beck, 1986). La dimensione strategica, culturale e progettuale delle infrastrutture verdi e blu rappresenta per il progetto della città contemporanea la sfida a cui gli strumenti, ma soprattutto le comunità di progettisti debbono aderire, per far si che all'imminenza di una "crisi ecologica" (Secchi, 2013) oramai ad un elevato stato di diffusione, e alle dinamiche di rischio ad essa connesse, faccia da contrappeso un ribaltamento degli "scenari di impatti preconizzati" (Intergovernmental Panel on Climate Change, 2019) che sia in grado di mettere insieme le forze e offrire opportune alternative.

Per andare alla radice di questo processo, un'attenzione particolare va rivolta alla condizione entro quale noi tutti, cittadini prima studiosi poi, ci troviamo in prima persona, e alla consapevolezza, tecnica, ma anche sociale, con la quale la generazione attuale affronta le diverse questioni. La crisi epocale che stiamo vivendo è innanzitutto una crisi trasversale perché attraversa le diverse sfere del nostro vivere quotidiano ponendo ogni giorno nuovi diversi interrogativi riguardo i suoi effetti e le possibili via d'uscita. Si tratta d'una crisi relativamente recente, che è stata profondamente determinata dalle dinamiche e dagli esiti dello sviluppo umano, ma in particolare dalla crescente fase di espansione in fase moderna¹ a cui è corrisposto un graduale declino e impoverimento delle risorse ecologiche urbane. Una di gueste è sicuramente la crisi legata alla

questione ambientale², alla quale la ricerca dedica un interesse specifico. Da un lato, perché è quella da cui dipende la sopravvivenza e la possibilità di utilizzo nel futuro delle risorse incerte come l'acqua, dall'altro perché come anche il caso studio conferma, l'acqua in termini di risorsa essenziale ha sempre rivestito un ruolo fondamentale per l'adempimento di più funzioni. Nella città contemporanea, queste funzioni essenziali sono state evidenziate con maggior certezza in corrispondenza con l'intensificarsi dei fenomeni di rischio e le ricadute economiche, sociali, ma anche alle mutazioni ecologiche ed ambientali che i cambiamenti climatici hanno generato nelle diverse città europee. In molte città europee, le differenze storiche, culturali, ma anche le condizioni climatiche hanno condizionato il modo di progettare città in contesti diversamente dipendenti dalle acque. Rispetto ai processi di progressivo adattamento registratisi in Europa, alcune regioni più di altre hanno dovuto fare i conti nella storia con una condizione di rischio perenne, a cu si è risposto con il consolidarsi di una "cultura idraulica" (Viganò, 2012) che ha gettato le proprie basi sulla capacità di fornire approcci differenti per affrontare la convivenza con le acque fluviali, e di consolidare esperienze significative rispetto alla necessità di addomesticare fenomeni già gravosi in un processo plurisecolare che oggi fa i conti con condizioni di accelerazione evidenti.

Ci troviamo di fronte a una crisi avvertita con forte incertezza, dubbio, rispetto agli impatti negativi previsti per il futuro e alla sua distribuzione spaziale a scala locale, ma che sappiamo essere tanto accelerata quanto lo sono i processi di sviluppo industriale attualmente in atto (Mezzi, P., Pelizzaro, 2016). Nelle strategie e negli accordi internazionali si paventa, appunto, l'impossibilità di individuare con fermezza quali aree siano maggiormente esposte ai rischi legati al cambiamento climatico e quali impatti siano per esse previsti, seppure esistano già dei gradi di vulnerabilità che dovrebbero fortemente responsabilizzare i singoli paesi a proiettare le proprie strategie verso un radicale rinnovamento. Trasversale perché essa tocca anche la sfera della dimensione sociale ed economica delle città, soprattutto se si parla di effetti e perdite di vite umane in occasione di gravi eventi catastrofici (Thieken et al., 2005).

Dai comportamenti di singoli paesi, infatti- in particolare quelli Ocse- dipendono le sorti anche di quelli più poveri, che fondano la loro sussistenza proprio sulla disponibilità delle risorse e sul loro utilizzo. E' una crisi in parte ingiusta, perché come già si è detto determina distribuzioni inique del rischio e profon-

¹ La ricerca pubblicata dall'IPCC Intergovernmental Panel on Climate Change, a cui hanno partecipato diversi esponenti della comunità scientifica, afferma che la maggior parte delle variazioni che hanno inciso sulla modificazione delle condizioni ambientali e climatologiche sono state rilevate a partire dal 1880, periodo che si fa corrispondere per convenienza con era antropogenica. Cfr: 5°rapporto IPCC, 2015. ONU

² La questione ambientale rappresenta una delle tre questioni imminenti che la società è tenuta ad affrontare per rispondere agli obiettivi ambiziosi di sviluppo sostenibile delle città. Cfr: Secchi

de ingiustizie sociali³, connaturate allo sviluppo economico dei paesi più forti. Per uscirne- i tempi sono ad ogni modo lunghi e poco misurabili con la lunghezza di vita di una sola generazione umana- occorre, come dice il programma ormai consolidato di Agenda21, "Pensare globalmente, agire localmente" (United Nations, 1992). Questo presuppone uno sforzo a lungo termine, e un grado flessibilità necessario che si esplicherà negli anni mediante l'avvio di processi partecipativi e democratici attorno al tema.

La relazione tra città e acqua assume in guesta cornice di studio una rilevanza strategica che può essere esplicitata nel lungo termine, e che deve trovare spazio sufficiente all'interno degli strumenti urbanistici, primi responsabili per la sostenibilità e la resilienza dei territori. Sappiamo bene che le responsabilità del progetto urbano sono al quanto limitate rispetto alle dinamiche diffuse globali, ma è chiaro che impatti e scenari, così come strategie e soluzioni introdotti dalle principali strategie internazionali sul tema richiedano un assorbimento culturale dall'urbanistica a livello urbano. I termini diffusi sono entrati a far parte del linguaggio urbanistico per un preciso scopo e le infrastrutture verdi e blu, tra queste, non sono e non devono essere considerate alla stregua di un obbiettivo da porsi per la realizzazione di interventi isolati, ma debbono divenire indicatori rilevanti di qualità ecologica e di sostenibilità del progetto urbanistico del futuro.

La relazione tra città e acqua rientra, perciò, a tutti gli effetti tra i temi appartenenti a questa cornice scientifica, ed è doveroso avanzare dei ragionamenti rispetto alla molteplicità dei rischi che ad esso sono connessi. Ad essa è attribuita una dimensione strategica multi-scalare, non solo ecologica, ma valoriale e culturale, tale da essere in grado di sintetizzare alla scala locale la compresenza delle questioni e di dare risposte strutturanti alle questioni poste delle città. Queste sono, oltre alla questione ambientale, quelle che riguardano con grande interesse la crisi diffusa a cui già si fatto riferimento, e si traducono nella questione dello spazio pubblico e alla riduttiva attenzione mostrata dai piani e dai progetti urbani negli ultimi anni, ma anche alla questione degli squilibri prodotti dalle disuguaglianze sociali⁴ in ambito urbano da processi neoliberisti e da un'accentuata brama di trasformare spazi urbani da "luoghi della partecipazione" ad spazi contraddistinti dal singolo valore di scambio (Casaglia, 2014). Oggi, diversi spazi urbani sono connotati dalla presenza di luoghi elitari a cui si da un diritto di accesso limitato, poiché la loro logica corrisponde a quella del consumo, e non a alla dimensione sociale e democratica

che dovrebbe rappresentarli. Parte della questione urbana fa riferimento alla crescita di un distacco tra capitali sociali, ambientali, economici e gruppi sociali, a ad una dimensione del vivere quotidiano in cui più che la prospettiva del vivere collettività premia la dimensione corporale del soggetto (Secchi, 2011). La dimensione progettuale legata all'acqua sollecita la condizione sociale del vivere quotidiano, la quale rappresenta un perno fondamentale attraverso cui costruire i processi di rigenerazione urbana, e un mezzo valido per ostacolare "la solitudine del cittadino globale" (Baumann,2000) nella società contemporanea. Diviene uno strumento valido per combattere lo sgretolamento del tessuto sociale nei diversi contesti, oltre che un'occasione unica per portare al centro del dibattito il tema del disinteresse sociale nei confronti del bene comune di fronte ai modelli imposti dalla società.

Il tema della accessibilità democraticità degli spazi urbani (Parkinson, 2012), insieme alla spinta accelerata dei cambiamenti climatici, pone in relazione la presenza delle infrastrutture verdi e blu secondo una prospettiva virtuosa in cui il rischio rappresenta allo stesso tempo un "connector" (Sassen, 2009) per la sperimentazione di nuovi campi di lavoro trasversali sotto il punto di vista degli impatti, e interdisciplinare dal punto di vista delle possibilità di approccio. La ricerca sulle infrastrutture verdi e blue solleva una riflessione sul tipo di ruolo che ha avuto il paesaggio nelle diverse aree geografiche, e del tipo di rapporto città-paesaggio delle acque ha determinato la funzione più o meno tecnica assunta da quest'ultimo per affrontare la questione dei rischi e dell'adattamento progressivo e plurisecolare nei confronti di condizioni persistenti.

Di fronte a questi temi la ricerca pone sullo stesso piano l'importanza che assume sia la consapevolezza scientifica e tecnica accumulata negli anni di fronte alla portata strategica e multi valoriale della risorsa acqua- confermata nel tempo dalla sovrapposizione di strumenti e strategie incentrate sulla valorizzazione in ambito urbano- sia alla consapevolezza diffusa che le comunità attribuiscono ad essa nei diversi contesti nazionali, e che stanno dimostrando progressivamente grazie alla diffusione di pratiche e processi di inclusione sociale a scala urbana sollecitati dagli stessi cittadini. La ricerca sottolinea, infine, l'urgenza di questo tema, e cerca di dimostrare

che un processo strutturante porta a possibili risvolti solo visibili nel lungo periodo, ponendo obiettivi esigenti paragonabili quasi quelli imposti per il contenimento delle temperature medie globali dagli accordi internazionali⁵, a cui

³ Se ne parla in: La nuova questione urbana

⁴ Cfr. Secchi B., La città dei ricchi e la città dei poveri. Roma-Bari. Laterza, 2013.

⁵ Negli anni 90' l'accordo internazionale di Copenaghen prefisse obiettivi ambiziosi rispetto alla necessità di tenere la variazione delle temperature medie globali sotto ai 2°C rispetto ai livelli preindustriali. Nel 2015 COP21, l'accordo siglato a Parigi sul clima,

comunque contribuirebbero significativamente.

Con maggiore evidenza, questa crisi sta mostrando i segni della forte accelerazione con cui stiamo sensibilmente intaccando il pianeta, per via dello sviluppo umano, ma soprattutto per le traiettorie intraprese dalla crescita economica delle nostre società. Alla questione ambientale, in particolare, hanno contribuito i diversi comportamenti dello sviluppo umano, delle sue azioni e del modo in cui si sono costruite le relazioni con le risorse disponibili in ambito urbano.

Tale ragione spinge la ricerca a collocarsi maggiormente, per una questione di aderenza agli indicatori fornitoci nel tempo, in una cornice temporale incentrata sui contributi che la città moderna ha generato, e su quelle che sono le dinamiche innescate a partire dall'era antropogenica, vale a dire quelle che fanno principalmente riferimento all'inizio dell'era industriale (Mezzi, P., Pelizzaro, 2016). Per diversi studiosi sarebbe guesto il periodo di riferimento per fare analisi comparative, projezioni di sviluppo e misurare gli impatti di scenario dei grandi rischi legati ai cambiamenti climatici, al riscaldamento globale, e al rischio legato al tema dell'acqua.

La ricerca pone volontariamente la dimensione del rischio legata all'acqua non come minaccia, ma come opportunità per rinnovare gli strumenti tradizionali a cui siamo abituati, e chiama in gioco la capacità strategica delle "infrastrutture verdi e blue come fertile occasione" (Gasparrini, 2016) di riflessione e sperimentazioni progettuali per tecnici, studiosi e comunità, unite sul tema dell'importanza strategica di questa risorsa sia come bene comune, che come infrastruttura urbana indispensabile per garantire lo sviluppo delle società e affrontare in modo resiliente gli scenari di impatti previsti per il futuro.

Dresda come caso studio interessante con una condizione di continuità critica e con una storia consolidata di adattamento intelligente ma anche di una condizione di criticità resa evidente alla luce dei cambiamenti climatici, anche per una città culturalmente e tecnicamente preparata, e con un'esperienza plurisecolare di adattamento alle condizioni di rischio.

Il risultato finale di questa operazione di smontaggio e rimontaggio porta a considerare il caso studio di Dresda come una vicenda fatta di tentativi e di processi, rivelatisi in alcuni casi fallaci, ma non per forza per motivi esterni e poco correlati alle condizioni di rischio (eventuali rendite fondiarie e interessi economici che hanno ostacolato magari il processo di adattamento), ma per condizioni climatiche e geografiche che richiedono uno specifico approccio disciplinare.

1.0 La molteplicità dei rischi legati all'acqua dentro la complessità urbana

Per poter suggerire una strategia, oltre che un approccio metodologico adeguato, è fondamentale inquadrare la questione dei rischi legati all'acqua in una dimensione più complessa rispetto alle letture tradizionali che ci vengono fornite dagli strumenti e dalle strategie messe in atto in questi anni. Collocare la questione dei rischi nella città vuol dire tener conto che è la stessa città a essere divenuta una macchina urbana complessa⁶, in cui è sempre più frequenta la possibilità che diversi fattori entrino in gioco e che, talvolta, le loro interazioni possano avere effetti sulla risorsa. Una delle prime questioni che il tema vuole affrontare è, appunto, la necessità di collocare la risorsa in una dimensione non esclusivamente ecologica, ma lasciare spazio alla trasversalità che il tema stesso sollecita, cercando di trasferire conoscenze, approcci metodologici, e esperienze provenienti da altri campi disciplinari all'interno dell'area di studio dell'Urbanistica e superare quella "razionalità limitata" che tanto contraddistingue l'analisi spaziale (Lefebvre, 1968) La seconda questione che si vuole sollecitare è che lo stesso concetto di rischio legato all'acqua non può essere considerato un fenomeno circoscrivibile e analizzabile a partire da un dato periodo di riferimento, poiché la storia e le civiltà, con i loro segni e le loro permanenze ancora oggi esistenti, mostrano una realtà contrastante con quello che a un primo impatto può essere il nesso tra la parola rischio e le mutazioni che stanno avvenendo a scala globale negli ultimi anni. Si può dire che i rischi abbiano sempre condizionato lo sviluppo di una città, la sua collocazione geografica rispetto ai territori, la condizione fisica e le proprie morfologie, e che queste a loro volta abbiano sollecitato metamorfosi di natura non solo fisica, ma anche culturale e sociale rispetto a una determinata idea di sviluppo.

La sovrapposizione di gueste due guestioni finora descritte fornisce al lettore una diversa chiave di lettura, mediante la guale interpretare la dimensione del rischio secondo un approccio inconsueto rispetto alla normale contestualizzazione del problema a cui sono abituate le comunità globali, perché sollecita lo sguardo a individuare diversi fattori naturali, sociali e antropici, che hanno

visti gli esiti, restringe le condizioni e chiede come sforzo maggiore quello di abbassare questo parametro al di sotto dell'1.5°C. Saranno molte le incertezze, guanto le incredulità che i diversi studiosi hanno riferito rispetto alla fattibilità di questo obiettivo principale.

⁶ Il testo fa riferimento alla definizione di città come macchina urbana complessa utilizzata da Carlo Gasparrini in Dross City per descrivere la condizione entro guale ci collochiamo in questa epoca storica. Cfr: Dross City, Urban metabolism resilience and drosscape recycling project. ListLab Eu, 2017.

da sempre condizionato le città. Per fare un esempio pragmatico, basti pensare alla molteplicità di rischi di tipo naturale, ovverosia quelli di esondazione, alluvione e i rischi idrogeologici con i quali l'uomo ha dovuto da sempre fare i conti per ottemperare al desiderio di dominare luoghi e risorse. Il desiderio stesso di addomesticare le acque, di utilizzare a proprio vantaggio e di stabilirne il dominio è testimoniato dagli usi e dalle pratiche che ancora oggi contraddistinguono interni pattern agricoli, ma anche dai segni che in maniera singolare hanno caratterizzato il "palinsesto territoriale"⁷(Corboz, 1983)or even of metropolitan areas. Its very representation, until very recent ages held to be terribly abstract and reserved to technicians, today belongs to the public domain. Exhibitions bearing titles such as Maps and Illustrations of the Earth (Paris, 1980.

Da sempre, infatti, componenti geomorfologiche e stratigrafiche condizionarono gli stanziamenti urbani in maniera non irrilevante. La prassi dell'agrimensura romana⁸, ancora conservata in molte città, testimonia come il rapporto tra uomo e acque avesse restituito nel tempo una fisionomia ampiamente antropizzata del suolo e del paesaggio idrico. «Mentre l'influenza delle acque sull'uomo era infatti regolata da fattori predeterminati e da fenomeni tendenzialmente ripetitivi, l'influenza dell'uomo sulle acque dipendeva da evenienze contingenti e da scelte comportamentali di per sé estremamente diversificate, per molti versi imprevedibili e non codificabili» (Ortalli, 2010). Dall'approvvigionamento per uso personale, sino all'utilizzo dell'acqua come infrastruttura di collegamento per garantire economie commerciali e industriali, sappiamo di certo che questa risorsa ha da sempre influenzato intere città di fondazione, paesaggi, territori. Sappiamo con certezza che altri rischi possono essere più facilmente collocabili nel tempo, poiché sono scaturiti in seguito all'avvio di processi di antropizzazione e di industrializzazione recenti che hanno determinato diversi fenomeni di contaminazione della risorsa, alla progressiva crescita di modelli economici dissipativi che hanno fatto uso indiscriminato di guesta risorsa e che per lungo periodo sono stati ritenuti necessari per assecondare lo sviluppo di alcune traiettorie del mercato economico.

Questi, insieme, hanno contribuito sensibilmente sia a determinare fenomeni di rischio talvolta irreversibili, o comunque non affrontabili nel medio breve periodo, legati all' inquinamento della risorsa, sia all'interruzione dei diversi cicli di vita ad essa connessa.

Sullo sfondo di questa lettura interpretativa si pone la consapevolezza sociale, umana, ma anche tecnica rispetto alla dimensione del problema, alla questione ambientale e al relativo cambiamento climatico a scala globale, ma anche alla velocità attraverso cui questi fenomeni di rischio stanno condizionando lo sviluppo delle comunità e la condizione urbana.

Con un riferimento ampio alla dimensione contemporanea, si è detto che viviamo nella "società del rischio", i cui caratteri di precarietà, incertezza, vulnerabilità utilizzati per descrivere la condizione sociale, risultano essere spesso associabili anche ai caratteri fisici e geografici della città entro cui viviamo, quasi come a voler consolidare l'idea secondo cui l'uomo e i territori sono fortemente in simbiosi e dal modificarsi dei comportamenti umani scaturisce un effetto di metamorfosi continua. Nella città contemporanea si individuerebbero, infatti, quelli che sono i caratteri di un "metabolismo impazzito" (Gasparrini, C., Terracciano, A., 2016) che a causa delle pressioni esercitate dall'uomo fa uso indiscriminato delle risorse ambientali, modificando sensibilmente i suoi cicli di vitae producendo una quantità considerevole di scarti urbani e di materiali

Le ragioni vanno ricercate, in parte, nella complessità della macchina urbana, vale dire alla coesistenza di diversi fattori che insieme nel tempo, e nello spazio, hanno sensibilmente modificato la condizione urbana; ma in parte nella difficoltà con la quale alcuni processi antropici si sono verificati, alle difficoltà gestionali intrinseche di questi processi di sviluppo, e ai risultati sottesi E' evidente che viviamo in un'epoca in cui si richiede forte preparazione ad affrontare le innumerevoli crisi, che si manifestano in forme diverse e toccano diverse dimensioni del vivere quotidiano. Ma le crisi, siano esse di natura ecologica, sociale, o economica, rappresentano senz'altro un'occasione di riflessione culturale sull'uso del territorio, ponendo degli interrogativi rispetto la ricerca di soluzioni alternative. Si pensi alla crisi petrolifera del 73', la quale portò l'Occidente intero, in seguito alla diminuzione delle esportazioni di petrolio da parte dei paesi arabi e all'aumento dei costi energetici, a riflettere sulla necessaria sostituzione dei combustibili fossili derivati dal petrolio con nuove fonti energetiche rinnovabili. In quel caso intere nazioni, al cospetto di una crisi inedita, posero un interrogativo fondamentale sulle fondamenta di una società, che avrebbe fatto da apripista per altre occasioni di discussione, e sul rapporto tra uomo e la presenza di risorse limitate sul pianeta.

⁷ Il testo fa rifermento alla definizione di palinsesto utilizzata da André Corboz per descrivere la molteplicità dei segni, delle diverse scritture anteposte nel tempo dalle differenti culture. Cfr: Il territorio come palinsesto

⁸ Si può avere un'idea di come le acque abbiano condizionato fortemente il paesaggio agricolo, volgendo lo sguardo ad alcuni casi emblematici presenti in Italia. Cfr. ad esempio, Archeologia e Ambiente: Dominio delle acque e dominio sulle acque in antiche città del territorio Padano, Italian Journal of Quaternary Sciences 23(2Bis), 2010 - Volume Speciale – pp. 335-354

Le diverse questioni sul tema. Condizioni geografiche e spaziali a rischio , sociali ed ecologiche,come opportunità per la messa in tensione dei rapporti città acque.

La complessità della macchina urbana, insieme alla compresenza di rischi di diversa natura che hanno a che fare la l'acqua, rappresentano una condizione entro cui operare per un diverso modo di orientare il progetto urbano, ma più specificamente la condizione da cui partire per ripensare culturalmente lo strumento urbanistico, che da sempre si è occupato di città individuando i modi attraverso cui suddividere usi, funzione e spazi della città, subordinando la questione ecologica, non solo, ma anche morfologica e spaziale, a strategie settoriali, appositamente separate dagli strumenti principali di sviluppo urbano. Una revisione scientifica, culturale dello strumento rappresenta l'occasione per sensibilizzare questi ultimi verso temi cruciali nella dimensione contemporanea, oltre che spingerli verso la definizione di un quadro di indirizzi coerenti con le diverse questioni urbane di cui si discute negli ultimi anni. Nono solo la questione ecologica, che comunque occuperebbe una posizione di primo ordine nell'agenda urbana, ma anche quella relativa alla necessaria importanza che lo spazio pubblico deve tornare a giocare nella visione di sviluppo futuro delle città. La costruzione dello spazio pubblico non solo come luogo d'incontro, ma come contenitore capace di accogliere istanze multiple legate sia alla dimensione sociale e collettiva, sia a quella economica e gestionale.

2.1 Culture tecniche e declinazioni culturali attorno al tema dell'acqua in età moderna: Il ruolo della risorsa nella fase di progettazione e modernizzazione delle grandi città europee.

L'età moderna è nota per essere stata il periodo delle grandi trasformazioni e delle maestose opere che hanno condizionato, talvolta positivamente, il futuro di intere città. Questo, come sappiamo, è accaduto soprattutto in quelle realtà urbane in cui si è sentita forte l'esigenza di un rinnovamento, ma anche la necessità di dover fronteggiare crisi urbane dettate dalla scarsa condizione igienica e dal malfunzionamento di quelle che erano le complesse infrastrutture urbane. Città come Parigi e Barcellona, in particolare, hanno prestato forte attenzione al tema della modernizzazione della città e al ruolo dell'acqua per la realizzazione di grandi infrastrutture urbane, in risposta alle notevoli difficoltà entro cui vivevano le rispettive comunità e la necessaria esigenza

di dover fronteggiare gli aumenti di crescita demografica. Il tema dell'acqua in questa fase storica ha dimostrato di avere un ruolo strutturante nella progettazione di interi sistemi infrastrutturali e di collettamento, ma anche nel processo di trasformazione che han portato queste città a essere note per la grande attenzione e l'impegno mostrato sule tema della conquista dello spazio pubblico mediante importanti riflessioni urbane attestate attorno alla progettazione delle aree permeabili. Nel rinnovare le città, o parti di esse, l'acqua ha ricoperto un ruolo strutturante dal punto di vista funzionale che solo molto più tardi verrà riscoperto negli ambiti urbani dalle città americane¹ nell'introdurre il concetto di "infrastrutture green" (Schueler, 1987). Si può dire, infatti, che l'Europa sia stata anticipatrice rispetto ad alcune questioni ecologiche ed ambientali, e che queste siano state oscurate alla stessa stregua degli altri contesti nel corso del Novecento dalle incursioni dell'era industriale. L'acqua, è stata in questo periodo storico è stata oggetto di declinazioni che sono andate oltre la sola questione igienista, attribuendo ad essa l'oneroso compito di contribuire ai processi di infrastrutturazione per garantire traffici commerciali e scambi economici, e di costruire determinati assetti di sviluppo. Le acque che avvolgevano e attraversavano le città sono state, di fatti, utilizzate dall'uomo per scopi sia difensivi e civili, sia per consentire la crescita economica di intere comunità. A molti sarà noto il tema dello sviluppo urbano di Amsterdam, un esempio illuminante di come l'acqua abbia contribuito alla crescita di questa città, una delle più importanti realtà portuali oggi maggiormente all'avanguardia. «Le fortune di Amsterdam, infatti, sono legate principalmente alla sua posizione geografica. Fino al XIII secolo non era che un piccolo villaggio di pescatori, sorto a cavallo dell'Amstel, sulle rive dell'Y, grande estuario che, raccogliendo le acque di numerosi laghi interni, sfociava nello Zuidersee, allora mare aperto. Lo Zuidersee era ricco di pesci e l'estuario dell'Y formava una rada sicura al tempestoso mare del Nord; inoltre il flusso e il riflusso delle maree manteneva a grande profondità il fondo dell'estuario, mentre gli altri porti, sorti sulle rive dello Zuidersee, andavano progressivamente insabbiandosi. Questa condizione di favore spinse i pescatori a tentare il mare aperto ed a trasformarsi in navigatori e mercanti, allacciando rapporti con le città anseatiche del Mare del Nord e del Baltico, mentre il primitivo sbarramento di fronte all'Amstel si tramutava via via in porto e in mercato» (Astengo, 1949).

Nello stesso articolo dell'autore vennero rilevati gli aspetti più interessanti per la preparazione del suolo alla realizzazione del quartiere di Slotermeer, situato in posizione occidentale e periferica rispetto al nucleo antico della città, ottenuto mediante lo sbancamento del lago e la realizzazione di uno artificiale di dimensioni maggiori.

Alla questione igienista e infrastrutturale si aggiunge senz'altro quella paesaggistica, che nel caso di Amsterdam è riuscita a dare risposte concrete a problemi di distribuzione spaziale e geografica che si pongono tendenzialmente in fase di pianificazione. In particolare, Amsterdam rappresenta un caso paradigmatico nella storia urbanistica per il ruolo muti-funzionale che ha conferito all'acqua secondo una declinazione principalmente paesaggistica. Un valore non solo divenuto ormai celebre in tutto il mondo, ma che a quel tempo poteva essere ritenuto di vitale importanza per affrontare in maniera risolutiva la questione della distribuzione spaziale nei piani di espansione delle città, e per determinare le conseguenti ripercussioni di natura sociale nelle aree di progetto. Ad Amsterdam, il tema del paesaggio delle acque si trasforma da barriera a rete paesaggistica di congiunzione tra i quartieri periferici e il nucleo della città. Essa, mediante realizzazione dei canali artificiali², insieme alla tema del progetto dei grandi spazi verdi, e dell'architettura come risorsa è in grado di affrontare il tema della qualificazione dello spazio aperto nei quartieri periferici destinati alla classe operaia, oltre che risolvere problemi di drenaggio urbano. Il piano urbanistico si preoccupa, infatti, di garantire il valore assoluto di questi luoghi prima ancora di costruire le abitazioni che sarebbero state destinate alla classe medio bassa, utilizzando come risorsa primaria proprio il tema strutturante dei canali. che Un esempio come altri che, in questo quadro, dimostra come l'uomo abbia da sempre addomesticato i suoli e le acque, e come esse siano da sempre state fattore non secondario di scelte importanti. E' evidente che il rischio, inteso anche in guesto senso, rappresenta in alcune fasi storiche, contestualmente, sia un'avversità che un'opportunità da cogliere per rendere favorevoli le scelte di un progetto di espansione della città. Si potrebbe parlare di una attitudine alla resilienza che è implicita ai territori, i quali sono stati conformati secondo precise contingenze.

¹ Il testo fa riferimento al progetto delle infrastrutture green progettate in America per fronteggiare il problema della coesistenza e della gestione della risorsa acqua.

² Il testo fa riferimento alla realizzazione dei canali artificiali (detti anche grachten) costruiti in passato, principalmente in Olanda e in Germania, utilizzati in molti casi come fogne e come sistema di drenaggio per le acque piovane.

Negli ultimi anni, II tema dell'acqua è tornato a giocare un ruolo fondamentale nei piani urbanistici, ma anche nelle strategie resilienti adottate da diverse città per far fronte agli scenari futuri che i cambiamenti climatici riservano ai territori. Eppure, per decenni il tema dell'acqua nelle operazioni progettuali urbane di recupero di aree industriali dismesse ha ricoperto un ruolo puramente complementare. Tra gli anni 80 e 90, le aree portuali dismesse e i "seafront" sono tornati a giocare un ruolo fondamentale nei progetti di recupero per la creazione di nuove funzionalità urbane destinate al commercio e al leisure, anche se spesso il senso di queste operazioni è risultato essere riduttivo rispetto a un problema effettivamente esistente.

Intorno agli anni 60 del 900 il rapporto città e acque trova all'interno dell'intera dimensione globale una sua connotazione specifica, grazie alla riscoperta delle aree costiere urbane che, per un lasso di tempo limitato, ma intenso, furono sottoposte a consistenti modificazioni morfologiche e insediative legati ai processi di sviluppo industriale. In America soprattutto, questo fenomeno trova la sua massima espressione nelle operazioni di rigenerazione dei water-front industriali³ e di tutti gli spazi di contatto, che di lì a poco avrebbero fatto posto a interi complessi di carattere pubblico, destinati principalmente ad accogliere attività turistico, ricettive per le comunità locali (**Figura 1**). Il tema sotteso, e in alcuni casi anche il motore di sviluppo, era quello dello spazio pubblico contemporaneo, decodificato anche secondo un'opportuna cultura locale.

Aree dismesse e degradate che per anni avevano svolto funzioni importanti, ma allo stesso tempo marginali rispetto a una idea di funzionalità urbana condivisa dalle comunità, sono divenute strategicamente, il perno di intere politiche di rigenerazione urbana volte al rinnovamento estetico e morfologico di questi luoghi, ognuna delle quale cercava di mostrare una coerenza con le memorie collettive legate a un passato industriale e una fortificazione delle identità urbane. Restituire il senso⁴ di questi luoghi – non la funzione, che era divenuta oramai obsoleta non solo logistici e tecnici, bensì per quel passaggio dalla modernità alla postmodernità3 - diveniva centrale in queste operazioni condivise da diverse città, non solo europee, per immaginare nuovi scenari che siano al tempo stesso condivisibili dagli stessi cittadini.

In America, dalla seconda metà del novecento, queste riflessioni culturali sul tema della rigenerazione dei grandi complessi industriali hanno suscitato grande interesse e, allo stesso tempo preoccupazione, al punto tale da favorire l'inizio di una stagione di politiche e progettualità urbane in cui il tema dell'acqua è divenuto un tema centrale.



66 67

Figura 1. Baltimore Inner Harbor, Maryland. Nel 1970 l'area ha ottnuto il suo masterplan per la rigenerazione spaziale e funzionale delle aree dismesse. Fonte: fotografia rilevata da Wikipedia

³ Cfr: R. Marshall, Waterfronts in Post-industrial Cities. London, Spoon Press. 2001
4 si parla del "senso dei luoghi" In: Secchi B. Progetto di Suolo. Casabella N°520, Gennaio-Febbraio, 1986

Alla radice di questo rinnovamento l'idea secondo cui "Watefront as catalyst for city renewal"⁵, poiché l'acqua ha avuto in queste operazioni di rigenerazione un ruolo effettivamente cruciale, ma riconducibile sostanzialmente alla dimensione e al valore paesaggistico ad esso attribuibile, piuttosto che ad una consapevolezza ecologica⁶ nei confronti dell'importanza di questa risorsa, a cui con molta probabilità ancora non era stata data la giusta importanza.

Nel 1992, la città di New York, decide che avrebbe riconsegnato alla città, attraverso una operazione di riconfigurazione dei moli e delle aree industriali dismesse, un intero tratto costiero che le era stato sottratto per sostenere l'industria marittima (**Figura 2**). Il nome di questa operazione politica, New York Comprehensive Waterfront Plan⁷, restituisce appieno il significato di un'operazione che non vuole avere carattere occasionale, ma dimostrare invece d'essere onnicomprensiva in un contesto in cui le istanze per lo spazio pubblico rappresentano un tema ampiamente diffuso nel periodo della dismissione industriale. Il tema delle grandi alluvioni, delle inondazioni e degli uragani atlantici sarà un tema che attraverserà le società solo a partire dal nuovo millennio, con l'irruzione e lo scatenarsi dei grandi eventi e dai risultati delle prime proiezioni di sviluppo, e non è di certo un tema che ha interessato prevalentemente le città europee, i cui processi sono stati condizionati dalla "questione di immagine"⁸ e dall'introduzione nelle società di alcuni settori economici in forte sviluppo in quegli anni.

La radice comune che smuove le coscienze è sicuramente II tema culturale dello spazio pubblico e, non a caso, i diversi progetti rappresentano i brani compositivi di uno processo per la creazione di spazio pubblico lineare costiero che si snoda lungo le quasi 580 miglia di costa individuate dal piano⁹.

Nel documento ufficiale, "reestablishing the public's connection to the waterfront by integrating open space and public access into redevelopment project-



68 69

Figura 2. Neighborood reach strategies, NYC Comprehensive Waterfront Plan, Vision 2020. Source: NewYork city authority

⁵ Martin L. Millspaugh, Waterfronts as catalysts for city renewal In: Marshall, R. (Ed.). (2001). Waterfronts in Post-Industrial Cities. London: Taylor & Francis.

⁶ Si parla di consapevolezza ecologica in Gasparrini C., In the city on the cities. Barcellona. LISt, 2015

⁷ La prima versione di questo Piano risale al 1992, diretta dall'amministrazione dell'allora sindaco Dinkins. Cfr: New York Comprehensive Waterfront Plan, Reclaiming the City's Edge

⁸ Arena Marina Adriana, Regium Watefront: una questione di immagine In: Savino M., (Waterfront d'Italia, Piani, Politiche, Progetti). Franco Angeli Editore

⁹ Sono 578 miglia la lunghezza della "shoreline" interessata dal Progetto guida del New York Comprehensive Waterfront Plan.

s"10, rimane una costante generale che accompagnerà i diversi progetti realizzati anche in fasi successive. Le riflessioni e i progetti per New York restano un caso emblematico sia per la capacità di ricondurre i diversi interventi ad un unico processo di riconfigurazione urbana che ha interessato tutta la città, non parti singole, ma anche per la flessibilità delle operazioni dimostrata dinanzi ai mutamenti urbani¹¹. A supporto degli scenari previsti per il primo Piano, la Vision 2020 della città di New York riafferma i principi di accessibilità degli spazi aperti al fronte mare, ed investe in azioni di riconfigurazione del sistema capillare della Blue Network per un migliore ripristino ecologico dell'ecosistema costiero.

Quasi come un effetto domino, le ricadute positive furono la valorizzazione economica delle aree intercettate da questi interventi, e una maggiore accessibilità degli spazi aperti urbani al fronte mare.

Anche in Europa si sono vissute stagioni di questo tipo, e in molti casi hanno dato vita a processi virtuosi di sviluppo di intere aree marginali, o comunque abbandonate in seguito alla dismissione di interi complessi industriali. Per anni la letteratura scientifica si occupata di attribuire una corerente definizione alla innumerevole quantità di spazi e complessi abbandonati, principalmente situati ai margini della città. Siti industriali dismessi, aree abbandonate, "Drossccape", sono passati dall'essere considerati detrattori del paesaggio urbano a aree strategiche interessate da nuove dinamiche urbane di sviluppo (Berger, 2007). Diversamente dalle politiche e dai processi di rigenerazione avviati in quegli anni in America, la maggior parte delle operazioni europee di trasformazione urbana avvenuta nelle aree costiere è stata inquadrata in un processo più ampio di rinnovamento urbano sostenuto, sia culturalmente che finanziariamente, dalla realizzazione dei grandi eventi culturali e sportivi. Alla radice di questa dinamica l'idea che dalla trasformazione fisica di queste aree, assieme alla creazione di nuovi tessuti urbani di alta qualità, si sarebbero potuti trasformare questi progetti di piccola scala in azioni di sviluppo urbano

e, talvolta territoriale.

I canali di finanziamento per l'avvio di processi di questo tipo sono stati in parte forniti da fondi comunitari europei, in parte ricavati da fondi privati e pubblici investiti nella realizzazione di grandi eventi espositivi di portata mondiale.

Caso paradigmatico quello della città di Barcellona, che a partire dagli anni 80 ha avviato un processo di rigenerazione urbana basato sulla riconquista dello spazio pubblico lungo le aree di contatto con l'acqua, definendo mediante una sequenza di operazioni, talvolta realizzate in fasi successive, il water-front come catalizzatore di nuove esperienze urbane.

Le Olimpiadi del 1992 rappresentarono una fertile occasione per rigenerare interamente il litorale costiero barcellonese e restituire alla comunità un pezzo importante di città che le era stato sottratto. Alla base del progetto unitario la realizzazione di un sistema di spazi pubblici diffusi e tenuti insieme da una ben definita rete di percorsi pedonali e ciclabili che si snodano lungo la costa, e che rappresentano nei diversi punti di intersezione con la città, i principali accessi al fronte mare. Appartengono alla seguenza di interventi di recupero ambientale la riqualificazione della spiaggia della Barceloneta, la realizzazione di parchi urbani costieri, tra cui Il parco pubblico progettato da Jeaun Nouvel che ha comportato la rinaturalizzazione del fiume Besos, il parco costiero "landform" realizzato dal gruppo Foreign OfficeArchitects¹², oltre che alla realizzazione di attrezzature tecnologiche, ricettive e cluster di vario tipo. Si tratta di una sequenza di operazioni di rigenerazione che hanno intercettato le diverse occasioni, gli eventi- che a Barcellona si sono realizzati anche dopo il 199213, come opportunità per costruire processi strutturali di sviluppo, non interventi occasionali, tesi a rilanciare l'immagine complessiva dell'intero tratto costiero.

2.2 Città e acque portuali: un rapporto privilegiato nelle politiche di rigenerazione urbana, ma anche una speranza per la riconquista dello spazio pubblico

In maniera del tutto differente dal passato, le città contemporanee testimoniano con le loro forme, la loro crescita diffusa, incontrollata, che lo sviluppo degli ultimi anni è avvenuto tenendo conto di dinamiche urbane indipendenti, spesso in contrasto tra loro. Per rafforzare il significato di una tendenza estranea a qualsiasi forma di controllo unilaterale ma, ad ogni modo, condizionata da una cultura autonoma, come per dire che "La città è lo specchio della complessità della vita moderna" (Marshall, 2001). Ed è in aree così emblematiche città contemporanea come quella dei Water-front, fatti di spazi autoreferenziali, illogici e contrastanti, che si individuano in questa stagione gli scorci per

¹⁰ New York Comprehensive Waterfront Plan, reclaiming the City's edge. 1992 (First edition)

¹¹ La Vision 2020 per il NYC Comprehensive Waterfront Plan è uno strumento che consolida le attenzioni alle tematiche della sostenibilità e della resilienza urbana contenute nel Piano del 1992, in maniera particolare sulla questione del "Natural Waterfront".

¹² Per una maggiore comprensione del progetto, Per la comprensione del progetto S-E Coastal Park a Barcellona, dei FOA (Foreign Office Architects) vai su:http://www. landezine.com/index.php/2009/10/forum-s-e-coastal-park/. 13 Il testo fa riferimento alla realizzazione del parco e delle attrezzature High Tech realizzate nel 2004, in occasione del Forum delle culture.

una nuova conquista dello spazio pubblico e della vitalità urbana¹⁴. Urbanisti, Architetti, studiosi, riscoprono in questi luoghi un importante risorsa per fare chiarezza su un problema importante riguardo il ruolo dello spazio pubblico, e quali significati poter attribuire ad esso in una società sempre più frammentata nelle sue diverse sfaccettature. "Terrain vague", "drosscapes", "non luoghi", sono solo alcune delle tassonomie utilizzate per descrivere lo status quo di aree in denitivo o in itinere stato di dismissione e di abbandono. La città come organismo incapace di inseguire le richieste del mercato globale, dell'innovazione tecnologica nel sistema di stoccaggio e di distribuzione dell'industria marittima, rappresenta solo una delle tante sfaccettature di guella complessità con cui il progetto urbano ha dovuto relazionarsi.

La riconfigurazione spaziale di un porto tanto significativo guale guello di Baltimore, ha dato origine a un insieme articolato di iniziative, politiche, ma anche progetti isolati che hanno posizionato il baricentro d'interesse sulla questione del ripensamento dei waterfront in tutto il mondo¹⁵

Iniziative accademiche attorno al tema città porto:

- Watefront in Postindustrial cities, Cambridge by the Harvard Graduate School of Design;
- Waterfronts 17," held in Charleston by the Waterfront Center
- "Worldwide Urban Waterfronts," held in Vancouver by Baltic Conventions from the United Kingdom

"Confini planetari" e anomalie contemporanee. Gli impatti del cambiamento climatico come uno dei maggiori fattori di accelerazione dei rischi legati all'acqua.

Secondo i dati raccolti dallo studio dello Stockholm Resilience centre¹, l'acqua rappresenta uno dei nove confini planetari che l'uomo sta raggiungendo nell'era dell'Antropocene. Il concetto di "confine planetario" è stato appunto utilizzato per spiegare le relazioni tra le differenti attività attinenti lo sviluppo umano e le variazioni delle componenti ambientali verificatesi in questo periodo storico (Figura 3). Ci sono due ragioni alla base per cui si è scelto di utilizzare il termine succitato, e di contestualizzarlo in un dato momento storico dell'evoluzione planetaria. Dei nove confini planetari individuati dallo studio del professor Steffen ci sono sicuramente il cambiamento climatico, termine che ha avuto la sua grande diffusione solo negli ultimi anni, e l'uso indiscriminato di acqua dolce. Gli altri non meno importanti sono stati messi da parte e non citati solo per questioni di necessaria focalizzazione sui due più pertinenti al tema di ricerca. La seconda ragione alla base di questa scelta risiede nel fatto che i confini sarebbero stati varcati dall'uomo in un periodo di tempo molto conciso e relativamente recente rispetto all'intervallo temporale di riferimento utilizzato per registrare il livello medio delle variazioni delle temperature sulla sfera terrestre².



¹ Il progetto è stato guidato dal professor Will Steffen dello Stockholm Resilience centre, con i contributi scientifici di diversi Istituti e Università, divenendo il risultato di uno sforzo internazionale.

Figura 3. Questo grafico illustra il cambiamento delle temperature sulla superficie terrestre, relative al periodo 1880-1980. 17 dei 18 anni più caldi registrati nei 136 anni si sono registrati a partire dal 2001, con la sola eccezione del 1998 Fonte: NASA- GISS.

¹⁴ Il testo fa riferimento alla definizione di riconquista di una vitalità urbana ottenuta attraverso il recupero dei waterfront, come progetti di città paradigmatici. Cfr: Watefront in Post industrial cities, Marshall, 2001

¹⁵ Il testo fa riferimento all'istituzione dell' "International Waterfront Network", a seguito di un interessamento globale al tema della riqualificazione delle aree industriali costiere.

² Le variazioni delle temperature globali, espresse in C°, nel periodo di tempo 1880-2015, sono fornite dagli studi e dalle relative rappresentazioni grafiche NASA's Goddard Institute for Space Studies (GISS). Credit: NASA/GISS
Delle 18 variazioni registrate dallo studio Nasa in 136 anni, 17 di questi sono stati registrati a partire dal 2001³. Questo dato, se da una parte conferma una traiettoria che è in continuo aumento, dall'altra evidenzia "un'anomalia" che è legata alla registrazione di queste variazioni in un periodo di tempo molto limitato. Lo studio di Steffen sulle interrelazioni tra le componenti ambientali e le lo sviluppo umano avvalora la tesi secondo cui ci troviamo di fronte a un periodo di forte accelerazione dei processi economici e di sviluppo sociale, e che i modelli economici e di sviluppo continuano ad essere eccessivamente dissipativi di energie, oltre ché irrazionali rispetto allo status attuali in cui si trovano i diversi ecosistemi. I dati confermano, quindi, un problema che apparentemente non sembra interessare la dimensione urbana perché registrano un fenomeno che è percepibile alla scala globale, e ci troviamo di fronte a una condizione in cui è ancora persistente la prevalenza di modelli economici globali altamente dissipativi di risorse e che essi siano ancora scarsamente significative le traiettorie intraprese fin'ora da quei modelli "sostenibili", diffusi negli ultimi anni. Ma se si analizzano in particolare gli effetti di questo fenomeno relativamente recente, si ha chiara la situazione che questi atteggiamenti finiscono col determinare, in realtà, una forte "disuguaglianza a scala globale" (Mezzi, P., Pelizzaro, 2016) e che questi siano determinati da paesi che in realtà rappresentano solo una piccola percentuale dell'intera popolazione mondiale (Figura 4).

Ovviamente, quello che è un dato risaltante è che i maggiori "inquinatori" della terra fino ad oggi sono stati proprio i paesi Ocse, in cui è più forte il modello di sviluppo economico e industriale grazie alle imponenti cooperazioni attivate negli anni. Di fronte a questo problema di rilievo globale sono proprio le strategie internazionali e comunitarie che devono poggiare lo sguardo su quella che è la condizione dei luoghi in cui viviamo. Sappiamo bene che l'urbanistica da sola non è grado di veicolare i modelli di sviluppo economico su scala urbana, tantomeno di pretendere che dal comportamento di una singola realtà urbana dipendano gli effetti negativi prodotti dai cambiamenti climatici che si stanno generando a scala globale. Tuttavia, è responsabilità dell'urbanistica, insieme agli strumenti politici locali, individuare i mezzi e gli strumenti idonei per costruire strategie strutturanti e a lungo termine di fronte a un pro



Figura 4. Questa mappa mostra la concentrazione media di biossido di azoto in atmosfera nell'anno 2005. In blue si indicano le riduzioni di biossido di azoto, mentre in arancio sono riportati gli aumenti in atmosfera. Fonte:NASA, Ozone Monitoring, Aura Satellite

³ Questo secondo i diversi studi, sarebbe quello che viene definita l'era dell'Antropocene, e sarebbe successiva all'Olocene poiché il suo stadio di inizio coinciderebbe secondo diversi geologi con il periodo industriale, vale a dire quello in cui si sono manifestate le prime influenze da parte dello sviluppo umano sul clima. A partire dal 2001 si sono, infatti, registrate variazioni significative rispetto alla velocità con la quale si erano manifestati prima questi cambiamenti, con un aumento medio di circa 0.2°C ogni decennio. Fonte: IPCC (Intergovernmental Panel on Climate Change)

blema che non si presenta come evento straordinario, ma come senario di impatto a scala plurisecolare. E' evidente, e i risultati lo dimostrano, che c'è uno scollamento tra gli sforzi internazionali e comunitari intrapresi in questi anni per il raggiungimento di obiettivi ambiziosi sul tema dei cambiamenti climatici e del riscaldamento globale, e i processi in corso di tipo economico e sociale all'interno di questi paesi promotori al livello globale. Coloro che dovevano essere i paesi traghettatori di questi obiettivi e che avrebbero dovuto dimostrare agli occhi dei più incerti la fattibilità di questi ultimi nei tempi previsti dalle strategie, continuano a imperniare le loro economie attorno a settori del mercato che fanno largo uso di combustibili fossili e arrecano danno all'ambiente, e contribuiranno a invalidare il mantenimento delle temperature medie nel lungo termine (**Figura 5**).

Un dato più sollevante arriva dalle immagini satellitari che hanno reso disponibili i ricercatori della NASA. Queste mostrano come nel periodo di tempo 2004-2015 ci sia stata una sostanziale riduzione delle emissioni di nitrogeno, il principale combustibile rilasciato dalle industrie e dall'uso indiscriminato di auto nelle nostre città⁴, nei paesi promotori delle regolamentazioni ambientali più restrittive, e che invece vi sia stato un sostanziale aumento nei paesi di nuovo sviluppo e di forte concorrenza.

Da questo punto di vista è necessario che essa torni maggiormente a occuparsi di questioni ambientali e che produca strumenti in grado di indirizzare coerentemente gli sviluppi della società contemporanea, di assecondarne i suoi comportamenti quando questi sono diretti a valorizzare il ruolo delle risorse⁵, ma soprattutto di incentivare modelli economici che siano in grado di coniugare la crescita economica con lo sviluppo sostenibile ambientale e la preservazione degli ecosistemi (**Figura 6**).

Ci sono ancora diversi dubbi rispetto agli scenari legati ai cambiamenti climatici ai quali nemmeno i diversi studiosi nel mondo, che ogni giorno collaborano con le principali istituzioni a livello mondiale⁶, hanno saputo rispondere. Que-

4 Per un interessante confronto dei cambiamenti registrati nell'intervallo temporale succitato, e la visione in sequenza delle immagini, può essere utile consultare l'articolo pubblicato da NASA su questo argomento. Fonte: https://svs.gsfc.nasa.gov/12094

5 Il testo fa riferimento alla nascita di iniziative e di processi diffusi di rigenerazione "bottom up" avviati dalle stesse comunità in ambito urbano-spesso ostacolate dagli strumenti urbanistici-per rispondere a una domanda collettiva di ripristino delle condizioni ambientali di luoghi obsoleti e dismessi.

6 Le simulazioni effettuate, assieme alle proiezioni per il controllo delle variazioni a scala globale pubblicate dall'IPCC (Intergovernmental Panel on Climate Ghange) sono sintetizzate costantemente a partire dalla letteratura scientifica messa a disposizione dai diversi studiosi in tutto il mondo.



Figura 5. La mappa globale mostra i risultati del trend sull'intervallo temporale 2004-2015, evidenziando (in blue) la riduzione delle emissioni di NO2 in Europa, a seguito delle regolamentazioni ambientali messe in atto in questi anni. Fonte:NASA. sti dubbi oggi riguardano quali potranno essere le entità che gli scenari futuri legati ai cambiamenti climatici potranno produrre nei prossimi decenni, e la loro distribuzione spaziale con gli impatti a scala locale. Quello che però è certo, ed è stato dimostrato, è che l'entità del riscaldamento globale dipenderà strettamente dalla quantità di gas serra che verranno immessi nell'atmosfera nei prossimi decenni, vale a dire dalle pressioni che le "emissioni antropogeniche"⁷ eserciteranno mediante le diverse attività economiche.

Per quanto riguarda il primo dei dubbi sollecitati, lo studio rivela che se anche le emissioni di gas serra dovessero diminuire drasticamente i risultati potrebbero verificarsi su una scala temporale plurisecolare e non in archi temporali a breve termine. Dall'altra parte si registra, come già anticipato, una forte accelerazione delle temperature medie a livello globale, con una particolare impennata nel decennio 2006-2015 in cui si è registrato un aumento medio dello 0.87C° in più rispetto ai livelli al periodo di tempo 1850-1900, e di un tasso di crescita di circa di 0.2C° per decennio proprio a causa delle emissioni passate e di quelle in corso⁸. L'altro dubbio è quello che riguarda la sua distribuzione del rischio legato ai cambiamenti climatici, oltre che ai possibili impatti a scala urbana.

Non si tratterebbe solo ed esclusivamente di una questione geografica, nonostante le previsioni lascino immaginare che questo possa essere un fattore comunque molto determinante. Per quanto riguarda l'Europa, è possibile dire che in base alle proiezioni climatiche si avrà un aumento delle temperature generale in tutte le regioni, con un sensibile squilibrio nelle precipitazioni tra le zone settentrionali -le più colpite sotto questo aspetto dagli scenari legati alle precipitazioni- e le zone meridionali. L'Europa del sud, risulta essere, comunque, la zona più esposta e vulnerabile agli impatti legati a questo fenomeno. Ma le mutazioni locali sono anche un effetto diretto delle vulnerabilità dei territori osservate sotto altri punti di vista, non specificamente geografici e ambientali. Gli studi avanzati dimostrano che i paesi più ricchi sono anche quelli più che hanno un livello di esposizione ai rischi legati ai cambiamenti

7 Le emissioni antropogeniche sono quelle prodotte dai Gas Serra introdotti nell'atmosfera. Questi appartengono alle differenti attività antropiche ed economiche che incidono particolarmente per la loro diffusione. Il testo fa riferimento anche alle attività economiche e agricole, quelle che fanno uso consistente di fertilizzanti e uso di combustibili fossili.

8 I dati rappresentano il prodotto di proiezioni e di studi utilizzati per individuare il livello medio del riscaldamento globale illustrati. I risultati di questi studi possono essere consultati su: Global warmin of 1.5 °C, edito dall'Intergovernmental Panel on Climate change IPCC. Electronic copies of this Summary for Policymakers are available from the IPCC website www.ipcc.ch



2040	2060	2080	2100
2010	2000	2000	

Figura 6. Cumulative emissions of COand future non-CO radiative forcing determine the probability of limiting warming to 1.5°C. Fonte: 5°rapporto IPCC 2015 sulle variazioni temporali delle temperature medie nel periodo 1960-2100. Fonte: IPCC, Report 2015.

climatici minore rispetto al resto del mondo, e questo è dovuto a una serie di fattori principalmente di tipo economico e politico, ma anche demografico. Anzitutto, è chiaro che una minore popolazione incida in maniera minore sul funzionamento di infrastrutture, sulla normale distribuzione dei servizi, e che essa eserciti una pressione minore sulla disponibilità delle risorse, diversamente da paesi in cui si registreranno maggiori sovraccarichi e una maggiore richieste di gueste ultime. Ma non meno influente è il fatto che guesti paesi sono tendenzialmente meno dipendenti dai modelli economici dipendenti ed esposti alla variazione delle temperature, oltre che ai cicli delle risorse. Sappiamo bene, infatti, che esistono paesi che traggono benefici e che fondano la loro economia di sussistenza proprio sui mercati legati alle filiere agricole, e quanto queste dipendano dal sistema climatico e dal variare dei cicli di risorse come l'acqua. Se volgiamo per un attimo lo sguardo all'Europa, e mettiamo a confronto due dati importanti che aiutano a fare maggiormente chiarezza sulle proiezioni e gli scenari di impatto per le differenti regioni, è facile capire che i possibili effetti negativi e la loro distribuzione spaziale avranno esiti molto più negativi nelle zone meridionali. In particolare, mettendo a confronto i dati sulla ricchezza di un paese⁹ -espressa in valore PIL pro-capite- e i dati sui gradi di vulnerabilità in Europa, si evidenzia come queste sono particolarmente esposte rispetto a quelle settentrionali.

Non si tratta solo di mettere in relazione esclusivamente i dati su organi istituzionali dei vari paesi, quanto piuttosto di capire come i singoli individui potrebbero rispondere alle proiezioni temporali legati a scenari di impatto negativi. Come reagirebbero le singole comunità in attesa di aiuti e ausili da parte dei governi centrali in casi di eventi catastrofici, fenomeni estremi come piogge e inondazioni? Davanti a questa domanda c'è da capire se le comunità detengono il giusto sostegno¹⁰ per affrontare la questione dei rischi legati all'acqua e ai cambiamenti climatici, e con quali forze economiche esse potrebbero reagire in caso di disastro. Negli ultimi anni l'Italia

Il 5° rapporto IPCC ha confermato nello studio succitato, che gli impatti più negativi e irreversibili si registreranno nelle città, vale a dire nelle aree maggiormente esposte alle pressioni antropiche, alle loro economie, e all'utilizzo dei sistemi infrastrutturali. Sebbene esistano diverse "soglie critiche"¹¹che vengono attraversate ogni qualvolta si esercitano pressioni antropiche, la maggior parte degli impatti provocati dal cambiamento climatico in ambito urbano generano un insieme di rischi direttamente collegati al tema delle acque, incidendo profondamente sulle persone, le economie locali e sui diversi ecosistemi. Tra queste si possono annoverare quelle maggiormente in aumento, come l'innalzamento del livello del mare dovuto allo scioglimento delle banchise di ghiaccio nelle zone polari, il tasso sempre più elevato di inondazioni in aree interne e costiere, ma anche il numero di precipitazioni estreme registrate in questi anni. Un recente studio ha dimostrato come circa 50 città costiere localizzate in tutto il mondo, con una popolazione superiore ai 10 milioni di abitanti, potrebbero essere soggette in futuro a inondazioni direttamente collegate al rischio di innalzamento del livello del mare (Figura 7).

Questo tipo di squilibrio oltre che essere divenuto un fenomeno recente in forte crescita e già manifestatosi in diverse cittò, è stato confermato anche dallo stesso studio IPCC, che ha inoltre fornito una proiezione specifica sulla variazione del livello del mare da qui alla fine del secolo. Non sono dati confortanti, e tanto meno sembrano essere contrastabili con gli strumenti di cui dispongono i modelli di governance utilizzati nelle regioni del sud Europa, vale a dire quelli che siamo abituati a chiamare "approcci tradizionali". I rischi legati alle acque sono u n sistema complesso di combinazioni fortemente dipendenti dalle variazioni climatiche, ed è per questo che esigono approcci capaci di rendere i territori maggiormente resilienti e meno vulnerabili. Sarebbero stati ambiziosi gli obiettivi prefissati già nel 90' dall'accordo internazionale di Copenaghen, se questi fossero stato rispettato almeno in parte. Limitare l'aumento delle temperature globali venne ritenuto un riferimento fondamentale anche nei diversi accordi internazionali sul clima, pena il cosiddetto raggiungimento della soglia di non ritorno¹². Nei principi fondamentali stabiliva che entro la fine del secolo successivo la variazione delle temperature medie globali non avrebbe dovuta essere superiore ai 2°C rispetto ai livelli 11 Per un maggior chiarimento a riguardo, si fa riferimento al contributo di Cesarini A. (2016), in: http://www.ildatomancante.it/opendata/ambiente/1360/i-cambiamenti-climatici-2/

12 Viene individuato dagli studiosi "tipping point" la soglia di non ritorno. In particolare, nella questione ambientale attinente il sistema climatico, si individuano diverse soglie di non ritorno, le quali possono dare forma a diversi effetti negativi a catena non lineari, su larga scala

⁹ I dati utilizzati sulla condizione economica espressa in PIL pro-capite sono forniti da Eurostat, che oltre a un infodata fornisce la classifica che esprime il potere d'acquisto in euro in Europa. Fonte: https://www.infodata.ilsole24ore.com/2017/04/14/ scopri-nella-mappa-le-regioni-europee-piu-ricche-piu-povere/

¹⁰ Il testo fa riferimento non solo al sostegno economico che i governi dovrebbero garantire in caso di eventi catastrofici, ma anche al sostegno civile e culturale rispetto alla necessaria consapevolezza che vi sono gradi di vulnerabilità dei territori differenti e che in alcuni casi questi possono compromettere sensibilmente la coesistenza dello sviluppo umano.



preindustriali, data utilizzata nel 1880 per motivi convenzionali. Un obiettivo, importante quanto scoraggiato già da chi aveva individuato in un atteggiamento tendenzialmente contradditorio un possibile fonte di ostacolo. James Hansen, uno dei climatologi più affermati al mondo afferma in realtà l'impossibilità di raggiungere determinati obiettivi rispetto agli andamenti e agli sforzi raggiunti fin'ora. Nel 2015, l'accordo di Parigi sul clima pone in primo piano un obiettivo ancora più ambizioso rispetto a quello siglato con l'accordo di Copenaghen, sfiorando l'idea che le variazioni della temperatura media globale possa tenersi a un livello minimo di aumento di circa 1,5° crispetto al periodo di riferimento, vale a dire solo lo 0,5°C in più rispetto allo stato attuale. Un obiettivo anch'esso contrastante con gli sforzi che i paesi Ocse, promotori principali di questo obiettivo, stanno effettuando per determinare la riduzione dei gas serra sull'intero sistema terra. Per molti una sfida, per alcuni un'utopia impossibile da realizzare, dati i mezzi a disposizione, l'inerzia legati al cambiamento del sistema tecnologico e ai sistemi agricoli- tra i primi a determinare l'incremento delle emissioni- e quella con cui rispondono la politica, ma anche i comportamenti dei singoli individui.

Figura 7. L'immagine mostra lo scenario di impatto e gli effetti negativi per l'innalzamento del livello del mare in 50 città costiere in tutto il mondo. Fonte: Clark et al, Nature 2016.

Gli eventi estremi come opportunità. Gli indirizzi ai piani strategici e le nuove direttive come cambio di paradigma degli strumenti nei confronti dei rischi legati alle acque.

In questo senso la ricerca vuole far sì che l'acqua, come parte integrante di un più ben organizzato sistema di infrastrutture green e blue, diventi un caposaldo nella definizione degli strumenti e che, sia essa inquadrata in una dimensione valoriale, multifunzionale, capace di dare tanto riposta alle istanze ecologiche quanto di costruire valore culturalmente significativo attorno alle diverse questioni urbane¹ che esse si porta dietro.

Negli ultimi anni la traiettoria è stata in parte è stata tracciata dalla presenza di norme e principi comunitari che hanno discusso ampiamente sul tema e sul valore multiplo delle risorse naturali in ambito urbano, della valorizzazione delle infrastrutture green and blue, e di un loro inserimento progressivo negli strumenti urbani secondo un approccio multidisciplinare. Un forte impulso è stato senz'altro attribuito all'introduzione di alcuni concetti chiave definiti sulla base di accordi e principi comunitari, e che sono entrati a far parte del linguaggio comune del progetto urbanistico. Primo fra tutti potrebbe essere, per data e risonanza, il termine della sostenibilità². Come accade spesso con alcuni concetti che vengono presi in prestito da altre discipline, così l'urbanistica ha preso in prestito alcuni di essi e li fatti propri, talvolta utilizzandoli eccessivamente fino a svuotarli di significato.

La sostenibilità³ nel campo delle politiche e delle strategie internazionali è un concetto chiave ampio che prende le mosse dalla realizzazione della Commissione mondiale sull'ambiente e sviluppo (WCED)⁴, presieduta dall'allora mini-

stro Brundtland. La diffusione degli studi avviati nei tre anni successivi alla creazione della Commissione porterà alla nascita di un report di cui il nome "Our Common future" evidenzia l'intenzionalità di costruire una visione comune di sviluppo sostenibile, e diventerà uno dei testi di riferimento per il Summit sulla terra e la creazione del programma di lavoro Agenda21. Si può considerare la tappa fondamentale perché da quella commissione si sono generati diversi programmi e strategie che hanno costruito le loro radici su questo concetto, interpretandolo, modificandolo secondo un preciso scopo di utilizzo.

Il concetto di "sviluppo sostenibile"⁵, termine ampiamente utilizzato nei diversi settori disciplinari, poi applicato anche alla disciplina dell'urbanistica, diviene un messaggio chiave che sortirà nel tempo effetti e produrrà nuovi testi in cui esso ne farà parte. All'origine del termine l'idea secondo cui a ogni qual forma di sviluppo, di cambiamento, sia fisico che politico-istituzionale, dovesse corrispondere una certa coerenza con i bisogni futuri, oltre che con quelli attuali. Questo importante documento, in realtà, ricalca un concetto importante che aveva già delineato la commissione ONU nel 1972, riunitasi a Stoccolma in occasione della "Conferenza sull'ambiente umano", ovverosia la necessità, a livello mondiale, di "difendere e migliorare l'ambiente per le generazioni presenti e future"⁶. L'importanza di assicurare un benessere fisico, di poter assicurare il godimento e l'uso del patrimonio ambientale alle generazioni presenti e future rimarrà un riferimento costante di cui si avvarranno anche testi e principi normativi emanativi successivamente. La conferenza mondiale ONU su "Ambiente e Sviluppo" parla di diritto di sviluppo per un equo soddisfacimento di bisogni da assicurare sia alle generazioni presenti, che a quelle future. Sostenibile diviene un suffisso importante nel 1994, in occasione della stesura di un accordo europeo per la realizzazione della Carta delle città europee -da cui seguiranno la2° e la 3° conferenza sulle città europee sostenibili, tenutesi tutt'e tre a distanza di 4 anni allo scopo di monitorare i progressi fatti dalla prima conferenza- per uno sviluppo durevole e sostenibile. Il suffisso Sostenibili accompagna il prefisso città europee per rendere esplicita la necessità di adottare un modello di sviluppo realizzabile localmente, ma fondata su principi di indirizzo comune7.

5 La definizione di sviluppo sostenibile a cui il testo fa riferimento è quella utilizzata per la prima volta nel rapporto Brundtland, elaborato nel 1987 dalla Commissione mondiale sull'ambiente e lo sviluppo (WCED,1987).

6 Il testo fa riferimento a un 'esplicita volontà di utilizzare questo estratto del testo come costante riferimento che è possibile individuare anche all'interno dei successivi atti di conferenze mondiali.

7 Il testo fa riferimento all'importanza attribuita alla realizzazione della Carta, il cui testo fu esaminato da oltre 600 partecipanti, divisi in 36 gruppi di lavoro e operanti

¹ Il testo fa riferimento alla molteplicità delle questioni cui l'urbanistica è chiamata a rispondere nella dimensione contemporanea, con particolare riferimento alle tre richiamate da Secchi, cioè la questione ecologica, ambientale, insediativa. Cfr Secchi B, In: La nuova questione urbana. Crios

²

³ Il testo vuole fare esplicito riferimento a un concetto di sostenibilità relativamente contemporaneo, derivato dalla diffusione di strategie e programmi di lavoro internazionali che hanno dato vita al concetto di sviluppo sostenibile.

⁴ Per una maggiore comprensione si consulti (WCED): 38/161 in December 1983, World Commission on Environment and Development, convened by the UN General Assembly.

Questi sono i principi alla base degli impegni comunitari e internazionali a cui i diversi paesi hanno aderito; La creazione di Agenda 21 conferma questa volontà di accomunare tutte le iniziative locali promosse a livello mondiale dai diversi paesi sotto un unico programma di indirizzo comune.

"Pensare globalmente agire localmente" identifica però anche lo spirito sotteso dell'iniziativa e la consapevolezza che la questione ambientale è ben più complessa di quello che s'immagina, e di certo trovare una soluzione convenzionale che si presti ai differenti paesi risulta tutt'altro che appropriato. Un atteggiamento chiave è da individuare nella determinazione del programma di incoraggiare processi di consultazione per avviare processi condivisibili, e nell'ambizione nel costruire consenso attraverso azioni partecipative in cui l'obiettivo rimane quello di "aumentare la consapevolezza ambientale da parte delle famiglie"⁸. La ricerca vuole porre l'attenzione non tanto sulla molteplicità e sull'articolazione dei vari strumenti intrapresi a livello comunitario e internazionale⁹, quanto piuttosto sull'importanza che questi hanno avuto nel delineare un percorso culturale, più che fisico, e sulla capacità di questi di sollecitare quella intelligenza critica (Pileri, 2016) necessaria alle comunità per rispondere a questioni irrinunciabili di natura globale in contesti che dimostrano di avere sempre di più i propri limiti¹⁰. Sono considerate, per questo, tappe fondamentali e edificanti perché, attraverso i loro stimoli hanno generato interventi e buone pratiche che hanno modificato lo stato fisico dei territori, in altri casi hanno prodotto una metamorfosi sociale e culturale positiva. referendum, pratiche sociali, sono solo alcuni episodi che si registrano e che vanno in questa direzione)

Alborg +10 rappresenta l'impegno di riferimento per le città sostenibili europee, a cui aderirono più di città con l'obiettivo di dare continuità agli obiettivi prefissati nelle precedenti occasioni e di diffondere maggiormente conoscenza rispetto a un problema condiviso. Esso si offre, infatti, come "pietra miliare nella continuazione del processo"11 avviato in precedenza ed ha lo scopo di

nei vari settori.

9 Sono considerati strumenti per una questione semplificativa, le conferenze avviate già begli anni 70', le convenzioni quadro, le guide normative, le direttive, i programmi d'azione, da esse scaturite, e qualsiasi iniziativa che abbia mirato nel tempo a dare concretezza alle questioni ambientali in ambito urbano.

10 I limiti a cui fa riferimento il testo

11 Il testo fa riferimento a un estratto di "The Aalborg Commitments (2004)" in cui si fa esplicito riferimento alla volontà della Carta di configurarsi quale continuazione di quello che è stato ampiamente auspicato dagli strumenti di indirizzo e dagli impegni garantire massima integrità tra i programmi già avviati, come nel caso di Agenda21 locale.

Flessibilità e adattabilità sono a tale scopo le parole cardine attorno a cui ruotano le iniziative in itinere, e quelle in programma per il futuro della rigenerazione urbana e dello sviluppo sostenibile. Si può dire che questi strumenti abbiano avuto una responsabilità importante, segnando in alcuni casi l'inizio di un percorso culturale finalizzato alla diffusione di concetti e di atteggiamenti di cui anche l'urbanistica ha fatto ampio utilizzo, sebbene i risultati spesso risultino ancora incerti.

In particolare, la ricerca vuole confermare una certa tendenza -dimostrata attraverso l'utilizzo di dati statistici comparati tra loro ad uno scopo preciso- che nel tempo si verifica, e che è influenzata certamente da questi fattori.

I programmi e le azioni avviate, sia in ambito europeo che globale, se da una parte dimostrano di voler portare avanti un percorso condiviso e continuativo, dall'altra parte rappresentano degli strumenti che in una dimensione sociale e culturale sollecitano un evidente interesse limitato da parte delle comunità che può essere circoscritto al momento della loro realizzazione e diffusione. Questo mette in luce, sicuramente un dato importante, ovvero sia la mancanza di forza nel tenere in costante tensione alcuni temi che fanno parte della nostra quotidianità. Questo fenomeno, come tanti altri, è rappresentabile utilizzando quelli che sono i dati numerici effettivi, e i trends che si generano nel tempo e nello spazio attorno ad alcune parole chiave di cui questi programmi si sono fatti portatori.

Uno degli aspetti interessanti di questo dato non è tanto il dato numerico, che può essere significativo solo se stessimo conducendo un'indagine statistica, quanto piuttosto la capacità di mostrare istantaneamente un "trend", e di mettere in luce anche una definita distribuzione geografica (Figura 8). In seguito, sono rappresentati a tale scopo, i grafici che mostrano gli interessi temporali¹² e la loro distribuzione geografica.

precedenti, con particolare riferimento alla capacità di integrazione con i programmi di azione locale appartenenti ad Agenda21

12 "Interest in time" è il dato fornito dal motore di ricerca Google su determinate parole. Esso permette di ottenere in linea di massima quanto una parola, su una scala di valori da 1 a 100, è stata cliccata, con particolare attenzione alla distribuzione geografica di questo dato. mettere in luce

86 87

Digital perimeter of the flooded area during the extreme event of the 31 March 1845 and overlapping with the historical cartography,

⁸ Cfr: capitolo 28 della Local Agenda 21



Questo grafico restituisce in parte la volontà dei programmi e delle azioni avviate a partire dagli anni 70' e fino ad oggi, di dare continuità agli obiettivi a cui essi ambiscono, di consentire la massima domesticità di alcuni termini- nel grafico sono rappresentate le parole chiave climate change, sustanability¹³, resilience- che le comunità locali trascuravano, secondo una visione di sviluppo comune. Alcune parole chiave, in particolare, sono state ampiamente sovrautilizzate in questo lasso di tempo e hanno, difatti, rappresentato anche un termine che ha fatto da filo conduttore per lo sviluppo di programmi e interventi in costante crescita (**Figura 9**). In questo caso si conferma il fatto che la parola "Climate change" ha suscitato un interesse nel tempo¹⁴ mediamente più alto rispetto agli altri termini indagati, ma anche una forte fase di attenzione da parte delle comunità in periodi di tempo circoscritti, probabilmente in occasione di alcuni eventi specifici, che rappresentano senza dubbio dei fattori d'incidenza. I dati comparativi sono rappresentati e distribuiti su un intervallo

13 Il testo vuole evidenziare una volontaria generalizzazione del termine, rispondendo alla necessità di tenere in considerazione la flessibilità e l'integrabilità della parola nei diversi contesti indagati dai programmi stessi. Per la definizione a cui si ambisce, il testo riconduce il termine alla definizione di sviluppo sostenibile, contenuta nel rapporto Brundtland, elaborato nel 1987 dalla Commissione mondiale sull'ambiente e lo sviluppo e che prende il nome dall'allora premier norvegese Gro Harlem Brundtland. 14 Il testo fa riferimento alla denominazione dei dati così come riportati dalla fonte Google; "interest in time", infatti, rappresenta un dato istantaneo calcolato su una scala di valori 1 a 100, allo scopo di rappresentare un livello informativo immediato, e di evidenziare fenomeni di interesse in un dato periodo. **Figura 8.** Il grafico temporale è utilizzato per evidenziare i "trends" delle parole chiave climate change, susttainability, resilience, cliccate in tutto il mondo dagli internet users. I dati fanno riferimento all'intervallo di tempo 2004-2019, e contengono livelli informativi ottenuti dal motore di ricerca Google. Fonte: immagine realizzata dall'autore con il contributo dati proveniente da Google Trends 2019. di tempo molto esteso, con l'obiettivo di evidenziare la rilevanza dei programmi stessi ai fini conoscitivi e fornire più livelli informativi attraverso un'unica rappresentazione.

I risultati mostrano che una distribuzione geografica della ricerca dei termini, in questo caso Climate change, risulta fortemente influenzata da alcuni fattori, due dei guali si possono ritenere di fondamentale importanza. Il primo è che la realizzazione di programmi ed eventi, oltre a dare impulso alle politiche nazionali secondo uno schema condiviso, determinano un'occasione utile per accostare le comunità ai temi legati alla questione ambientale ed ecologica. Dall'altra parte, la forte concentrazione dei dati raccolti in alcune aree, gli Stati Uniti in questo caso, fa immaginare che è lo stesso fenomeno di rischio a generare una forma di autoconsapevolezza nei confronti di un processo di metamorfosi ambientale, mentre altrove il fenomeno risulta ancora poco indagato. Nel solo paese americano si registrano, infatti, maggiori livelli di attenzione rispetto al resto del mondo per le tematiche fin qui argomentate, e quasi alla stessa misura possono talvolta combinarsi le parole chiave della sostenibilità e del climate change (Figura 10 A e B). Questo dato è reso ancora più evidente dalla successiva mappa sulla distribuzione geografica della parola sostenibilità, la quale appare più decisa nei paesi in cui maggiori sono le crisi di natura ecologica ed ambientale, oltre che più frequenti i fenomeni catastrofici ambientali.

Il rapporto tra questi dati e l'acqua è abbastanza evidente se ci si sofferma sulle diverse aree che vengono mostrate in mappa, ed è facile intuire che più forte è il danno subito da questi fenomeni, maggiore è il desiderio delle comunità di prendere coscienza del fenomeno. Si tratterebbe di pura coscienza dei fatti, ma non di attitudine al cambiamento o al desiderio di cambiare per adattarsi, ed è un dato che invita piuttosto a una riflessione di carattere disciplinare cui l'urbanistica non può esimersi, poiché non coglie in guanto disciplina di razionalizzazione dei suoli, le trasformazioni fisiche, ama anche culturali ancorate spesso ai nuovi processi di cambiamento, ma così fragili da non essere parte dell'agenda urbana, seppure così importanti. In questo senso l'Urbanistica deve tornare a riflettere sul suo ruolo, sulle inevitabili trasversalità cui deve andare incontro per divenire sempre più uno strumento capace di cogliere delle esigenze, domande politiche espresse dalle comunità. Diventa allora il termometro attraverso cui misurare alcuni fenomeni in atto, e dinamiche troppo spesso non indagate perché convinti che siano parte di un processo a cui lo strumento non può dare risposta.

Dieci anni dopo, la conferma che sviluppo sostenibile non coincide con il termine di crescita economica, e che esso debba necessariamente prevalere sulla

scala dei vertici del valore sul secondo.

Ricostruire le tappe fondamentali i principi e gli accordi internazionali che hanno dato vita ad alcuni concetti chiave può risultare un'operazione utile a fare chiarezza su alcuni termini che sono divenuti familiari nel linguaggio urbanistico per descrivere la condizione urbana e per giustificare prospettive future.



Figura 9. Distribuzione geografica del trend su intervallo temporale 2004-2019, per il livello informativo "Climate change" come keyword ricercata in tutto il mondo dagli internet users. Fonte: mappa realizzata dall'autore con i dati informativi provenienti dal motore di ricerca Google.





Una condizione cruciale per la scelta del caso studio di Dresda, Germania: la condizione storica di rischio legata alle acque dell'Elba come espediente per una interpretazione pro-attiva del rischio nel progetto urbano.

Dresden, la città capitale dello stato Federale della Sassonia, sin dalla sua fondazione nel XIII secolo, si è sviluppata nell'ambito industriale e della ricerca. Stando ai dati del censimento 2004, Dresda ha una popolazione di 478.000 abitanti che vivono in 255.000 abitazioni, con circa 26 industrie localizzate intorno alla città¹.

I motivi che spingono la ricerca a occuparsi di guesta città sono però particolarmente legati alla compresenza del rischio legato all'acqua, come condizione plurisecolare a cui la città è da sempre dipendente. Lo studio si propone di indagare i principi, gli obiettivi-considerando anche i suoi limiti-e la consapevolezza rispetto al tema del rischio da parte di strumenti tradizionali esistenti e della comunità locale. Obiettivo, appunto, è quello di verificare se il caso registra un processo di adattamento al rischio resiliente, che sia in grado di andare oltre gli atteggiamenti tecnici registrati fino a qualche anno fa per far fronte al problema. Lo studio dei piani e dei processi storici è un punto di riferimento fondamentale che pone un interesse sul modo in cui nel tempo è stata affrontata la dimensione del rischio, ma sollecita anche letture interpretative che consentono di capire in che modo l'uomo ha addometicato la risorsa.

Obiettivo generale è quello di fornire una letteratura interpretativa che metta in tensione gli effetti negativi indotti dal rischio legato alle acque e la consapevolezza sociale diffusa sul tema da parte della comunità. Una prima conferma arriva dal fatto che la messa in relazione evidenzia come, a scala nazionale, una maggiore consapevolezza concreta sia da associare alla determinazione di fenomeni di rischio nelle differenti città, i quali probabilmente spingono le comunità ad un interesse specifico verso dinamiche che le interessano più o meno direttamente. L'utilizzo di alcune parole chiave che nel linguaggio formale degli strumenti urbanistici, ma soprattutto dei documenti europei, hanno rappresentato un elemento fondamentale, serve in questo caso a mettere in luce le differenti sensibilità dei contesti di fronte a un problema. Può essere utile utilizzare come indicatore di consapevolezza rispetto al problema la ricerca di alcune di queste parole chiave da parte della comunità (Figura 11).

1 Statistikamt Dresden, 2004, Infas GEOdaten 2004

Figura 10. (A) Distribuzione geografica del trend su intervallo temporale 2004-2019, per il livello informativo "Sostenibilità" come keyword ricercata in tutto il mondo dagli internet users. Dati informativi provenienti dal motore di ricerca Google. (B)Distribuzione geografica del trend su intervallo temporale 2004-2019, per il livello informativo "Resilienza" come keyword ricercata in tutto il mondo dagli internet users. Fonte: mappe realizzate dall'autore con i dati informativi provenienti dal motore di ricerca Google.

A Dresda, infatti, si può evidenziare con maggiore certezza quanto anticipato rispetto alla dipendenza dei dati dalla effettiva corrispondenza dei fenomeni (caso evidenziato anche ad Amburgo, città fortemente vulnerabile ai cambiamenti climatici).

La città di Dresda è un caso emblematico del rapporto tra città e acque in ambito urbano, ed è a causa delle molteplici inondazioni verificatesi negli anni, che essa sollecita un interesse specifico e si pone come paradigma culturale per lo studio del tema del rischio legato all'acqua. Dei vari fenomeni di inondazione sono da ricordare quella del 1862, e del 1890, così come quelle più recenti del 2002² e del 2006.

Nell'agosto del 2002 la città è stata colpita dalla più grande inondazione registratasi negli ultimi 500 anni, la cui portata e il cui effetto è avvenuto per mezzo di quattro differenti fenomeni alluvionali, ognuno di essi legato ad un diverso caso, e verificatosi in giorni diversi.

La prima tipologia è quella caratterizzata dalle forti piogge torrenziali, che causarono la forte inondazione della città; la seconda tipologia fu caratterizzata dalle inondazioni causate dagli affluenti del fiume Elba, che convogliano le loro acque proprio all'interno della città di Dresda; la terza tipologia si verificò per innalzamento del livello delle acque del fiume Elba fino a 9.40 m, causando un'inondazione su una superficie di 9,30 Km²³; La quarta tipologia di inondazione scaturì dalla risalita in superficie della falda acquifera, di cui si hanno certezze che il livello rimase alto per diversi mesi.

Circa il 15% della città è stata inondata⁴, causando forti danni alle comunità. In particolare, la città, in quella occasione, fu colpita dalle inondazioni dei canali dell'Elba, dagli affluenti Weißeritz (12 km) e dal Lockwitzbach e dalle acque di falda.

La prontezza e la consapevolezza delle autorità rispetto al problema, nonostante i precedenti, fu considerata inefficace. Nonostante lo sviluppo di alcune misure precauzionali da parte delle comunità locali, ancora una volta, la disponibilità a metterle in atto si dimostrava più bassa delle aree rurali dell'Estonia⁵. Lo scopo del testo è quello di evidenziare il tipo di misure intraprese dalla città per far fronte al problema della vulnerabilità di questa città, e per rispondere significativamente con misure mitigative. La città di Dresda ha una lunga storia e dalle diverse fonti emerge che essa ha da sempre dovuto fare i conti con il problema della coesistenza con le acque urbane, ma soprattutto con il problema delle inondazioni. La prima di gueste accertata solo nel 1501. Nel 1845 la città fu colpita dal peggior fenomeno di inondazione che si fosse mai registrato, con un innalzamento delle acque fino a 8 m e un'esondazione di circa 5700m³. Tra le misure intraprese in guella circostanza, guella di tenere le aree golenali del fiume libere da qualsiasi manufatto edilizio. Altri eventi si registrarono tra il 1845 e il 1890 e, a tal proposito, le autorità locali decisero di costruire due canali di esondazione controllata, il primo tra il 1906 e il 1910 e il secondo tra il 1919 e 1921, con lo scopo di smistare le acque in eccesso durante i fenomeni di inondazione⁶. L'ultimo fenomeno del XX secolo si registrò nel 1954, per poi far dimenticare per molto tempo il problema della continua dipendenza dai rischi.

Uno degli aspetti più interessanti della vicenda urbana di Dresda è proprio legata alla scomparsa di questo fenomeno per un periodo di tempo di circa 60 anni, ed è proprio questo aspetto che ha reso la ricerca un'occasione di lettura degli atteggiamenti intrapresi negli anni anche sul tema del rischio latente⁷. A conferma dell'esistenza di un rischio latente che per anni è rimasto lì, inconsciamente sottovaluto dai piani e dalle misure di mitigazione, il susseguirsi di dinamiche insediative altamente dissipative⁸ attestatesi proprio in quelle aree golenali che in prima istanza avrebbero dovute essere oggetto di salvaguardia9. Dresda è stata oggetto di grandi investimenti nel mercato immobiliare lungo le aree del fiume Elba in seguito alla sua riunificazione della Germania. Intorno al 1990 si attestarono nuove industrie su queste aree, modificando l'economia di guesta città sensibilmente, e allo stesso tempo, la sorte di gueste aree nell'ultimo evento che verificatosi nel 2002.

E' stata proprio l'inadeguata prontezza con la quale si è risposto agli eventi di esondazione verificatisi che ha condotto la città verso esiti disastrosi. Solo dopo l'evento di esondazione del 2002 le autorità locali hanno provveduto a mettere in atto misure significative per la messa in sicurezza delle abitazioni¹⁰.

6 Korndöfer, 2003.

7 Faccio riferimento alla latenza dei rischi in diverse circostanze che raccontano la contemporaneità. In particolar modo la latenza del rischio legato a fenomeni di inondazione è un aspetto ricorrente nel racconto della città contemporanea. Fenomeni insediativi contrastanti mostrano come ci si sia comportati in questi anni, senza tener conto di questa esistenza, e senza aver dato peso alle misure intraprese in un primo momento.

8 Cfr. Carlo Gasparrini In: Drosscity, 2016.

- 9 DKKV, 2003.
- 10 Circa il 67% delle abitazioni totali in Dresda sono stati sottoposti a misure di messa

² L'alluvione del 2002 portò solo in Germania danni alle infrastrutture urbane per 9.2 milioni di euro, con un numero di vittime pari a 19

³ BKG 2003

⁴ DKKV, 2003

⁵ Consequences of the extreme flood event of August 2002 in the city of Dresden, Germany In: Sustainable water management for Large cities pp 164-173



in sicurezza dal rischio idraulico. Cfr: Coping with floods in the city of Dresden, Germany, Heidi Kreibich, Annegret H. Thieken, Article in Natural Hazards, 2009. 11 Cfr: AMS

Figura 11. Consapevolezza sociale rispetto alla parola chiave "cambiamento Climatico". Mappa realizzata dall'autore, con il contributo dei dati statistici e numerici forniti da Google.

I 478.000 abitanti attuali si distribuiscono in circa 255.000 abitazioni, occupando un'area di circa il 38% della superficie totale. L'evento di esondazione del 2006 ebbe ricadute significativamente minori rispetto al precedente del 2002, colpendo solo in parte le aree abitate (Figura 15). Nel 2006, infatti, lo scioglimento delle nevi e le ondate di pioggia portarono il bacino idrografico situato nel punto più alto, a Praga, a aumentare notevolmente e, a un innalzamento del fiume nei punti di massima a un'altezza di 7,49 m (Korndörfer et al., 2006). La comparazione dei dati sui livelli di esondazione raggiunti dal fiume Elba sembrano tenersi sotto una soglia non preoccupante per tutta la metà del XX secolo¹¹.

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102 103

Dresden, Germany. **Geographic characteristics** and historic vulnerability as precondition for the presence of a water related risk in the city of Dresden.



105 Map: Karte des Elbstromes innerhalb des Königreichs Sachsen mit Hochwasser 31 03 1845

Abstract

With a projected view toward the emergent condition and recent catastrophes, including floods of August 2002 and June 2013 that affected the entire Central Europe, the first chapter aims to investigate the history of this territory, by analyzing both the progressive adaptation to water-related risks, which were already complex and disastrous, and describing characteristics of adaptation occurred over a centuries-long period. Essential is the chronology of historical events and characteristics of severe natural hazards in an extremely fragile geographic area. Furthermore, the historical and cultural differences that have influenced the way to construct the city in this context, as well as climatic conditions that have always influenced the relationship between the city and the water resources.

1. Foreword: Dresden, Germany. Geographic characteristics and historic vulnerability as precondition for the presence of a water related risk in the city of Dresden.

"Each flood is a result of a complex web of meteorological (mainly precipitation), environmental (e.g. physical characteristics of surface or vegetation or vegetation cover) or anthropogenic (e.g. breaking embankments in war action) factors on the river run-off" (Mendel et al., 1997)

The work on the case study aims to solicit a general reflection on water related risk issues within urban settings and to examine in depth the particular condition that characterizes the geographic area of Dresden, by highlighting dynamics that have interested the city in time. Particularly, two are the assumptions that the research aims to delineate in this chapter for the purposes of a clear definition of preconditions that influence the city of Dresden within the European context.

The first hypothesis is to become conscious of historicized geographic and geomorphological conditions that have characterized in time and that still characterize the area, by making the city unique in its kind. Therefore, on one side the research focuses on natural implications and consequences that meteorological conditions together with geomorphological structure have had on the current spatial configuration and, on the other side on significant repercussion in terms of social and cultural answers that have determined in time specific relational metamorphosis between river and the city (**Figure 1**).

The second precondition has a cultural root and can be considered in part as a consequence of the first one, although historical circumstances would suggest them as complementary prerequisites. It is referred, in fact, to the study of processes of adaptation to water risk conditions, as well as specific connotations of efforts that have led to domesticate this resource in time. The observation of processes of spatial metamorphosis occurred in the city represent in this stage a method of research that aims to reconstruct, through the identification of specific phases, a synthesis framework compared to *cultural declination*^{[1} that water resource has assumed over the centuries (Gasparrini



¹ Cfr. the foreword of Carlo Gasparrini (2017) "Le Infrastrutture verdi e blu nel progetto della città contemporanea", in: Urbanistica e informazioni 273-274, INU Edizioni,

C., 2017).

The time frame on which the research considers as a starting point the beginning of the XIX century, which was particularly interesting for the cultural condition that Dresden experienced in the early phase of Modern age and for fertile explorations occurred in several fields as the Maritime engineering and the "International agreement for a Free Navigation"^{[2} along the Elbe River, as well as for the phase of expansion of the city which determined specific connotations of social and cultural character.

On this regard, an important step of the research is dedicated to the comprehension of efforts made over time in order to domesticate the water resource and at crucial transformations that have radically modified the spatial structure of the city. The following chapter includes the various interpretations and the roles attributed to water resource which will be explained in more detail, by highlighting the spatial transformation that they have determined and change in terms of relationship with the community (Thieken et al., 2005). The water in cities as Dresden has contributed to the spatial mutation that have sensibly altered the topography of places. However, it is highly relevant in this phase to put the attention on those that are preconditions that have determined the successive configurations.

The differentiated use of water resources in time, as well as several interpretations that have been attributed to the Elbe river constitute an essential element of study through which is possible to redefine the complex urban metabolism^{[3} that regulated this city over time (Wolman, 1965).

Beyond the various historical parenthesis, it is fundamental to contextualize the "Dresden Elbe valley"^{[4} within a European geographic framework in order to clarify some aspects that are emblematic and that have to be considered as assumption. In particular, extreme floods registered over the last 500 years

pp. 25-28.

have been apparently caused by the role of cyclone pathway "Zugtrasse VB"^{[5} . This weather situation is retained to be typical of Central Europe, although anthropogenically induced climate change has been hypothesized to add a risk to of extreme river floods because a warmer atmosphere can carry more water (Mudelsee, 2004). The "Zugstrasse Vb," represents a weather situation in which a low-pressure system travels from the Adriatic region northeastward, carrying moist air and bringing orographic rainfall in the mountainous catchment areas (Erzgebirge, Sudeten, and Beskids). At the end of the nineteenth century, W. J. van Bebber developed the hypothesis that low-pressure systems moving from the northern Atlantic to the European area prefer certain pathways ("Zugbahn" or "Zugstrasse"). "In an analysis [van Bebber, 1898] for the period 1876-1889 (5114 days), he found 1440 days (28%) where at least one of six defined pathways were occupied. Only the "Zugstrasse Vb" (Figure 2) seems to have survived as a useful explanatory tool, primarily in connection with flood occurrence in the central European region. In a Vb situation^{[6}, a cyclone transports warm and moist air from the Adriatic region and moves in a northeast direction (Hofstätter and Chimani, 2012). This may lead to orographic rainfall in the catchment areas of the Elbe and Oder and cause summer floods, as was suggested, among others, by Hellmann and von Elsner [1911]"[7.

The explanation of geographical characters is necessary to move away any type of doubts that would associate the condition of risks occurred over the last years exclusively at the pressure of climate change (Figure 3). However, these plausible atmospheric conditions have underwent a notable increase due to impacts of climate change with consequential and devastating impacts registered over the last few years. Although, they have been recorded as long centuries natural hazards, in Central Europe, the Elbe flood in August 2002 caused 36 deaths and over 15 billion USD damages (Grünewald, et al., 2003).

² A specific reconstruction of the phases of this agreement is reported in the following chapter, with a particular focus on the "International agreement for Free navigation of Elbe River", occurred in Vienna treatment in 1814.

³ Cfr. Wolman A., "the metabolism of cities", Scientific American, n.213, 1965.

⁴ In 2004, the area that extends 18 kilometers along the river from Übigau Palace and Ostragehege fields in the northwest to the Pillnitz Palace and the Elbe River Island in the southeast was nominated by UNESCO committee for the inclusion on the World Heritage List. Among criteria of nomination, there were considered landscape features, architectures and garden that have been a reference for the development of Central Europe in 18th and 19th century. Cfr. World Heritage Scanned Nomination, File Name: 1156. UNESCO Region, Europe and North America.

⁵ Cyclonic atmospheric pressure systems or barometric minima coming from the west and traveling on a few preferred pathways ("Zugstrassen") across Europe, Cfr. Van Bebber W.G 1898.

⁶ Cfr. Hofstätter M., Chimani B., (2012) "Van Bebber's cyclone tracks at 700 hPa in the Eastern Alps for 1961–2002 and their comparison to Circulation Type Classifications". 7 Cfr. Mudelsee M., Börngen M., Tetzlaff G., Grünewald U., Extreme floods in central Europe over the past 500 years: Role of cyclone pathway "Zugstrasse Vb". JOURNAL OF GEOPHYSICAL RESEARCH, VOL. 109, D23101, Dec. 2004, pp. 3 ss.



Figure 2. Late nineteenth century view of cyclonic atmospheric pressure systems or barometric minima coming from the west and traveling on a few preferred pathways ("Zugstrassen") across Europe, here shown for July. Lows moving on the "Zugstrasse Vb" take up warm, moist air over the Adriatic region and move in a northeast direction. Source: Map produced by the author on the basis of W. J. van Bebber work. At the end of the nineteenth century, W. J. van Bebber developed the hypothesis that low-pressure systems moving from the northern Atlantic to the European area prefer certain pathways ("Zugbahn" or "Zugstrasse").

2. Studies and historical documentations of extreme floods as a starting point for the perception of water related risks.

The presence of documents about floods in Elbe rivers circumscribe also an important historic phase in which flood rates began to be controlled.

The lack of documents for previous periods testimonies also that "the perception of floods was likely different in early times" (Glaser, 2001). Although, after the flood interval at A.D 1021 the observation in flood rates became relevant and more abundant, the scope of the research on this stage is to focus only on strong floods that can be estimated through a homogeneity in data produced for them and with a particular relevance in the historic phase of modernity of Dresden. However, at the purpose of constructing a representative chronology of floods in Dresden, a wider sequence of extreme events has been considered for a demonstrative scope. For example, the flood of 1501 which is considered one the heaviest flood in the last 500 years for the water stage at Dresden, which was given at that time as 866 cm (Schäfer, 1848). "The February 1655 event was again an ice flood, with a water stage at Dresden of 897 cm. For the June–July 1675 event, many reports exist about this summer flood (water stage 810 cm) without description of rainfall leading to it. A prolonged, wet summer led to the June-July 1698 event (786 cm stage). The February-March 1784 event was an ice flood (859 cm stage), described by many sources and inspiring the research in the years 1784, 1786, 1800 (Pötzsch, 1784). The February 1799 event was an ice flood not as strong (829 cm stage) as the preceding one. The March 1830 event was an ice flood not as strong (798 cm stage) as the preceding two. The March–April 1845 event was an ice flood, at some locations stronger (water stage Dresden 877 cm) than the 1784 flood" (Mudelsee et al., 2004).

2.1 Historical irregularity and extreme floods in Elbe drainage basin

What followed in the next years is an irregularity in extreme floods and water stages that occurred in them, differently of what already happened in the history of Elbe region.

The Elbe drainage basin is in the normal run of things under a continental and low mountainous climate which is characterizes by heavy floods in hydrogeological summer and in winter also by thawing snow (Mudelsee, 2003). For the summer floods the period is from May to October, whereas in winter the period in which floods can may occur is between November and April (Fischer,



Figure 3. Elbe river Valley in within the city of Dresden. The image shows the 111particular geo-morphological condition that characterizes the city of Dresden, which is exactly situated within the wide valley. The Elbe river crosses the valley and it is moistened by transversal tributaries, as the Weißeritz. Source: Map realized by the author with the DEM Digital Elevation Model of Copernicus EU, EEA.

1907; Grünewald et al., 1998). However, there are some episodes particularly relevant from an analysis point of view, which they have taken in consideration in order to explain a certain irregularity in floods registered over time.

Generally, what determines a catastrophe is a grouping of particular characteristics that can define a specific flood. These characteristics, e.g. the peak discharge, the water stage, the flood stage associated to a natural flood, the duration, and the height, transform what is in itself a natural event into a catastrophe. A flood become a catastrophe when it is concentrated into a space and a time that the society feel strongly threaten (Plate et Merz, 2001). According to C. Weikinn sources on hydrographic events in Europe, there were recorded in Elbe region several and prolonged dryness periods, which may be in contrast with previous history in extreme floods has recorded.

In particular, the summer of 1590 and 1842 were considered major events, where both years saw dryness also in other parts of Germany (Glaser, 2001). "Notable were also dry summers in 1509, 1616, 1631, 1706, 1746, 1790, 1800, 1813, 1834, and 1835, most of which are also seen in other parts of Germany, Bohemia, and Moravia"^[1].

For several summers, long periods of dryness were recorded that seemed to be strongly in contrast with previous experiences within this specific geographic area. In particular, these periods can be identified in *Weikinn's compilation* of drought for the years 1958, 1960, 1961, 1963, 2000, 2002^[2]. To these irregular episodes of dryness have corresponded also *"exceptionally strong floods"*^[3] that have turned upside down the city of Dresden for *water stages* and *peak discharges* recorded (**Figure 4 A and B**).

These belong to the third class of events, which are considered in the compilation realized by *Weikinn*, and by CLIMDAT, the worst in terms of characteristics mentioned in history of floods. From 1850 to present, the February 1862 event represented a strong ice flood, with a water stage of 824 cm and



Figure 4 (A) Classification of flood magnitudes (1, minor; 2, strong; 3, exceptionally strong) using linear regressions between flood stage and inferred runoff. Elbe, runoff (m³ s⁻¹) in Dresden monitoring station, 1852–1892. Source: Weikinn C. and by CLIMDAT, representation of Mudelsee M. (**B**) Daily runoff time series. (a) Elbe, station Dresden, covering the interval January 1852 to November 1999. Flood magnitude class bounds (Figure 4) are shown as horizontal lines. Source: Weikinn C. and by CLIMDAT, representation of Mudelsee M. (**B**) Daily runoff time series.

¹ Cfr. Number of Dry Intervals noted by C. Weikinn, in: Comparison of Elbe and Oder Flood Chronologies Based

on Entries by Weikinn [1958, 1960, 1961, 1963, 2000, 2002] and CLIMDAT, In: Mudelsee et al. (2004) Extreme floods in Central Europe, p. 5

² Cfr. Weikinn, C. (1965), Katastrophale Dürrejahre während des Zeitraums 1500 – 1850 in den Flussgebieten der heutigen Deutschen Demokratischen Republik, Acta Hydrophys., 10, pp. 33– 54.

³ Cfr. the dedicated chapter in: Mudelsee et al. (2004) Extreme floods in Central Europe.

a runoff of 4490 m³ -s¹. The September 1890, instead, was a flood caused by extended rainfall in southern Bohemia, with a 837 cm stage, and 4450 m³ - s¹ (Mudelsee, 2004).

In august 2002, the event was determined by a meteorological cause induced by the low pressure that travelled on a path displaced in a considerable measure to the north of *Zugtrasse Vb* (Figure 5), leading to a prolonged rainfall. The water stage at that time was of 940 cm stage, with a 4700 m³ – s¹ runoff (Ulbrich et al. 2003a, 2003b).



Figure 5. Daily runoff time series. (a) Elbe, station Dresden, covering the interval January 1852 to November 1999, with the data available for august 2002. Flood magnitude class bounds are shown as horizontal lines. Source: Weikinn C. and by CLIMDAT, Produced by the author on the basis of the representation of Mudelsee M, 2003.

2.2 Taxonomy of extreme historical floods and chronology of events territorially representable

The following steps aim to reproduce an illustrative framework of extreme floods with a particular focus on the causes and effects that were recorded in history of the *Elbe floods*^{[4} Specifically, the *magnitude classification M03*^[5] identifies four meteorological conditions that occurred in history of extreme events, which are basically related to winter and summer floods. The first stage in winter floods is a *large snow cover* followed by thawing and, replace

5 Cfr. CLIMDAT and Weikinn's compilation in extreme floods. However, classifications for floods magnitudes belong to different sources that have been adapted in time.

by condition of *river freezing* with a consequent break up owing to warming. In summer periods, differently, have been founded two main types of historical floods that can be associated to meteorological conditions and they are generally different among them for the intensity and the duration of the rainfall. The first type, in fact, is a *prolonged rainfall* that could also not be always significantly high in terms of intensity. The duration of the rainfall event can vary from a minimum of a couple of weeks to extended periods of months. The second type is the shortest one and it's normally identified as a *cloudburst* with a relevant intensity and a duration of maximum five days (Weikinn, 1965). These episodes were being distinguished also for the localizations, which were more local or occasionally over-regionals. The temporal and special variability in operation such as meteorological conditions, environmental characteristics, anthropogenic factors can condition the occurrence and the severity of individual floods (Brázdil et al., 1999). However, there are different sources that have subdivided floods in history, by classifying them on the basis of their classes, which are mostly related to time dependences and water stage that they are able to reach.

In analysing floods in sixteenth century, Brázdil reproduced a scheme in which he identified a Class1 that included "*minor flood*" in short period of overflow with minor damages within a local context. Followed a Class2 that expected to consider "*strong flood*" of longer duration, large damages and water stage in Dresden between 690 and 770 cm. The Class3 referred to "*exceptionally strong flood*" with a longer duration, heavy damages within an over-regional scale and a water stage in Dresden above 770 cm. The author himself, in giving certain explanations of what was recorded in Central Europe have resorted to previous studies on extreme floods.

"From a meteorological point of view, it is necessary for Central Europe to distinguish between floods caused by (i) short but intense precipitations (downpours, cloudburst), (ii) long-lasting continuous rainfalls, and (iii) the melting of snow cover" (Brádka, 1967).

According to scopes of research, are considered relevant those extreme floods that can be also territorially represented and that can be compared with today's situation. From the several data it is given significance at those occurred in the in the XIX century, such as the September 1890 event, which was an extreme flood caused by an extended rainfall that came at that time from the southern of Bohemia and that recorded 837 cm stage and 4450 m³ s⁻¹ runoff (Königliche Elbstrombauverwaltung 1898).

The latest phenomenon is August 2002, an event that recorded at that time

⁴ Cfr. Weikinn's compilation In: Weikinn, C. (2000), Quellentexte zur Witterungsgeschichte Europas von

der Zeitwende bis zum Jahr 1850: Hydrographie, Teil 5 (1751 –1800), edited by M. Börngen and G. Tetzlaff, Gebru¨der Borntraeger, Berlin.

940 cm stage and 4700 m³ s¹ runoff and was caused by the already mentioned pressure low that travelled on the path to the north of Zugtrasse Vb (Bundesastalt für Gewässerkunde 2002).

These extreme floods are particularly preferred to others, which could be equally consultable, for the reliability of them and the homogeneity in the construction of representable scheme of comparison. However, data came also before the period of intense industrialization and growth of the city of Dresden and despite they are not representable into a map, it is possible to construct a chronology of events that included relevant indicators at research purpose. For the Elbe river, winter and summer seasons floods with all information about magnitude classes are really low in the early part and start to increase later (Mudelsee, 2004). Fewer documents about floods were written (before the invention of printing) or have lasted to the day when they were included in the 2nd Weikinn's compilation, by leading to an underestimation of flood occurrence (Glaser, 2001). Indeed, the most abundant information on floods in the historical period came from the stations Litomerice, Pillnitz, Dresden, Meißen, Torgau, Wittenberg, Aken and Magdeburg (Mudelsee, 2004).

2.3 Accuracy and comparability of historical sources

Despite the presence of several written sources from previous periods, comparable materials can be considered valid for comparison purposes only after 1500, since when this information started to be accredited for an accurate reconstruction of historical floods in Elbe basin (Falckenstein 1739; Reiche 1896; Schmidt 2000).

Among the historical sources there are water stage signals, which are still spread in flooded areas of Elbe river valley and which differ from each other for the exactitude of data reported (Figure 6 A and B).

They are to be considered all as a crucial source to be referred for a better awareness of spatial condition in occurrence of these phenomena and for a better comprehension of damages reported.

However, these sources should be considered relevant but not indisputable from a demonstrative point of view, since the position of these signals of water stage, not always, has respected the previous position in occasion of interventions of urban regeneration after 1989 (Deutsch, 2005).

With the sprawl of the printing more documents were retained to be officially readable and retained valid in time. Among them, are relevant sources written by governmental agencies, as well as written official reports by the work commission for the compensation of damages to the community (Rost, Deutsch,

2006). Particularly, investigations in historical extreme floods have worked mainly on over-regional events that have seriously damaged cities crossed or around the Elbe drainage basin.

According to Deutsch study, more than 10.000 historical reports and individual data have been analyzed that considered to be extremely relevant the following 9 floods, in which their duration is also reported:

Catastrophes, over regional floods in the middle of Germany 1500-1900

- 1501 (August) 15. To 20.08. Persistent rainfall, occasional heavy rainfall and storms.

- 1595 (March) 04. To 18/03 - snow melting, temporary persistent rainfall, ice drift/ ice jam.

- 1655 (February) 07. To 24.02. Sudden onset of snowmelt, ice drift / ice jam. - 1682 (February, March) 25/26.02 to 02/03/03. Melting snow, temporary but persistent rainfall.

- 1784 (February, March) 27/ 28/02. to 03/03. Snow melting, occasional persistent rainfall, ice drift / ice jam.

- 1799 (February, March) 21- 22/02 to 03/03 Snow melting, occasional persistent rainfall, ice drift / ice jam.

- 1845 (March, April) 22-23/03 to 01-02/04. Snow melting, temporary persistent rainfall, ice drift/ ice jam.

- 1871 (June, July) 27-28/06. To 01-02/07. Since beginning of June numerous rainfalls, continues from middle of June, temporary heavy precipitation and thunderstorms.

- 1890 (November) 23to 26- 27/11. A lot of rain in October, lots of rain since mid-November, before from the 21. To 23.11. Persistent rainfall.

Data furnished by: HHOWAD: Historische Hochwasserdatenbank der AG »Historische Hochwasser/Historischer Hochwasserschutz« am Geographischen Institut der Universität Göttingen., data reported by Mathias Deutsch. "Forschungen zu historischen Hochwasserereignissen sowie zu Maßnahmen des historischen Hochwasserschutzes (ca. 1500 bis um 1960) durchgeführt. Mit Schließung des FG Geographie der Universität Erfurt zum 30.09.05 wechselte die AG "Historische Hochwasser/ Historischer Hochwasserschutz" zur Universität Göttingen" (Deutsch, 1995).

It is certain is that the anthropogenic era started already in March 1845 to show its effects on a large scale. In particular, an unexpected increase in temperature elicited at that time a breakage of the frozen river plain by resulting in a fragmentation and the formation of several sheets of ice. The presence of



Figure 6. Water stage signals for extreme floods. (A) Water stage signal for the 31 March 1845 and 6 September 1890. Source: Markierung von Wasserstandshöhen (31. März 1843 und 06. September 1890) Source: SLUB / Deutsche Fotothek. (B) Water stage signals in Pillnitz Castle with the representation of historical Flood days and the Water stage reached at that time. Source: Photo took by the author.





a multitude of fragments represented an obstacle (Figure 7) for the runoff of rivers and channel that led to the destruction of several infrastructures (Glaser, 2001).

Over the centuries, there were several types of sources including historical written documents that contained the proved information which still represent today the evidence of the facts, which can be identified also in official maps and artistic figuration (e.g. lithography, depicts, photography. See as an example, the breakage of Augustusbrücke (Figure 8).



Figure 7. Ubersicht der grossen Ueberschwemmung in Dresden am 31 März 1845 / Grav. v. E. Böhme. Source: SLUB / Deutsche Fotothek Source: SLUB / Deutsche Fotothek

forces, also when it is temporary^{[6}, is an aspect that normally defies to all normal technical representation which are therefore intent to give details on the water stage, peak discharge and unexpected disfunction in river runoff. However, the compresence of other sources, allowing that the use of the official data referenced in its entirety is unescapable and can lead the work to deepen issues of social relevance which illustrate how a community was already, in a certain sense, prepared to face extreme situations of this type. Through the observation of iconographic sources is possible to reconstruct, where possible, the seriousness of phenomena and temporary solutions that were identified in order to make safe the city from a natural hazard. As an example, it is showed a lithography of Dresden in which the community tried to make them safe, by crossing the river on a temporary bridge (Figure 9).



The research aims to focus on one of the several risk conditions that are influencing the liveability within cities and on the significant and multifunctional role that "Green and Blue Infrastructures"^{[7} can play at different scales. The Figure 8. Breakage of Augustusbrücke during the extreme flood in March 1845. The presence of sheets of ice in correspondence of several bridges determined in that occasion an obstruction that led to the inundation of cities. Source: Ansicht der Elbbrücke zu Dresden während ihrer Zerstörung 1845, Stich, 1845. Source: SLUB / Deutsche Fotothek

⁶ The temporary of an event is always associated to the period of extreme flood and the successive phase of management of precarious condition determined by collateral effects of damages. They can be express in week, or sometimes also in months. 7 The term Green and blue infrastructure to which the thesis refers belong to the EU



Figure 9. Use of a temporary bridge in occasion of the extreme flood in March 1845. Lithography, author: unknown, time of realization: unknown. Source: SLUB / Deutsche Fotothek.

city of Dresden aims to constitute a case study which compares the condition of central and south Europe, representing a paradigm for the establishment of resilient condition that have been consolidated during the historical process. In particular, the geographical and climatology conditions are considered relevant to analyse.

An overall look, Europe seems to be characterized by the presence of a spread water network, which is greater within the central Europe. Cities that belong to this geographical area, always dealt with water related risks since their establishment and, in a sense, these layers have represented a notably part of the urban "palimpsest" (Corboz, 1983). Differently are cities of south Europe where the presence of water had not been a threat immediately. Still today threats that hit the region in Europe are different for geographic conditions, climate change is leading these areas toward different types but still enormous disasters. The phenomena of flooding in Dresden started to be evidenced since 1500, in occasion of "sommerhochwasser" and "winterhochwasser" (summer and winter flood evidenced in official documents), by highlighting water stage levels that have been reached in different years. What is interesting, is that those levels have not respected a continuous increase of water flooding that might be related to the pressure of human habits and the first phases of urban construction. Think of the water stage reached by Elbe river in 1590^{[8}, which were almost unknown causes and effects of climate change pressure. Only with the 2002 Extreme and the damages reported, Dresden acquired a plenty awareness of Flood risk, which brought to the creation of a Flood trail that should help people to better comprehend risks and coexistence opportunities (Grunewald et al., 2009).

After more than 200 years, in 1824, the water level reached by flooding in summer event was less worrisome than in 1590, in this occasion a flooding of 7,50 meters was registered. The introduction to Flooding levels within the field of research is relevant not for mathematics purposes, but rather to demonstrate curred over the last years would have us believe that it constitutes apparently only one of the recent threats that many cities are facing, and that it would

exclusively be associated to effects and impacts of climate changes. The environmental issue is today among the 3 main urban issues that define the new urban question^{[9} which planners and administrations should consider under the pressure of globalization crisis and climate change effects (Secchi, 2013). What is true is that frequency and seriousness of these phenomena represent parameters which makes it possible to measure the effects and impacts of climate change thrust, as well as are the variability of condition in terms of relationship between urban and ecological ecosystems. General attitude with problems leads to think that the theme of risks (especially those related to water) can be traced back to the era in which multiple consequences of human behaviour have started to had effects on the equilibrium of the planet, the one most knows as "Anthropogenic era"^{[10} (Mezzi and Pelizzaro, 2016). that the water in terms of risks has always represented a constant phenomenon. However, the general framework within the research which wants to allocate the issues of water related risk in Dresden is referred to the period of major expansion of city and its urban fabrics due to the industrialization phase and important urban and social transformation that have modified the way of conceiving the particular relationship between the community and the Elbe river. From 200.000 inhabitants in 1875, the population of Dresden passed 350.000 habitants in 1895, by an increasing growth of industries around the city of Dresden^{[11}.

The economic crises of 1878 provided the grow of numerous industries that were settled in the periphery of Dresden due to lack of building land. Numerous building rules of that time avoided the grow of various industries and limited the dimension of them when they us to be constructed close to the city center. "Stronger than in other big cities in Saxony, the residential character was worthy of consideration by government". Particularly favourable were considered at that time the topographic condition that allowed the government to keep distant from the industrial complexes and the healthy city center and to localize outside big industries. These regulations created the condition in which Dresden could become also a front-runner into the industrial sector compared to other big cities in Saxony (Helas V, 1986). Decisive was not only the desire to preserve the city and its urban Landscape,

Strategy on Green Infrastructure - European Commission (2013). Cfr: https://ec.europa.eu/environment/nature/ecosystems/strategy/index

⁸ At that time the water stage reached by the flood was around 8,60 meters height and despite the enormous damages that could have provoked to the city, there was not yet a plenty awareness of consequences of consequences that these types of extreme events would have had on the future construction of the city. Cfr. "Leben am Fluss, mit Hochwasser leben" in: "Lernen aus der Flut", http://www.hochwasserlehrpfad-dresden.de

⁹ Cfr. Disuguaglianze sociali, questione urbana e crisi, pp. 71-90, in: Secchi B., ed. 2018, La città dei ricchi e la città dei poveri. Laterza, Bari 10 Cfr. Mezzi P., Pelizzaro P., (2016) "la città resiliente".

¹¹ Cfr: 1879-1894 Residenz undIndustriestadt, in: Helas V., Architektur in Dresden 1800-1900, durchgesehene Auflage 1986. Vieweg & Sohn Verlagsgesellschaft mbH, Braunschwieg, Germany, 1986.

but also the will of the city to insert itself within an international economic traffic, an aspect that was determined for the economic development and the starting point of new building construction stages. Building regulations together with the realization of important public infrastructures led the city toward a process of spatial metamorphosis. The construction of a new railway tracks coincided with the realization of their corresponding stations and new public spaces, which guaranteed, in particular, the development of new important residential areas within peripherical contexts particularly important. The realization of *Bahnhof* (central station) in 1893 solicited the transformation of the surrounding area, by leading toward the realization of new urban roads. Among the significant operation of transformation in that period there was also the realization of Prager Straße in 1851 (considered already one of the most important shopping streets), new bridges e.g. Marienbrücke (**Figure 10**) (1846/1852) and Albertbrücke (1875/1877) which were considered essential for the connection between Altstadt and Neustadt.

Furthermore, the introduction of the first horse-drawn tram (1872) allowed to reach the suburban area faster (**Figure 11**). All these interventions had important consequences from the aesthetical and functional point of view, but above all they constituted a fundamental pre-requisite for a different development of the city and its relationship with water resource. At that time, the local government retained that it would be necessary to consider all the small interventions as social engagement by architects and local workers in order to pursue the purposes of coherence for the construction of a unique organism (Helas V, 1986). The realization of new streets in correspondence on train stations, as well as the enhancement of connections between the *Altstadt* and *Neustadt* through new bridges allowed the first real phase of urbanization (**Figure 12**).

The seriousness and the frequency in which water related catastrophes have occurred over the last years would have us believe that it constitutes apparently only one of the recent threats that many cities are facing, and that it would exclusively be associated to effects and impacts of climate changes. The environmental issue is today among the 3 main urban issues that define *the new urban question*^{[12} which planners and administrations should consider under the pressure of globalization crisis and climate change effects (Secchi, 2013). What is true is that frequency and seriousness of these phenomena

¹² Cfr. Disuguaglianze sociali, questione urbana e crisi, pp. 71-90, in: Secchi B., ed. 2018, La città dei ricchi e la città dei poveri. Laterza, Bari



Figure 10. Realization of the Marien bridge. Krone, Hermann: Blick von der Marienbrücke nach der Altstadt (Hofkirche, Schloß und Frauenkirche), um 1863. Source: Dresden, Hermann-Krone-Sammlung der TU Dresden.

represent parameters which makes it possible to measure the effects and impacts of climate change thrust, as well as are the variability of condition in terms of relationship between urban and ecological ecosystems. General attitude with problems leads to think that the theme of risks (especially those related to water) can be traced back to the era in which multiple consequences of human behaviour have started to had effects on the equilibrium of the planet, the one most knows as "Anthropogenic era"^{[13} (Mezzi and Pelizzaro, 2016).



Figure 11. The first horse-drawn tram (1872). Dresden-Altstadt, Neumarkt. Pferdebahn der Linie Neumarkt - Strehlen mit einspännigem Oberdeckwagen Nr. 80 (1872; Starbuck Car und Wagon Birkenhead). Source: SLUB / Deutsche Fotothek.

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¹³ Cfr. Mezzi P., Pelizzaro P., (2016) "la città resiliente".



Figure 12. The view of Dresden in 1852 from an aerostat. Eltzner, Adolf: Dresden vom Ballon gesehen. H. Walter lith. d'après Eltzner. Dresden: Arnold (1852). Source: Dresden, Sächsische Landesbibliothek - Staats- und Universitätsbibliothek Dresden (SLUB), Kartensammlung.

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3. Purposes and Methodology of research applied to the case study in this stage

At this purpose, the method of study aims to make those characters of major vulnerability due to already existing geographical and natural conditions understandable and to focus on the process of adaptation led by city in time. Various natural risks that may occur when these areas get in touch with communities, or when living conditions have been created in these specific contexts, as in the case of Dresden.

Cities located in Central Europe present obviously different geographic and topographic characteristics and the presence of *large rivers*^{[1} that go through territories, as well as blue corridors and any kind of water channels constitute both a resource to manage for a qualitative urban ecosystem but also a possible threat when these organisms enter a situation of conflict that generate a reduction in terms of *water breath*^{[2} within the space (Gasparrini, 2018).

On the other side, cities of South Europe, where the climate and geographic condition seemed to appear less concerned, have demonstrate that the abandonment and lack of interest for the ecological questions within the cities can become a serious risk for the community. The adoption of conflicting choices with the theme of environmental safeguard due to development dynamics have lead cities toward increased risk conditions and extreme events.

Widespread phenomena within Mediterranean countries e.g. Italy and Spain in nineteenth- twenties centuries were the interments of channels inside urban contexts, often due to dynamics of development of areas in which rivers passed or to put in place urban regulations that aimed to guarantee a more hygienic condition within residential areas. It is clear that in the beginning of great urban transformations those interventions did not represent a threat, today under the pressure of urban dynamics and climate change effects they can be considered a

serious problem. Inside geographic contexts as Dresden spatial metamorphosis but also a gradual and spontaneous processes of adaptation have occurred over time. At a later stage, iconographic sources will represent an instrument for investigation useful in providing information about significant approach to water resource by community and typical uses at that time. In this work phase, the research aims to shed light on the permanent condition of risk in history that characterized this city, by identifying relevant aspects that can be used as indicators and criteria of comparability among successive periods of flooding.

Despite the notable adaptation centuries-long and the gradual development of an attitude toward the coexistence among water and normal urban functions, the city of Dresden has experienced in 2002^{[3}, together with other cities in the Central Europe, one the worst phenomena of summer flooding that have occurred in the last 500 years (Figure 13 A,B and C). There were in that occasion lower emergency measures taken which resulted from the people's lack of flood experience and insufficient knowledge of how to protect themselves (Kienzler et al., 2015).

3.1 The unprecedented event of Flood in 2002 as a catalyst for a retrospective analysis of historical condition of water coexistence.

The speed and the seriousness of the event in 2002 have let that Dresden was literally unprepared. In particular, the event of the summer 2002, had not only generated social and economic losses, but has also shed light exactly on one of those questions that are concerning the last years due to the effects of climate change. After the flood in 2002, many things are changed regarding water risk protection. Not only in Dresden but also at European level, new strategies and principles were launched for the affected area in Europe, along with Poland and Cheech Republic (Kienzler et al., 2015). At local level, several temporary water protections systems were introduced which could have been used in case of flooding. Nevertheless, that phenomenon displayed that cities are seriously unprepared compared to efficient solutions to adopt in a really short time.

Dresden was critically damaged by water flood and the flow rate that destroyed houses and urban spaces. However, the harmfulness was reduced thanks to presence of a larger river profile characterized by enormous green spaces that

¹ According to the EEA "European Environment Agency" Large rivers are rivers that have a catchment area large than 50,000 km2 or other rivers and tributaries that have a catchment area larger than 5,000 km2. Cfr: https://www.eea.europa.eu/data-and-maps/data/ wise-large-rivers-and-large-lakes

² The theme of water breath of a river within cities represented a research issue in which the Department of Architecture of Naples is strongly interested. In 2015, the international workshop "Rome 2025" had shown results of a work of the Riverscape of Rome and its tributaries coexistence within the suburbs of Rome: Cfr.: Gasparrini C., Terracciano A., 2018, Rome 2025 Resilient Osmotic Metabolic Ecological. Listlab, Trento-Italy.

³ In particular, the event of August 2002 led the entire Europe toward the realization of different Acts, as the European Floods Directive (2007/EC/60) where important policies were realized in order to pass from a technically-oriented approach toward a more integrated flood management, which can consider also non-structural measures to minimize adverse effects of floodings. Cfr: https://ec.europa.eu/environment/water/flood_risk/



Figure 13. View of the Altstadt during the flood in August 2002. (A)The image shows the Augustus bridge almost completely inundated by the water stage of Elbe river and the Brühl Terrasse that worked at that time as flooding barrier. Source: SLUB / Deutsche Fotothek , Blick vom Neustädter Elbufer über die Elbe mit Augustusbrücke gegen Brühlsche Terrasse, Kathedrale und Opernhaus.. (B). View of the Marienbridge during the flood in 2002. Blick von der Marienbrücke über die Elbe gegen Baustelle des Kongreßzentrums und Yenidze. Source: SLUB / Deutsche Fotothek

(**C**) View of the pedestrian street that goes from Neustadt to the Cathedreal in Altstadt. Blick über den überfluteten Fußgängertunnel gegen Altstadt mit Kathedrale. Source: SLUB / Deutsche Fotothek.





functioned during the flood as water basins. Paradoxically, worst breakages were registered in correspondence with *Weißeritz*, a left tributary of Elbe river of 13,8 km long that runs through *Freital* and *Dresden* before it enters the Dresden basin. In 2002 the river reached Dresden central station, as well as *Zwinger Palace*, by flooding several districts of the inner city. The river's high fall from 108 m to 106 m and the fact that the channel was canalized made that the flow rate that went through Dresden caused serious damage.

The Summer flood 2002, indeed symbolizes the first alarm bell for the city of Dresden due to the increasingly intensity in which events occurred under the pressure of climate change. From this point of view, this event is unprecedented in terms of flood levels compared to the last 500 years and this aspect represents a catalysed restart in order to make the city resilient to possible future events. First of all, in this stage of work the latest event of flood represents an instrument of retrospective analysis intended to the study of circumstance that precede in time and that have determined the current conditions.

This year aims to represent a turning point which a glance on water related dynamics that have characterized the city and at urban strategies/regulations that are introduced in order to prevent water risks^{[4}.

In this case it has been shown that perpetual condition of risks can be exasperated within dynamics of transformation due to climate change effects and modification of urban ecosystems. However, the flood levels¹⁵ reached by water can be compared (with less impact) with those registered in summer 1845.

Particularly, it is relevant for research purposes to highlight levels of floods and damages in terms of social and economic losses (Grunewald et al. 2009).

Therefore, the methodology for investigation applied in this phase is based on the comparation of official sources elaborated by authorities in occasion of flooding of years 1820, 1833, 1845, 2002, 2013. Despite a succession of numerous events (available data demonstrate that at least 20 flood events over the last 500 years has occurred in Dresden), the research will focus on those that are most similar in terms of comparability and availability of parameter of analysis.

The consultation of these sources allows to identify those indicators that have already anticipated and that will be useful to understand which areas of the city turns out to be particularly vulnerable from a flood risk point of view.

⁴ A better statement about the strategies and urban sector regulations is provided within the chapter dedicated to new processes of adaptation of Dresden.

⁵ The water level registered seem to be not really a new phenomenon. In the "Hochwasser" of 1845, the level of water reached a high almost comparable with the last one. Cfr: *Weikinnn'Comiplation* (1965)

4. Construction of an historical comparative framework for extreme events in Dresden

The research starts with the identification and the systematization of historical available data about extreme flood events in the history of the city. In this stage, the research aims to construct a comparative framework that is able to understand which indicators should be considered relevant for analysis purposes and which can be considered comparable with information over the time.

A first reconstruction of technical and numeric data is provided by official documents realized by engineering companies^{[1} on behalf of the Kingdom of Saxony in occasion of catastrophic events.

For this phase, iconographic sources will be used which are constituted by single lithographic sections of global maps. Each of these sources are normally subdivided into numerical sections that correspond to specific districts or parts of a guarter in which the relationship between water and urban fabrics is shown in detail, as well as the perimeter of the flooded area. The construction of the comparative framework is associated to the realization of maps that would be comparable between each other and that can be overlapped in order to identify the following aspects:

- Identification of fixed boundaries of water risk due to specific natural condition (geomorphological, geographical, hydrological).
- Recognition of possible changes over the time due to the modification of already anthropized contexts.
- Identification of areas with a particular intensity in terms of vulnerability associated to the presence of flood areas reached over the time. - Delimitation of critical areas in which urban and infrastructural modification have determined a higher water risk condition over the time.

For the realization of historical maps which can be overlapped and, therefore, comparable, the study takes into consideration the use of the following historic Sources:

For the Description of water risk condition in the early XIX century, the material of research included are: Flooded areas during the decade 1820-1833.

1. Description of the map: "Karte des Elbstromes und seines Hochwasserbereiches / [Königlich Sächsische Kameralvermessungsanstalt unter Direktor W. E. A. v. Schlieben". Scale of representation c.a. 1:5000.

Datierung: 1820-1833

Urheber: Schlieben, Wilhelm Ernst August von, Kartenzeichner Verwalter: Dresden, Sächsisches Staatsarchiv, Hauptstaatsarchiv Dresden, 12884, Karten und Risse, Signatur/Inventar-Nr.: Makro 05315-05388 & (Schr 000, F 176, Nr 001) Sektion 36: Elbstromkarte von Cossebaude Sektion 37: Elbstromkarte von Stetzsch Sektion 38: Elbstromkarte von Trachau Sektion 39: Elbstromkarte von Leipziger Vorstadt Sektion 40: Elbstromkarte von Radeberger Vorstadt Sektion 41: Elbstromkarte von dem Gebiet bei Radeberger Vorstadt

Sektion 42: Elbstromkarte von dem Gebiet bei Briesnitz

Sektion 43: Elbstromkarte von dem Gebiet bei Cotta

Sektion 44: Elbstromkarte von Dresden

Sektion 45: Elbstromkarte von dem Gebiet bei Blasewitz

Sektion 46: Elbstromkarte von Loschwitz

For the Description of water risk condition during the flood in September 1890, the material of research included are: Description: Flood of 6 and 7 September 1890

2. Description of the map: "Karte des Elbstromes im Königreich Sachsen: enthaltend die Situation bis zur Überschwemmungsgrenze des Hochwassers vom 6./7. September 1890" Datierung: 1890 Urheber: Rilke, F, Kartenzeichner

Verwalter: Dresden, Sächsische Landesbibliothek - Staats- und Universitätsbibliothek Dresden (SLUB), Kartensammlung Sektion: 10, 11, 12, 13, 14, 15, 16, 17.

For the Description of water risk condition during the flood in March 1845, materials of research included are:

Description of the map: The map of Flood realized for the kingdom of Saxony in the decade 1850-1855 represents "a unique source of information"^{[2} about

2 The flood map of Sachsen region represents a unique source of information that

¹ In 1845 the Royal Hydraulic Engineering Directorate / realized official maps divided into 15 sections on behalf of the Royal Saxon Financial Surveying Bureau. Cfr: Karte des Elbstromes innerhalb des Königreichs Sachsen mit Angabe des durch das Hochwasser vom 31sten März 1845 erreichten Ueberschwemmungsgebietes. Source: SLUB / Deutsche Fotothek

union of single sections



1:12000. The city of Dresden is indicated in the IX section. The map of Dresden still shows the presence of the old river plain of Weißritz, whose river estuary was moved in 1891/1893 of about 3 kilometers along the Elbe river. During the flooding of 1897, 1958 and recently of 2002, the flood hit the old riverplain of Weißritz, actually Friedrichstadt.

Description of the map: "Karte des Elbstromes innerhalb des Königreichs Sachsen: mit Angabe des durch das Hochwasser vom 31sten März 1845 erreichten Ueberschwemmungsgebietes ; in 15 Sectionen und mit den von der Königlichen Wasserbau-Direction aufgenommenen Stromprofilen und Wassertiefen / bearb. von dem Königlich Sächsischen Finanzvermessungs-Bureau". Datierung: 1850-1855

Urheber: Werner, Wilhelm Kartograf, Lithograph

Verwalter: Dresden, Sächsische Landesbibliothek - Staats- und Universitätsbibliothek

4.1 Systematization and geo-referencing of historical maps

The main purpose of this phase is to provide a useful a source that is normally not comparable with recent maps of water related risks. In fact, available data come from meticulous handmade works realized in sections that used to be commissioned by the Kingdom of Saxony in occasion of these disasters and which are not digitalized. After the first phase of grouping of separated sections, the research expected, therefore, to put in place the digitalization and the development of a process of geo-referencing that will transform these cartographic/lithographic sources definitively into a "geo-referenced" and digitalized maps (Figure 14).

The digitalization of paper format sources is extremely necessary for:

1 To Transform the printed information into a digitalized data which can be furnished of a own informative "database"

2 To use this digitalized and geo referenced basis for the construction of spatial data which are more comparable with latest information about flood in 2002, 2006, 2013 (e.g. design of flood areas, Elbe river profile over the time). 3 To overlap these data and to produce new information that were not available at the time the document was produced and that today are considered

is still valid for the comprehension of characteristics and relevant information of that time.

Figure 14. Subdivision of phases for the construction of a comparable historical sources. (A) The first phase regards the union of all data collected for the creation of a unique representation. (B) The second stage is to collect different map and to make them as much as comparable in terms of representation. (C) the Third phase expects the georeferencing of all the data collected in order to construct a Comparative Framework of historical maps. Source: Scheme produced by the author with the EU source: CLC Corinne Land Cover 2018, EEA Copernicus Land Monitoring Service; Water courses- Elbe River section.



creation of overall map



geo-referencing



longitude 13.772693 latitude 51.076440





C




extremely relevant.

The Scope of this phase is to make superimposable and comparable sources that are normally accessible as printed format, with no geographic reference, therefore, not suitable for the following purposes.

The systematization phase allows a first reading of the condition of risk present at that time, by showing areas that were already vulnerable in all probability due to geographic and topographic conditions. Furthermore, the overlay of this historic maps, once they are geo-referenced, show a temporal continuity in representation that is extremely important to design spatial metamorphosis that have certainly modified the relationship between the Elbe and inhabited areas.

In particular, historical floods event of 1845, 1890 can be considered important documentation tools for the comparation with recent phenomena occurred in 2002 2006 and 2013(**Figure 15 A, B and C**).

The reason is principally those of reconstruct a framework that points out ecological and spatial conditions of that time (with a focus on the fact that Dresden around the middle of the nineteenth century was in the stage of a large industrial and social expansion) and that explains gradual phases of transformation/spatial metamorphoses. It is not secondary, to highlight that Dresden registered between 1875 and 1895 a notable increase in number of citizens and an expansion of urban fabrics, which will be significant in the history of Dresden (Volker 1986).

The superimposition of digitalized maps shows the areas that were flooded by water in 1820/33, 1845, 1890, by permitting to reconstruct a first important spatial indicator that will be useful in the phase of comparation with the latest flood in Dresden (**Figure 16**).

Among the different available data will be take particularly into consideration those realized after the flooding of 1845 and the most recent in 2002 (flooding of 2003 and 2006 were not comparable with the event of 2002 in terms of damages and flooding). In particular, last events are not really useful at this phase of work, as the interval of time that occurred between them and the impact that they produced is not relevant for the comparation of historic floods.

The juxtaposition of flooded areas over time allows, in the first place, to identify urban fabrics that are historically vulnerable and districts which were se



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Figure 15 Georeferencing of separated sections for the realization of historical overlapping maps. Maps are geo-referenced and showed within the perimeter of the city of Dresden, by highlighting the specific morphological and geological condition of the Elbe river valley. (A) "Karte des Elbstromes und seines Hochwasserbereiches / [Königlich Sächsische Kameralvermessungsanstalt unter Direktor W. E. A. v. Schlieben". Scale of representation c.a. 1:5000. (B) "Karte des Elbstromes innerhalb des Königreichs Sachsen : mit Angabe des durch das Hochwasser vom 31sten März 1845 erreichten Ueberschwemmungsgebietes

; in 15 Sectionen und mit den von der Königlichen Wasserbau-Direction aufgenommenen Stromprofilen und Wassertiefen / bearb. von dem Königlich Sächsischen Finanzvermessungs-Bureau". (C) "Karte des Elbstromes im Königreich Sachsen: enthaltend die Situation bis zur Überschwemmungsgrenze des Hochwassers vom 6./7. September 1890" Source:-Maps realized by the author with data that come from: EEA Copernicus Land Monitoring Service, for the creation of DEM digital elevation model; SLUB Deutsch Fototheck.







Figure 17. (A) Digital perimeter of the flooded area during the extreme event of the 31 March 1845 and overlapping with the historical cartography, (B) Digital perimeter of the flooded area during the extreme event of the 6-7 September 1890 and overlapping with the historical cartography, (C) Digital perimeter of the flooded area during the extreme event of the August 2002 and identification of urban fabrics that were hit at that time, (**D**) Digital perimeter of the flooded area during the extreme event of the June 2013 and identification of urban fabrics that were hit at that time. Source: Maps realized by the author with the following data: "Karte des Elbstromes im Königreich Sachsen: enthaltend die Situation bis zur Überschwemmungsgrenze des Hochwassers vom 6/7. September 1890"; "Karte des Elbstromes innerhalb des Königreichs Sachsen: mit Angabe des durch das Hochwasser vom 31sten März 1845 erreichten Ueberschwemmungsgebietes", "Karte des Elbstromes und seines Hochwasserbereiches; CLC Corinne Land Cover 2018, EEA Copernicus Land Monitoring Service; Water courses- Elbe River section; OSM Openstreetmap, for the Buildings feature.





Elbe river Tributaries of the Elbe river Digital perimeter of flooded areas in 2013 Urban fabrics damaged by the flood in 2013 The juxtaposition of flooded areas over time allows, in the first place, to identify urban fabrics that are historically vulnerable and districts which were se The juxtaposition of flooded areas over time allows, in the first place, to identify urban fabrics that are historically vulnerable and districts which were severely hit by flood. As an example, the Ostragehege area has always represented an essential water basin capable of welcoming water in excess during extreme events and, at the same time, to guarantee functions in the field of agriculture. Over centuries, this area has been an object of several transformations which have reduced significantly its water drainage capacity, although today the function of water basin is still preserved (Figure 18).

The synthesis of changes of the Elbe river profile over time, as well as the identification of major repercussions in terms of flood, allow to understand the entity of damages that the flood created over the time and to verify the riskiness of the overall superficial hydraulic system. Particularly interesting are the consequences of the flooding 2002, in which can be confirmed that the majority of damages were provoked by a tributary of the Elbe river (Figure 19 A and B). Losses and damages are circumscribed within the area of Altstadt and Friedrichstadt, where the "Weißeritz" overflowed into several areas by causing serious economic losses to infrastructures and residences (Thieken et al., 2005).

> Figure 18. Sequence of flooded area over the time along the Elbe river valley. The image shows the sequence of events over the centuries and the modification of the Elbe river profile. A major focus is reserved to the Ostragehege area, which was in history particularly hit by floods. From 1845 to 2013 is represented the synthesis of the spatial transformation of the water basin, as well as the perimeter (in negative) of the flooded zones. Source: Maps and schemes realized by the author with the data of Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie, OSM Openstreetmap CLC Corinne Land Cover 2018, EEA Copernicus Land Monitoring Service; Water courses- Elbe River section Perimeters of flooded area for 1845 and 1890 are realized by the author with the superimposition of historical section of official maps.

the focus works as an example ofor the interpretation of the following phases of flood over the time





URBAN FABRICS HIT BY FLOOD 2002

Elbe river Eisenborbach(left) Weißeritz(right) tributaries Urban fabrics damaged by the flood in 2002

2

INFRASTRUCTURES HIT BY FLOOD 2002

Figure 19 (A)Buildings hit by the extreme flood of 2002 in Dresden. Urban fabrics in red are those that were particularly inundated by water overflow, which correspond with the Altstadt, Pieschen district and Friedrichstadt. (B) Infrastructures seriously flooded by the Extreme event of August 2002 in Dresden. In red are showed the primary and secondary road system, the railway system and the tramway system. Source: Map produced by the author with data of Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie, OSM Openstreetmap CLC Corinne Land Cover 2018, EEA Copernicus Land Monitoring Service; Water courses- Elbe River section.

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Elbe river Eisenborbach(left) Weißeritz(right) tributaries roads and trail infrastructures damaged by the flood ir

5. Visual urbanism as method of research

Water related risks and flood phenomena have held the city of Dresden in tension for long time, by registering events that have been repeated more than one time over each century. Among the first episodes registered in the city a flood occurred in 1501, in which the flood level reached 8,80 meters (Figure 20), even if the continuity in flood in time would suggest that Dresden has a centuries-long experience in water related risks. According to data, living under the threat of a possible flood represents for Dresden a condition of normality to which have had correspond in the history of the city a gradual but also necessary process of adaptation that has allowed a coherent urban development. Recently, this calm faced with the problem of pressure and effects of climate change brought the city back to a state of tension, especially after the flood of 2002. However, the occurrence of these events did not disturb the normal functionality of urban spaces and of closer areas to the Elbe, which have in several occasion used both as water basins and public space. In fact, an interesting aspect which can be observed is the constant presence in time of regular activities and uses of spaces along the Elbe river that have been maintained also after catastrophes. What were mapped at that time as critical areas within the official documents represented also elements of the spatial structure at its disposal in which the community used to spend their time.



Figure 20. Diagram of flooding in Dresden over the time the with testimony of historical water stage. Source: Diagram realized by author. Data are included in Weikinn's Compilation and on the website of the city of Dresden. The contribution of the work on the *visual experience* in contexts of extreme vulnerability as Elbe river is to identify episodes which are retained to be significant at research purposes. In fact, these iconographic representations furnish an explanatory framework of types of relationship generated between citizens and the *waterscape*. This term could be retained unthinkable and difficult to put near a period hermetically closed for debates about coexistence of functions and resistance to water risks. However, the depiction of paints of Elbe landscape almost never vacant of functions and normal activities suggests that Elbe river and its riverside had never represented a barrier into human imagination.

5.1 Representative and historical Buildings along the Elbe river and their water experience coexistence

What normally in other cities has configured a spatial limit, as well as a physic boundary, conquered in Dresden a privileged function in terms of public space offers. Complicit the will of Kingdoms to keep the riverside free from industries and to imagine it as open space and welcome place for representative architectures. The hydrographic basin of Dresden is nowadays surrounded by a constellation of symbolic architectures constructed in time with the purpose of enjoy of the Elbe river landscape.

Principal entrances of Castles and Kingdoms houses were built with water-stairs (*Wassertreppe*) localized directly onto the water, which makes it easier to store the warehouse of raw-materials for families that lived there. Over time these buildings became part of the most attractive overviews for touristic sightseeing (**Figure 21**). The presence of Castles and representative houses, which have a view on the riverside and a direct entrance onto the water, demonstrates a political determination in privilege these spaces as representative places (**Figure 22 A and B**). Some of these buildings have been flooded several times in the history of Flood in Dresden, although they never lost their principal function and still exist (**Figure 23**). Following phases of adaptation to water risk by the community, but also spatial metamorphoses that are entails.

Spaces in front of Altstadt, in proximity of the Japanese Palace were principally used for leisure and recreational scopes;
Since the construction of the Augustusbrücke, it always represented the pedestrian street for excellence through which people can reach the Neustadt. This bridge always had a representative role for its aesthetic characteristics and its functionality. The bridge crosses the Elbe river in way to connect two of the most representative public spaces of Dresden.



Figure 21. Representative entrance of the Pillnitz Castle and the maritime Transport Chain system along the Elbe river. Pillnitz mit Schloß. Luftbild-Schrägaufnahme von Osten über die Elbe. Datierung 1945. Source: SLUB / Deutsche Fotothek





Figure 22. (A) Principal entrance of Pil-Initz Castle. In the photography is represented the water level registered in pre- 162vious flood. Dresden-Pillnitz. Junge Frau auf der Wassertreppe von Schloss Pillnitz sitzend. Datierung 1945. Source: SLUB / 163 Deutsche Fotothek. (B) The representative entrance of the Pillnitz Castle, with the localization on the right side of the stair of the measurement of water stage realized by Pötsch. Photo took by the author.



Figure 23. Identification of principal representative buildings and Castles located in proximity of the Elbe river banks within the city of Dresden. Source: map produced by the author. Data included come from Sächsisches Landesamt für Umwelt, Landwirtschaft und Geologie, OSM Openstreetmap CLC Corinne Land Cover 2018, EEA Copernicus Land Monitoring Service; Water courses- Elbe River section.



FLOOD AREAS IN 1845

FLOOD AREAS IN 2002

Figure 24. Comparation of two phases of flood in 1845 and 2002. Identification of principal representative buildings and 164 Castles located in proximity of the Elbe river, he basis for the construction of urban fabrics is recent and it is used only to display in which context are the building located. Source: map produced by the author.

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5.2 The Use of bi dimensional sources for a shift scales into the observation of spatial phenomena

The combination of different bi-dimensional sources and the systematization of them guarantees a shift scale into the observation of phenomena which allow to shed light to aspects that are only visible through the analysis of zenithally maps. In particular, this exercise of multi-scalar analysis permits to construct a framework of experiences compared to the uses of areas of basins by the community.

This "silent metamorphosis"^{[1} has transformed in time these areas of hydraulic safety into open spaces which have consolidated the sense of transversal relationships of various nature. Thanks to public consensus of that time the water basins experienced a process of appropriation by people that has transformed them into historicized urban spaces which is still easy to capture today. If the large scales reading of superficial hydrographic network permits to intervene in the process of domestication of water in time, by examining changes of spatial relationships and alterations occurred due to dynamics of urban growth. This observation of iconographic sources represents a way to interpret different typologies of interactions that have occurred within spatial structures. Read out the physic space determines the focusing on the nature of them in terms of perception of the landscape through the sensible sight of artists and photographers.

"There is no territory without the imaginary of a territory. Being a project, the territory is semanticized. It is 'discursivizable'. It bears a name. All sorts of projections are attached to it, thus transforming it into a subject" (Corboz, 1983). The Objective is to catch the essence of the relationship that this resource has been able to solicit and how this have been maintained in time. Initially, the figurative arts and later the photography were tools that tried to catch the image of perceived space on the basis of a personal culture and own feelings.

5.3 Multi scalar investigation as a tool to decipher signs of urban palimpsest The use of a multi-scalar method of investigation allows to observe particular phenomena and to contextualize them within a large scales process of examination that aims to decipher the read out that belong to the "urban palimpsest"^{[2}.

2 The word is particularly referred to the sentence of the author Andrè Corboz in which every part of the earth's crust defined a territory, which commonly identified as the object of a relation of appropriation. He said: "the part of the earth's crust identiThe observation of lithography and paints that aimed to represent scenes of everyday life constitutes a fundamental step, not only to identify specific functions, but also to verify which of them have been represented at that time as a symbol of social appropriation of public spaces.

One of characters for the identification of green and blue infrastructures includes the capacity of water resources to work as public spaces and to be used by the community also for these purposes.

Additionally, this phase permits to understand which of the several urban spaces used to be privileged by the community, and what kind of use they made of them.

The following sources furnish an overall scheme of spaces principally frequented in time:

The construction of a space time analysis includes the peruse of representative historical data divided pro phase of flood in history and with similar and comparable information. Historical maps are used to reconstruct boundaries of those areas that were considered at that time as vulnerable and flooding and the effects that them caused on contexts that were hit.

5.4 The role of romanticism exponents in Germany as an instrument of investigation for the interpretation of multiple uses in Elbe river valley Before official sources that show risk condition of some areas were available, there were already some sources e.g. paintings that can be considered partially interesting for the information they provide about flood and vulnerability of contexts. In particular, exponents of the German romanticism art between the end of 19th century and the beginning of 20th century, which were mostly interested in representing the symbolic landscape and to give great importance to the particularity of German landscapes and natural Landscape. The Elbe river and its surrounding areas were among favourite contests of representation in Saxony due to presence of natural characteristics of the river plain, which were considered by painters of that time capable to provoke great emotions in viewers^[3]. Mapping of these inspiration contexts allow to produce an evidence of themes already existing at that time and to leverage on questions of research that can be in sequence described (Figure 25). One in particular is the paint of Ostragehege area, that is within the depict

fied as territory is usually subjected to appropriation that occurs not only in physical terms, but instead that implements various mythical or political intentions." 3 The work of Caspar David Friedrich is principally focused on the capacity of painting to provoke emotions in viewers. An intense but short period of work of the artist settled in the city of Dresden.

¹ Cfr. Gasparrini C., In the city on the cities. ListLab, Trento, 2015, pp. 210 ss.



Figure 25. Interpretative framework of uses and perceptions along the Elbe River through the use of artistic sources. The map represents a collection of historical depicts realized between the beginning and the end of the XIX century, with the purpose to communicate through the "art source" the perception and consequently the functions that people used to attribute to spaces along the Elbe river valley in Dresden. Source: scheme produced by the author.

represented as a wetland ready to welcome water in excess comes from flooding of Elbe river but also an area devoted to pasture. The intention of the painter at that time was to inspire strong emotions about the great presence of natural landscape, buts it shows also technical aspects which are more or less interesting that evidence an important question of research. This area will be considered, within the history of water risks experience of Dresden, a context of great interest for the capacity of being controlled flooding area able to let the river breath and becoming in time an area of water coexistence experiments.

5.5 Interpretation of mechanisms of control of the Elbe river: Mapping and geo-referencing of artistic sources as methodology of research The use of photography has always represented an instrument of conservation of a status within a spatial dimension but also an important attempt to conserve for the future generations. Purposes are different and have in part be useful to architect and urban planner into phases of construction / re-construction of cities or part of them. "In the field of urban studies, images are intrinsically related to knowledge, thought and action. From the Renaissance up to the Second World War, urban planning has been built, both as a profession and as an expertise, on a common basis of visual representations, which were used by planners to visualize the physical, social or economic dimensions of space, and to project objects into it" (Söderström, 2000). The question raised over the last few years is "how do researcher use photography in contemporary urban studies?". The use of bi dimensional figures as a mean to describe urban spaces, territories and domestic spaces reflects the fact that dimensions are various.

"The semiotic status [of photography] creates an effect of distance, which increases the effect of designation" (Piette, 2007).

According to authors the function of photography is to show also if both the photographer and viewer play an important role in the production of meanings (Conord, Cuny 2014). What happened with photographers was also valid for painters of that time, whose were intentioned to give viewers a result that could be interpreted in different manners depending on the sensibility of the person. Several experiments have been conducted at the end of 20th century in order to collect experiences from closer views of urban Landscapes, as well as to construct a shared vision of how people perceive some spaces. More recently, the workshop conducted by Robert Venturi and Denise Scott Brown in Las Vegas in the 1970s consisted in exploring The Strip using films and photographs taken from a moving car (Venturi, Scott, Izenour, 1972). Purposes

related to this phase is to show how community, trough the construction of spatial and visual narratives, was related to the space they have made for themselves. It is not only aimed to document physical properties but also to show social ecological approaches toward the artefact nature of city. In this manner the research aims to solicit the scope that is behind the reproduction of reality. "Photography is not a transparent reproduction of reality, as the photographer produces a situated view of it, which takes on technical, social and ethical dimensions" (Conord, 2007).

As digital technologies spread into public administrations during the 1990s, they profoundly transformed the codes of conventional systems of representation in urban planning. Indeed, they promoted images that seemed to be closer to the shared visual experience, as they showed urban objects from a pedestrian point of view (Bailleul, 2008). However, there is also a scientific use of photography and paint that can be used to describe urban and natural phenomena that otherwise would have been communicated in not comprehensive way only through the use of cartographic sources. At this scope, it can be extremely useful to achieve a result that is carried out through the combination of a system of cartographic representations and visual experiences collected from artworks and photography (Figure 26). They all lead to the definition of a spatial and visual narrative that keeps in tension at the same time the closer dimension of depict or photography with the overall representation of a phenomenon.

As the photographer Nadja Monnet explained in her works, the role of photographer is to create a "data production" instead of a "data collection", which is different for the capacity of the first one describing urban dynamics, by combining the representation of public spaces human bodies with the capturing of interactions that aim to forming a collection of signs that must be decipher (Figure 27). In the case of Dresden, the correlation between asserted geographic/topographic conditions and the synthesis of transformations which in time modified the spatial relationship between the river and the city returns to a clear framework of various interpretations that the city have given to water resource and different form of adaptation. In particular, the sequence of modifications that the river and its tributaries underwent over the centuries gives a testimony of several attempts of domestication of the ecological resource (Figure 28).

The necessity to interpret transformations that have led the river system in



Figure 26. Overlap of Elbe river in 1845 together with flood areas of Sommerhochwasser in 1845, combined with historical paints. Source: designed by the author with data collected from CLC Corinne Land Cover 2018 for the green areas and pastures; The Elbe river and flood areas produced by the author from the historical cartography of Hochwasser 1845; Paints comes from SLUB / Deutsche Fotothek, "TU Dresden Bibliotheck".

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Dresden toward processes of artificialization is supported by a clear intention of highlighting those that were over the years mechanisms of control of the hydraulic system. The control on the water has allowed over time to reach important purposes related to the development of trading, and industrial growth later, but also to guarantee to the city an adequate system of military defence against enemy assaults. In order to permit the enhancement of urban infrastructures and promote efficiently the development of the city, Dresden had to deal with persistent presence of water risks.

Several spaces of contact with the Elbe river have been subjected to phases of alteration that have caused the formation of a variable spatial structure over centuries. These spatial metamorphoses are the result of both of modifications that have interested superficial areas, sections of *river plain* and its tributaries and more complex operations, which have conducted toward a large-scale intervention. In particular, overall projects have involved the creation of new architectures and new open spaces, by endowing the city with new functions and new urban qualities.



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Figure 27. (A) Das Große Gehege, auch Ostra-Gehege, ist ein um 1832 entstandenes Gemälde von Caspar David Friedri- 174 ch, Galerie Neue Meister im Albertinum, Staatliche Kunstsammlungen Dresden. Source: Google – Wikimedia. (B) View of Dresden by Moonlight, Johan Christian Dahl, 1839, Galerie Neue Meister in Dresden. Source: Google – Wikimedia. (C) Dresden i solnedgang, Knud Andreassen Baade (1838), National Museum Stockholm. Source: Google – Wikimedia.

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Urheber: Schlieben, Wilhelm Ernst August von, Kartenzeichner Verwalter: Dresden, Sächsisches Staatsarchiv, Hauptstaatsarchiv Dresden, 12884, Karten und Risse, Signatur/Inventar-Nr.: Makro 05315-05388 & (Schr 000, F 176, Nr 001)

III. Sitegraphy

- http://inspire.ec.europa.eu/codelist/EventEnvironmentValue/riverPlainSystemSetting; INSPIRE Europa
- https://ec.europa.eu/environment/nature/ecosystems/strategy Green and Blue Infrastructures Strategy
- https://archive.epa.gov ; EPA United States Environmental Protection Agency
- https://waterdata.usgs.gov; National Water Information System USGS science for a changing world
- https://www.bbc.co.uk/bitesize/guide; Interpretation of hydrographs BBC
- http://www.ssc.education.ed.ac.uk/BSL/geography; SSC Scot-
- tish Sensory Center BSL Geography Glossary- University of Edinburgh
- http://www.hochwasserlehrpfad-dresden.de; Leben mit dem Hochwasser
- https://ec.europa.eu/environment/water/flood_risk/; European Floods Directive 2007

IV. Interpretation of hydrographs

Drainage area. When rain falls on an area of land, the water travels downhill and typically collects into a lake or travels on through a river. The area where this happens is called a Catchment Area. In a catchment area water can be collected through rain or drained by rivers or streams. A catchment area can also be known as Drainage Basin.

Cfr. SSC Scottish Sensory Center BSL Geography Glossary- University of Edinburgh

Peak discharge. The peak discharge is the time when the river reaches its highest flow. There is a delay because it takes time for the water to find its way to the river. This is called lag time. The normal (base) flow of the river starts to rise when run-off, ground and soil water reaches the river. Cfr. https: Interpretation of hydrographs BBC

River plain Geologic setting dominated by a river system; river plains may occur in any climatic setting. Includes active channels, abandoned channels, levees, oxbow lakes, flood plain. May be part of an alluvial plain that includes terraces composed of abandoned river plain deposits. Cfr. INSPIRE Europa, http://inspire.ec.europa.eu/

River stage. The river stage is an important concept when analyzing how much water is moving in a stream at any given moment. Stage is the water level above some arbitrary point, usually with the zero height being near the river bed.

Cfr. National Water Information System USGS science for a changing world

Runoff. That part of the precipitation, snow melt, or irrigation water that appears in uncontrolled (not regulated by a dam upstream) surface streams, rivers, drains or sewers. Runoff may be classified according to speed of appearance after rainfall or melting snow as direct runoff or base runoff, and according to source as surface runoff, storm interflow, or groundwater runoff. Cfr. National Water Information System USGS science for a changing world

Stream flow. Stream flow, or discharge, is the volume of water that moves over a designated point over a fixed period of time. It is often expressed as cubic feet per second (ft3/sec). The flow of a stream is directly related to the amount of water moving off the watershed into the stream channel. Cfr. EPA United States Environmental Protection Agency

Flood stage. In general, the term flood stage is defined as the gage height of the lowest bank of the reach in which the gage is situated. The term "lowest bank" is, however, not to be taken to mean an unusually low place or break in the natural bank through which the water inundates an unimportant and small area. The common definition is the stage at which overflow of the natural banks of a stream begins to cause damage in the local area from inundation (flooding).

Cfr. National Water Information System USGS science for a changing world

"Each flood is a result of a complex web of meteorological (mainly precipitation), environmental (e.g. physical characteristics of surface or vegetation or vegetation cover) or anthropogenic (e.g breaking embankments in war action) factors on the river run-off" (Mendel et al., 1997)





Abstract

Analyzing the evolutionary dynamics that water-related risk **77** produced over the time on the transformation and processes of urban construction, this chapter aims to understand how the presence of water and its related risks effected the realization of plans, strategies of adaptation. Particularly, how the production of a Landscape dominated by infrastructural interventions mostly related to the industrial growth and phases of urban development of the city, starting from the end of XVII century, influence the spatial structure of the Elbe river. The purpose is to shed light on essential milestones, as well as shadows, that were fundamental for strengthening urban resilience characters, but also to point out possible critical issues that have characterized some urban interventions.

1. Foreword: Use of resilience/resistance approaches as cultural declination toward the theme of water risks.

Common vision originated by cultural reflections within the urbanism field of research, the significance of resilience, would correspond to an expressive capacity of the city, as a system, to respond promptly to extreme events, or otherwise to natural hazards that could put in tension the normal environmental social and ecological equilibrium within an urban ecosystem. According to one of the latest scientific deposition, "Resilience is a term that emerged from the field of ecology in the 1970s, to describe the capacity of a system to maintain or recover functionality in the event of disruption or disturbance. It is applicable to cities because they are complex systems that are constantly adapting to changing circumstances" (Rockfeller foundation, 2014).

Within the geographic area of central Europe, this concept assumes a particular relevance and a distinctness which make it incomparable with other contexts, although they have had over time similar experiences in extreme events and water related risks. Particular meteorological conditions that have been already solicited in the previous chapter, together with topographic and morphological characteristics, especially within the Saxony region, constitute together a fundamental prerequisite that aims to stimulate reflections compared to approaches that have in centuries conditioned ecological equilibriums and significant transformation of the spatial structure of the Dresden *Elbe valley*¹.

In particular, the choice to dedicate a chapter to the historical processes of adaptation to water related risks represents a way to put in light temporal equilibrium compared to approach of *resistance/resistance* (Viganò, 2012) at associated risks and to explore in depth the field of interpretations attribut-

ed to the Elbe for different purposes. What is interesting to examine in this stage of the research is not the issue of the water risk in itself, to which it has been given great importance in the previous chapter, but rather efforts and compelling attempts made by human capacity in order to ensure equally the development of the city under conditions of extremely vulnerability and exposition at extreme floods and to *domesticate water* on the basis of rigorous scopes (Ortalli, 2010).

The methodology of research applied in this stage, indeed, aims to observe the synthesis of spatial and ecological metamorphosis occurred over the centuries that followed both after historical floods and military, political and engineering purposes independently from climate conditions. The mutation of the spatial structures of the Elbe river shed light on consequences and particular aspects through which the researcher can interpret *the metabolism of the city* (Wolman, A., 1965) and in which way it has influenced the entire urban ecosystem.

The city of Dresden, as normally happened in other contexts, has experienced two different but complementary processes of adaptation to water related risks, which can be assumed within framework of scopes which are more or less rational. The first one is the one that is led by precise purposes of territorial rationality and that transforms the relationship between the water on the basis of intentionality that belong to a determined culture. Belong to the first category all efforts made through urban and strategical plans which have from time to time furnished several roles to the water, but also safety regulations and great interventions occurred after damaging episodes of floods. These, in a certain sense, configured a succession of operations that aimed to consolidate the superficial hydraulic mechanism. Among them, there are efforts made by researchers, politicians, and by kingdoms of the Saxony region in order to figure out which solution of adaptation would have faced with risks in the future.

These types of transformations have had in Dresden consequences that are still today visible and that have modified over the time roles and priority. The second one it's a process that is constructed in a more spontaneous way, sometimes with the involvement of the community, whose established over the centuries independently from city and territorial rules criteria of use of Elbe *waterscape*. The period of reference for the examination of transformations of the hydraulic system in Dresden is considerably long and regards several attempts made over the centuries, although a particularly phase of significant interventions can be traced between the beginning of the XIX century and the second-half of the XX century. Before of the industrialization phase, in fact, Dresden has experienced mutations of water system wholly related to military and political scopes, which did not modify sensibly the structure of

¹ The Dresden Elbe valley it's a geographical and spatial entity officially recognized by the UNESCO in 2004. The area has an extension of 18 kilometers along the river from Übigau Palace and Ostragehege fields in the northwest to the Pillnitz Palace and the Elbe River Island in the southeast. It was nominated by UNESCO committee for the inclusion on the World Heritage List. Among criteria of nomination, there were considered landscape features, architectures and garden that have been a reference for the development of Central Europe in 18th and 19th century. Cfr. "World Heritage Scanned Nomination, File Name: 1156. UNESCO Region, Europe and North America", in: https://whc.unesco.org/en/list/1156/



Figure 1. View of Dresden in the first decade of XVIII century. The depict shows the image of a city still barricaded within the city defense wall and the vastity of the surrounded space. Source: "Ansicht von Dresden, Datierung:1710, Urheber: Pescheck, Carl Justus Ludwig, Kupferstecher, SLUB, Deutsch Fothoteck.

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the River at a territorial scale (Figure 1).

1.1 Elbe river as an historical "multi-purpose infrastructure" for transient conditions of livability and social requests

Both general processes, get the chance not only to analyze historical reactions of resistance and resilience faced the problem of water risks, but also to examine the character of multifunctionality that has been developed within the *waterscape*². In particular, Since the origin of its occupation, the Elbe river has always constituted a multi-purpose infrastructure which has had the task to interpret both transient conditions of livability according to political and military purpose of a certain time, and social requests expressed by unfiltered and direct uses of open spaces of proximity of the *Elbe drainage basin*³.

As compared to the historical *Weikinn's compilation*⁴ the number of extreme floods in Dresden are extremely high and each of them give a testimony of a historical vulnerability that has always went with the processes of development of the city.

Spatial metamorphoses of the Elbe river profile within the limits of the city of Dresden began quite soon and although they are incisive in terms of substantial modifications of the river stream, they were circumscribed enough within the area of interest of the Altstadt and the Neustadt (**Figure 2**). Conditions on the basis of these transformations are almost entirely related to political and defense purposes. According to historical data, a plenty awareness of water risks condition and damages associated to them were already analyzed and took into consideration by experts starting from 1500, by investigating flood reconstructions which are based on documentary evidence (Glaser *et al.*, 2010).

The historicized risk condition was not yet a considered a serious issue both for the Altstadt and the Neustadt, since they were settled within a geographical and morphological position that its historically less damaged by flooding and there was attentiveness to leave opens some *water basin* (e.g. within the

2 For a better comprehension of the definition of "Waterscape", the word refers to the texts: Fabian L., *A territory built by water*, in: Fabian L., Viganò P., (2010) Extreme City, Climate Change and transformation of waterscape. Università Iuav di Venezia, Venezia.

3 Cfr. Previous chapter in order to understand the following definition.

4 Cfr. the previous chapter in order to comprehend the succession of data realized in history for extreme floods in Elbe drainage system, particularly in Dresden. More informations are consultable in: Weikinn, C. (1965), Katastrophale Dürrejahre wa "hrend des Zeitraums 1500 – 1850 in den Flussgebieten der heutigen Deutschen Demokratischen Republik, Acta Hydrophys., 10, pp. 33– 54.



Figure 2. Plan for military exercitations around 1750. The historical map shows a territorial dimension extremely open and the limits of Altstadt and Neustadt were circumscribed within water defense walls. In the countryside the space was reserved in some occasions for the construction of complexes reserved exclusively to military exercitations. Source: Plan von Truppenübungen in der Lößnitz bei Dresden, 1:10.000, datierung: 1750/ SLUB, Deutsch Fototheck.

map the Ostragehege area was already depicted as a water basin capable to welcome water in case of inundation) that could have be prompt in case of extreme events. It is only after the second half of the XVIII century that lands outside the city walls of Dresden start to be object of interest for the city expansion (**Figure 3**).

However, the period that is interesting to focus in started around 1845, when a serious and damaging flood signed the beginning of the new conflictual scenario between the theme of great phase of growth of Dresden and the persistent condition of powerlessness o face up to disruptive and extreme events related to floods. This period is considered by the research a starting point because of first significative and structural reactions triggered by human approaches at natural hazards, and for the sequence of developments that the city would have carried in terms of water system modification. It is only in XIX century that Dresden accomplished a certain degree of urban metamorphosis due to several transformations such as to allow the city to experience the phase of modernity⁵. The theme of construction of great infrastructures, together with the modification of several spaces, before considered suburban or otherwise countryside, represented the result of a culture strongly oriented toward an international openness for trading and the acquisition of a supreme position into the field of engineering innovation. Starting from this century, the Elbe river acquired a position crucial that it has not had before of it⁶. At the turn of the century, Dresden experienced the fundamental step that was predominantly interesting at that time cities in Europe, although with a

particular specificity. The *evolutionists culture* would circumscribe this stage within a dimension that expects new forms of organization of the territory which are equally influenced by urban culture and, therefore, would have had urban characteristics that are causal and not casual.

From this point of view, are more relevant urban aspects of functionality and social relationships that are settled into the city, and that associate the new <u>settlements to the ecological niche of the species</u>⁷, rather than its physical and 5 For a major comprehension of decisive phases of expansion of the city, as well as the identification of the phase of realization of modern infrastructures for the modification of the spatial structure of the city of Dresden, consult the previous chapter related to the great interventions occurred in the first half of XIX century in Dresden. 6 Cfr. the series of agreements and national accords that were realized from that moment, in the following paragraphs: "The passage from a political culture based on military scopes toward the development of commercial and industrial growth as reading occasion of the spatial relationships between Dresden and the Elbe river".

7 Cfr. Indovina F., (1999), La città diffusa. Cos'è e come si governa. Daest, IUAV, Ve-



Figure 3. Plan of the royal residence city Dresden with project of filling the trench made around 1760. The image shows the reinforcement of the city wall and the identification of new external urban fabrics that shortly after would have been realized. Source: Plan von der koenigl Residenz-Stadt Dresden mit Projekt von Ausfüllung des Grabens gefertigt, 1 5500 Handzeichnung um 1760. SLUB, Deutsch Fototheck

morphological connote (Indovina F., 1999). What be found interesting within the city of Dresden is the capacity of kingdoms in this period to keep together relevant issues of safeguard of aesthetical and ecological values of the environment and to guarantee at the same time the industrial development of the city according to the purposes of growth of the city.

More than condition of general awareness toward the ecological issue, this intentionality was particularly influenced by the wish of maintaining over the centuries the image of a city constructed on the basis of an organic vision that well contemplates the relationship between architecture and natural resource (Helas V, 1986). Fundamental were all the operations of spatial modifications related to the construction of a better mobility network that allowed to guarantee an easier connection also when manufacturing were settled outside the area of the city center (**Figure 4**)

1.2 The superficial water network of Elbe river as performing and hybrid machine within the Elbe valley

Try to keep under control the management of a hydraulic machine as the Elbe river in its entirety could result to be an operation extremely improbable from a physical point of view, other than economically unfeasible. The Elbe is a river of great dimensions that origins in Czech Republic, in a 1386 meters high location of *Bilè Labe* and crosses before the German and Czech frontier by passing through the east side of Saxony region toward the north-west side, flowing finally into North See, in correspondence of its river mouth at *Cuxhaven* city. The stream flow, as well as the length of 1.112 kilometers, presumes that also the management of a transect of the entire Elbe river would have found several obstacles and faced with large scale management dynamics. However, the Elbe river that flows within the *Dresden Elbe valley* and passes through Dresden represents a hybrid machine that has been historically objected of partial modifications, at times temporary, which have notably modified the relationship between the city and the water.



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2. Research methodology

Main Purpose of research in this stage of work is to destructure and construct again processes of various nature that have determined the modification of *river stream*, but also of surrounded spaces of the city, by suggesting over the time different criteria of use of it. Particularly, turn to be interesting how the city adapted to permanent flood risk and which physical transformations and efforts have made the city over the years in order to adapt, co-exist, mitigate these risks compared to the necessities and city objectives. The final result will lead to define with major precision cultural declinations and multifunctional-ities¹ attributed to the water over the centuries, by putting in light habits and costumes that have had positive/negative effects on the contemporary status of the city, which is today under the pressure of effects of climate change.

At this purpose to better identify specific modifications of the river and to relate them to specific phase of the history, the approach will be those to construct a framework of historical profiles of Elbe river transects for particular phase of examination, by highlighting from time to time modifications occurred within water network for the city of Dresden.

2.1 Deconstruction and re-construction of Elbe river transects dynamics within the Dresden river valley.

This will lead to the construction of a comparison framework through which can be observed and verified several attempts of domestication of the river over centuries and the purposes that were behind of it. The construction of a comparison framework of water stream profiles within the city turns out to be an efficient tool for the implementation of a deductive process carried out by the researcher, which is extremely useful to obtain a major awareness about cultural declinations attributed to the water over the time.

As it has already demonstrated in the previous phase of examination about the historical water risk condition over the centuries, tools utilized for this stage of the research presumes a systematization of historical sources that aim together to reconstruct a chronology of physical interventions which are particularly interesting in order to better comprehend which cultural declinations lie behind of them.

Over the time, in fact, the Elbe river profile went through different phases of <u>intervention that</u> modified not only the river stream itself but also the system 1 Cfr. Gasparrini. "Le infrastrutture verdi e blu per il progetto della città contemporanea". Introduzione ai lavori della Biennale dello spazio pubblico 2017, Roma. of morphological and ecological relationships between water and spaces. The observation of historical data allows, indeed, to identify important indicator, sometimes qualitative data, on which consolidate information already available from theories and bibliographies of arguments. The comparison of historical cartography permits, as an example, to obtain indisputable information regard the general spatial structure within a scale of reference already defined.

From this point of view, the observation of planimetries and historical maps represents a first selective operation through construct a first spatial data that is able to explain the spatial organization of the urban system in time, and which role was attributed to the river. Therefore, the main scope of this stage is to analyze the complexity of operations of transformation which have been realized in centuries and establish if specific morphological and spatial conditions are still valid.

However, the exclusive peruse of a typology of information of technical matrix does not give back a full comprehension of the succession of dynamics that have interested the Elbe river.

The correlation between of the chronology of historical events and a verified documentation of spatial maps about the Elbe expects, in particular, the reconstruction of fundamental stages which have signed the beginning of an intense use of the river for several purposes, other than the subjection of it to international agreement of cooperation. Phases of regimentation of the Elbe river profile, deviation of its transects at political and city defense scopes, as well as intervention of realization of dykes and flood channels, are considered all part of a systematization of information that help to understand which roles were associated to the hydrographical system.

A particular part is dedicated to those steps which were carried on in the XIX century, when the city started to be mature enough to undertake political and commercial routes that would have led it toward the passage from a military city to a modern city and that would have seen the beginning of first great phases of river transformation (**Figure 5**).

2 Elbe river morphology in 1813 Contour lines 50 m river flood plain 1813

Elbe river morphology in 1881 Contour lines 50 m river flood plain 1881





2.2 The use of complementary tools for the construction of spatial indicators

In order to obtain a clear reconstruction of events/processes of transformation and spatial impacts that they determined over the centuries, the methodology of research puts in relation the complementary use of historical written sources and the repertoire of historical cartography, as well as of iconographic sources that can help to obtain those shifts in scale of information that are normally not obtainable by zenithal maps.

As aforementioned, each of these sources pursues a precise and different scope and aims to construct a partial indicator that can contribute together with other type of sources to build a deductive framework of interventions and interpretation of historical structure of the water system.

Information obtained from different families of data are in sequence described:

- Historical written sources represent fundamental and introductory documentation that aimed to the reconstruction of a precise and irrefutable version of historical facts in sequence and suggest rational hypothesis for a better reconstruction of spatial and designed documentations.

- Repertoire of historical cartography allow to identify the precise configuration of spatial structures of medium and large scale over the years, compared to the presence of a morphological, spatial-ecological relationship between the river with its tributaries and the city. Moreover, they offer the opportunity to identify within a particular time frame the general organization of a city and the ecological, spatial, functional role that was reserved to the river.

Figure 5. Sequence of transformation occurred in Elbe river within the city of Dresden in less than 100 years. In sequence are represented the Elbe river profile for the year 1813, 1881, 1904. Source: Map realized by the author.

- Iconographic sources as lithography and artistic depicts represent a tool of synthesis which enclosed within it a set of information of various nature about the relationship between spaces coincieved as water basin, drainage system, flood channels and *river breath space*² and city. At this purpose, the collocation of the river within representative images or panoramic views allows to the research to collocate at the centre of the debate the landscape dimension and to guarantee those *"Return of Landscape"*³ (Valentien D., 2010) which permits at the iconography to transmit information of emotional character and social aspects about customs and traditions of that time in the use of water resource, but also physical details of the nature within which the river was located in time. In particular, the identification of spaces or segment of waterscape, extraordinary glimpses of a urban reality that is unimaginable to catch only with the use of maps.

3. Transients Spatial metamorphosis of the Elbe river associated to ambitious projects of political, social, and economic nature.

It has already mentioned that the XVIII century configures not only for Dresden but for the overall geographic area of Saxony region a particular historic period in which several important events occurred. Each of these events responded to specific interests and purposes that we could define transients (Figure 6). The beginning of the century was promptly signed by natural hazards and an extreme summer flood damaged seriously the city and brought the water stage at more than 8 meters high (Pötzsch, 1784). For this reason, Christian Gottlieb Pötzsch, a polyvalent researcher of that time, was involved by the kingdom with the scope of observing meteorological phenomena that Dresden experienced and to provide evidences of the variation of water stage along the Elbe. Pötzsch, was commissioned by the Kingdom for the realization of the first tool for measuring water stage on the Elbe river, with experiment before in Meißen in 1775 and then in Dresden in 1786. Still today, this instrument of observation is retained by several as a valid and efficient tool capable of measuring the water stage in the moment of an extreme event, and it is still part of instruments utilized in Dresden to measure the stream flow (Figure 7).

However, if it is essential to know about the historical flooding occurred in the history of Dresden, it is also indispensable to shed light on the city in this historical period for the enactment of handling procedures of the Elbe river that determined the realization of substantial projects of hydraulic engineering. Among these operations, some decree the origination of a many-centuried process of artificialization of the natural stream, which contributed at modifying increasingly the natural profile of the Elbe river. Several interventions were registered before of the century within the river stream, which were mostly associated to the elimination within the river of natural elements that used to represent an obstacle for the navigation along the river. Between them, there were the first modifications of the profile of the river, as well as the removal of the sand banks, but it is still difficult to speak in this period of intervention of hydraulic engineering.

² Cfr. Gasparrini C., Terracciano A., (2018) "Rome 2025 Resilient Osmotic Metabolic Ecological". Listlab, Trento-Italy.

^{3 &}quot;Until recently, the construction of the cityscape tended to entail the subjugation of nature and landscape; the consequences of this approach have been climate change, water shortages and the loss of biodiversity. The twenty-first-century city must abide by a new model that deploys creative, sustainable solutions and a more holistic approach to urban development. On the occasion of an interdisciplinary exhibition at the Akademie der Künste in Berlin, Return of Landscape probes the future of the city, not only as a living space but also as the creative center of tomorrow's society". Valentien D. (2010) Return of Landscape, Jovis, Berlin.



Figure 6. Plan of Dresden, 1765. Grundriss Von Dresden - Nebst Einen Theil Des Daran Stosente Teran, 1:27.600, datierung 1765. Source: SLUB, Deutsch Fotothek

3.1 The role of Rampart fortifications over the XVI and the processes of modification which included physical transformations of the Elbe river profile. In the early XIX century, part of this process of substantial modification of the Elbe river profile included the elimination of city defensive walls in Altstadt and Neustadt, which was originally imagined as a complex defense structure against enemies and with a strong declination toward an architecture of fortification systems realized previously in Italy. The majestic walls that surrounding the ancient unit of the Altstadt were initially thought as a defense system constituted by a singular fortification, and after, in concomitance with the enhancement of firearms the walls were reinforced through the realization of an external unit separate by the internal walls by the presence of a water trench, whose scope was to represent an additional obstacl in case of unexpected incursions.

The realization of the first Bastionary fortress on the right side of the Elbe river dates back to the 1545 under the elector Moritz¹ and was imagined, indeed, as a re-interpretation of the old Italian style. In 1546, under the guidance of Caspar Voigt von Wierandt and Melchior Trost, Dresden reached a status of absolute protection against enemies, by realizing a fortification on the left side too. The XVI century was highly relevant in Europe for the art of fortress construction, which reached an international turning point. Dresden, in fact, was one of the first cities in Germany to have a modern bastion fortress (Dietrich, Kretschmann, 2006).

However, several documentations demonstrate the presence of a first system of fortification already in 1299, and this let us to presume that the entire defense walls grew up with the city until Dresden was defortified in the beginning of the XIX century. The medieval city wall was mentioned for the first time on the 17 August 1299² in a document of the then Dresden city lord Friedrich the Small. Its existence can already be assumed to have been around a century earlier. At the time of the city's foundation, a palisade fortification was assumed, and archaeological findings suggest that the stone city fortification was built in the last quarter of the 12th century. Nevertheless, its existence is supposed to be assumed around a century earlier, since at the time of the city's foundation a palisade fortification was ascertained.

¹ Cfr. Festung Dresden Geschichte (the history of the Bastionary Fortification), in: www.festung-dresden.de

² An official document of the Codex Diplomaticus Saxonia Regiae is consultable on the website, in: https://codex.isgv.de



Figure 7. Stream stage gauge of the Elbe river during flood in Winter 1799, registered and observed by Christian Gottlieb Pötzsch in Dresden. Source: SLUB / Deutsche Fotothek A relevant document, without doubts, is the testimony contained within the *Codex Diplomatic Saxonia Regiae*, which reports several information's about the existence of the *Altzella monastery*³ and a clear indication of a city which was considered at that time a city fortificated. Between the first and the second half of the XIV century⁴the fortification was enlarged with the help of Sovereigns money permits and the transfer of the salt trade surplus from the sovereigns to the Council of Dresden. In 1427⁵, a second low defensive city wall was erected, by creating a kennel wall in order to fortify the entire structure and to ensure a strategical defense when attackers succeeded in overcoming the kennel wall.

At that time, the access into the city was allowed only through five city gates, which were the Elbtor (or bridge gate, Altdresdnisches Tor), the Seetor, the Wilsche Tor (or Wilsdruffer Tor) and the Frauentor as well as the Kleine Kreuzpforte. The Elbtor was located in the north side, at the exit of the Schloßstraße in front of the Elbbrücke, the later Augustusbrücke (Figure 8). During the decade 1519 - 1529 a series of spatial transformations led by the Duke Georg the Bearded permitted an expansion that incorporated settlements on the Elbe and the Frauenkirche within the first extension of the city fortifications. This "New City" was also protected by the use of a rampart and by the realization of the new gate Rampische Tor in 1530, although the presence of the old wall remained inside the area of the historic city (Figure 9) The period 1545-1555, thanks to the Duke Moritz, marked a turning point in the transition from medieval defensive walls to a modern system. The project of expansion expected both the demolition of the old city wall and some gates (e.g. the Rampische Tor), other than the realization of a more modern brick structure. Among the several operations, there were the extension of the Elbtor and the demolition of the *Georgentor* and the *Sector* (Papke, 2007).

3 At this purpose, turns out to be of relevant importance the documentation contained within the Diplomatic codes of the Saxony region CDSR regarding the origin of the city and its fortification. Cfr. CDSR 1/A/3, Nr. 217 vom 21. Januar 1216: Acta sunt hec anno ab incarnatione domini nostri lesu Christi millesimo ducentesimo XVI., indictione V., XII. kal. febr. in civitate nostra Dreseden; feliciter. In: https://codex.isgv.de 4 Cfr. CDSR 2/5, Nr. 58 von 1359 bis 1370: Landesherrliche Geldbewilligungen zu den Befestigungsbauten der Dresdner Bürger. (24. Juli 1359, 25. Februar 1361, 19. Juli 1363, 12. September 1365, 2. Januar 1366, 12. März 1367 und 4. Januar 1370) und CDSR 2/5 Nr. 59 vom 15. Juli 1361: Die Markgrafen Friedrich der Strenge und Balthasar übertragen der Stadt den Salzhandel mit der Bestimmung, dass die nach Abzug der Verwaltungskosten sich ergebenden Ueberschüsse zur Stadtbefestigung verwendet werden sollen., In: in: https://codex.isgv.de

5 A clear representation of the evolution phases of the City defensive walls is furnished within the circuit realized by the Festung Museum Dresden



Figure 8. View of Altstadt and Augustus bridge with the presence of the city door, 1679. Dresden von Osten gesehen, kolorierter Kupferstich, 1679, Author Schollenberger, Johann Jakob, Kupferstecher. Source: Dresden, Sächsische Landesbibliothek - Staats- und Universitätsbibliothek

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Figure 9. The old city of Dresden as it had been watched in 1529, Schneider, Georg Jakob (engraver), 1680. The plant of Dresden shows the inclusion within the old city of the Frauenkirche and new settlements. The expansion of the city determined the realization of a new city defensive wall and a new gate. Source: SLUB / Deutsche Fotothek

When the Duke Moritz died in 1533, the brother and successor Augustus completed the last part of new defensive complex, by constructing new bastions around the already protected city. By 1721, by order of August the Strong, the names of the bastions were changed to Roman god names. Among them there was the famous Venus Bastion "*Jungfernbastion*", situated on the eastern point of the fortification of Dresden, which later in time became part of the *Brühlsche Terrasse*, whose name comes from the first Minister Friedrich Augustus I, Heinrich von Brühl the Minister Brühl who converted it into the garden in 1748/1749 "*Brühl terrace*" and open it to the community in 1814 (Löffler, 1958).

After the unification of *Altendresdner* with Dresden on 29 March 1549, the extensions of the fortifications for *Altendresden* begun in 1546 remained suspended, until in 1632 fortifications were extended.

However, during the entire 18th century the *Altendresdner* and *Neustädter* fortifications were extended several times, from 1704 to 1706, 1732, 1740, 1757 and 1796⁶, by undergoing spatial modifications that reconsidered continuously the border of both historical cities. All these interventions, although transients and spatially delimited, modified at that time the sense of the role that could have been attributed to water resources, by utilizing often the hydraulic system as a protective system, and a barrier of separation between the unsafe territory situated outside and the protected city.

3.2 The passage from a politic culturally based on military scopes toward the development of a cultural declination oriented at the commercial and industrial growth: as occasion of re-interpretation of the organization system of morphological and functional relationships within the physical space of the city

In the middle of the XVIII century, the city fortifications lost their military value and Dresden was defended at the beginning of the XIX century only with few exceptions.

The city experienced a process of general renewal that aimed to use the presence of water resource, together with the capacity of orienting the development of the city toward an international circuit, as occasion of re-interpretation of the organization system of morphological and functional relationships within the physical space of the city

6 Cfr. the interventions of modification and enlargement of old city defensive walls on the following document "Die Geschichte der Festung Dresden" elaborated by the Museum of city defensive wall of Dresden "Festung Dresden", in: https://www.festung-dresden.de

For urban planning reasons and to gain building land, breaches in the Old Town's fortifications were already made in the first half of the 18th century. Parts of the Luna bastion were removed during the construction of the Zwinger Palace and parts of the rampart were removed during the construction of the Catholic Court Church and the Palace square in 1738.

First plans for the complete demolition of walls were already drawn up in 1760 by Oberlandesbaumeister Julius Heinrich Schwarze. However, these plans were rejected for military reasons.

After the bombardment of Dresden by the Prussians in the Seven Years' War, the Bavarian court architect François de Cuvilliés drew up plans in 1762 for the complete defortification, which for financial reasons these plans could not be realized.

The beginning of the new century represented a radical change in the conception of values and general purposes that the city aimed to reach, with particular reference to new opportunities that the geographical location of the city offers in terms of management of new maritime routes and commercial interests.

In 1809, in fact, "probably at the instigation of Napoleon I", the removal of the fortifications began. About 1000 workers broke down the fortifications on 20 November. Work quickly began in the new town, as the ramparts belonged to the town. In the old town, ramparts were partly privately owned, and gardens were laid out on them. In April 1812 works were stopped and in 1813 even a new complex was built. By order of the Russian governor Nikolai Grigorjewitsch Repnin-Wolkonski in 1814 an open staircase was laid by Gottlob Friedrich Thormeyer from the palace square to the Brühlsche Terrasse, which thus became accessible to the public. In April 1817 the dismantling work was continued under a "Demolition Commission", to which Thormeyer also belonged. Around 1829/1830 the demolition was completed (Lippert, 1926).

The first half of the XIX century marked a change into the perspective of development of the city, which see the transition from a city politically and military barricade toward a more open and modern city, on which depended the certainty of the industrial development into the river trading of all the Germany.

According to researchers, already in the XII century the city of Dresden was provided with construction of dyke system, despite the following centuries would suggest that the management of flood, in connection with the development of the urban fabrics along the Elbe valley, oriented safeguard interventions toward the modification of the Elbe river profile and the regimentation of several natural banks (IKSE, 2003).

During the XVI century, the length of the Elbe river was considerately reduced of 119 km⁷, with negative consequences such as an increase of the flow, shortening of the running time of river stream, a notable erosion of drainage soils and the destruction of important floodplains. Additionally, the realization of Dykes system along the Dresden Elbe valley and within areas flowed by the Elbe and its tributaries deprived the territory of several natural water basins (Umweltamt, 2010).

According to data, a total course approximately of 5 781 km, of which 89 km² in the Czech Republic and 127 km² in Saxony, on the expected 100-year flood flow rate was 2.3 billion m³.

The purpose, at that time, was to transform the Elbe into an efficient system of navigation and to enhance the functionality of it in a way to make it a transnational infrastructure able to manage the European trading and to adapt it to the acknowledged condition of water risk.

"While ship traffic on the Elbe below Magdeburg could already be proven in the year 805, such traffic is only known for the entire Elbe after the 13th century. However, it was not until the 18th century that the waterways played a major role" (Wasserstraßen und Schifffahrtsverwaltung Dresden).

However, it was only in the first half of XIX century that great results were achieved thanks to the solicitation of an agreement that would have guaranteed the use of the river as a mobility infrastructure. At the congress of Vienna in 1815, was signed by several members in Europe the first documentation that contained official guidelines for European shipping law, in which the Elbe river has been declared navigable⁸. Following other two steps, in the 7th August 1819 in occasion of the releasement of the "Elbestrombaumandat", a mandate containing the rules on the use of Elbe stream, banks and dykes, and the Elbe Navigation Act which was signed by all on 23th June 1821 inside Pillnitz Castle. This one was particularly relevant at enforcing the already scopes fixed in 1815 within the Congress.

⁷ The precise measure of Elbe river reduction, in terms of length, is a data that comes from the official report of the Ministry of the Environment of Saxony region. Cfr. Landeshauptstadt Dresden, (2010), Gewässersteckbrief Elbe Die Oberbürgermeisterin; Umweltamt (Hg).

⁸ Cfr. General Treaty in Congress at Vienna, June 9, 1815: Regulations for the free navigation of rivers, 8 February, in: https://opil.ouplaw.com/page/congress-vienna-1814-1815

3.3 Great phases of infrastructural interventions and intergovernmental agreement for the navigation of the Elbe river.

Concurrently, an international committee worked on the establishment of new international rules for the navigation and on the creation of policies of customs duties. In 1844 an additional act approved the previous one undersigned in Pillnitz in 1821, by representing the birth certificate of an international regulation for the Elbe navigation. The undersigning of regulations for the navigation along the river made necessary the realization of interventions aimed to facilitate trading routes. At the end of XIX century, several natural parts of the river plain were replaced by rocks and solid pavements, with the scope of guarantying secureness against freezing and floods. With the artificialization of the natural stream, were carried out operations of hydraulic engineering such as river containment weirs which would have ensured predefined distances among two river banks. Today, the width of the Elbe river measures in average 113 meters (Landeshauptstadt Dresden, Umwelt, 2010). However, the process of artificialization of the river did not provide only the modification of the river revetments, which would have created relevant problems in case of flooding, but also the elimination of the river islands that hired the water drainage and used to create an obstacle for the passage of the ships. Only in the area close to Pillnitz Castle the distance between banks allowed to preserve the "Elbinseln Pillnitz", which is characteristic for the presence of several green spaces and a riparian vegetation. Gradually, the Elbe river was being to become an important spatial component of the process of modernization that led the city toward the activation of international circuits of trading and industries. At this purpose, the research aims to shed light on significant spatial metamorphosis of the river ecosystem and to reconstruct through the analysis of differentiated historical profiles of the Elbe stream the substantial modification that have occurred over the time on the basis of perspective of uses of the hydraulic system.

As it has aforementioned, the beginning of XIX configured, on one side, the starting point of process of modification that would have in part blocked the natural process of metamorphoses of the river plain which is normally associated to several ecological7 environmental factors and, on the other side, the begin of a series of specific alteration of Elbe river profile in different transects (e.g. by eliminating the natural islands within the river stream) which corresponded to purposes of development of the entire city. This century, in fact, was a witness of spatial transformations and *dynamics of Landscape*⁹ that

led the Elbe toward a gradual process of spatial modification that contributed over the time to realize the transition from a natural *stream* toward an efficient *Network* for multipurpose scopes. The river did not configure anymore only a natural ecosystem dominated principally by environmental forces, but a hydraulic machine conditioned by human disturbance and capable of interfering with the urban metabolism (**Figure 10**).

Ecological corridors, matrixes and natural *patches* were replaced and converted into multifunctional infrastructures domesticated and at that point responsible for the acceleration of processes of degradation of impoverishment of natural ecosystem (Forman, Gordon, 1981). At a short time's distance, in occasion of the Versailles agreement¹⁰ of 1922, the Elbe river was declared as International Water road for the European traffic. "Czecho-Slovakia claims that a very substantial amount ought to be added to the basic traffic of 1913 because of the fact that in the future a large traffic will move by the Elbe to and from Czecho-Slovakia which prior to the war moved via Trieste and Fiume" (NATIONS UNIES - UNITED NATIONS, 2006).

The enactment of the Elbe River Tree Mandate in 1819 and the Elbe River Navigation Act in 1821 provided the legal and intergovernmental basis for the commencement of a planned work aimed to improve riverway conditions and to maintain safe banks of the Elbe. At these purposes, in the period 1904 /1911, a committee of experts belonged to Saxony worked to regulate and to solve the problem of the low *water stage*, by adopting the system of River ground sills. In addition, were carried out several processes of facilitation that led the regularization of trading and the relationship between cities. The aim of promoting inland navigation, which had already been pursued in the Vienna Peace Treaty of 1815, was achieved in 1870 with the abolition of the last Elbe tariffs.

Phases of major interventions:

- 30th May 1814. "Regulations for the free navigation of rivers". The Treaty laid down the principle of the freedom of navigation on the major international rivers of Europe.

- 7th August 1819, "Elbestrombaumandat", rules on the use of Elbe

1981). Oxford University Press on behalf of the American Institute of BiologicalSciences, pp. 733-740

10 Cfr. the Article331: "The following rivers are declared international: the Elbe (Labe)from its confluence with the Vltava (Moldau)and the Vltava (Moldau) from Prague". In: Elbe navigation Czechoslovakia, Germany, Reports of International Arbitrar Awards, 14 June 1921, VOLUME I. United Nations 2006, pp. 83-95

⁹ Cfr. Dynamics of Landscape In: Forman R.T. T., Godron M., (1981), Patches and Structural Components for a Landscape Ecology In: BioScience, Vol. 31, No. 10 (Nov.,

river (stream, banks, dykes)

- 23th June 1821, Elbe Navigation Act, which was signed by all on inside Pillnitz Castle.

- 1844, International regulation for the Elbe navigation, on the basis of the agreement of 1812 signed in Pillnitz Castle

- 1870, the abolition of the last Elbe tariffs for navigation

- end of XIX century, several natural parts of the *river plain* were replaced by rocks and solid pavements

- 1904/1911, the Saxony region worked at the regulation of water low stage in Elbe river, by adopting the system of River ground sills.

- 1922 Versailles agreement, the Elbe river was declared as International Water road for the European traffic.

- 1935 "Elbstrombauverwaltung", draft for the improvement of fairway conditions.

Parallel operations which had influences on the Elbe stream

- 1856, realization of the harbor of Pieschen

- 1867, the company had created the Loschwitz port

- between 1869 and 1874, Introduction of the transport chain system within the Elbe river

- between 1891 and 1895, the realization of the *Alberthafen* harbor within the Friedrichstadt district

- 1893/95,two iron lattice bridges 433 meters long were realized at the entry point of the Albert harbour

- 1898, the chains of individual routes were no longer renewed, and chain navigation was replaced by paddle steamers with economical triple-expansion engines increased

3.4 Maritime engineering as a catalysator of morphological metamorphosis into the Elbe river system.

In keeping with the constant increase in the number and value of vessels, safe winter ports had to be built in Dresden, Mühlberg, Torgau, Wittenberg and Aken. In order to secure and facilitate the shipping operations, own officers of the power engineering administration took over the bearing and the designation of the fairway. Furthermore, at the exhortation of the Reich Ministry of Transport, the "Elbstrombauverwaltung" presented a new draft for the improvement of fairway conditions in 1935. In order to increase the fairway depths of the river at very low water levels, it was planned to supply additional water from reservoirs. From that time, the Hydraulic engineering focused on









Figure 10. Spatial and morphological metamorphosis of the Elbe river within the city of Dresden. (A) The image shows the morphological and spatial character of the Elbe river in Dresden in 1813, with the presence of the moat around the historic city (Altstadt), whose sole purpose was to defend the city by enemies attaches. The image aims to shed light on the Ostragehege area, in Friedrichstadt district, an area considerably vulnerable and under the threat of inundation. Within the district were still natural flood channels before the realization of the Alberthafen. (B) The image highlights a sensible change in the profile of the river in 1881, due to the elimination of the moat around the city and the realization of the Pieschen harbour on the opposite side of Friedrichstadt. (C) The image shows the intervention of the Alberthafen, by highlighting how the dimension of the latest one was highly superior compared to Pieschen harbour (1856) and Loschwitz port (1867). (D) The image shows the great evolution occurred in the city in less than 50 years, by connecting the new Alberthafen with the railway system and for the commercial and industrial development. The representation is overlapped on the historical map of Dresden in 1904, with the purpose of showing also the urbanization level at the beginning of the XX century. All the representations are realized by the author. Source for the historical maps: SLUB / Deutsche Fotothek, Plan von Dresden 1813 "Dresden und seine Umgebungen: Gedächtnis-Tafel für das Jahr 1813 = Dresde et ses Environs / nach der Aufnahme und Originalzeichnung von Johann George Lehmann. Gest. v. C. Keyl. (ca. 1:10 800)"; Plan von Dresden 1881 "Topographische Karte (Äquidistantenkarte) Sachsen1881, 1-25000"; Stadtplanen von Dresden 1904 "Stadtplan von Dresden, 1:15 000, Lithographie, ca. 1904".

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the issue of the navigation of the Elbe River, by dedicating projects to the fine tunneling (low water regulation), and by installing head-thresholds in front of the groynes and ground sills in the over-deeps scour. The aim was to reduce the size of the sandbanks obstructing navigation and to stabilize the fairway (Waterways and Shipharts Administration of the Federal Republic of Dresden).

Between the second half and the end of the XIX century, the maritime transport of the Elbe river aimed to keep up with the rail transport, which emerged in around 1860, by utilizing a new system to tow materials along the water road. In particular, starting from the 1874 was installed the system of transport chain along the riverplain, which expected the realization of a road segment that connected faster origins and destinations. This propulsion system had the purpose of towing also toward complex destinations and to connect the river shipping with several hubs, by guarantying the creation of new commercial routes and new commercial agreements.

The transport chain system caught on between 1869 and 1874 within the transect that goes from Magdeburg to Hamburg and in 1869 also in Saxony region, by permitting the establishment of the new company *"Kettenschleppschifffahrt der Oberelbe zu Dresden"*. In 1883 there were about 625 km of chain within the Elbe and 27 tugboats that used to navigate from Schmilka to Hamburg. It also owned 110 barges, twelve paddle steamers, eight express cargo steamers and two passenger steamers. This was the spearhead of this technology on the Elbe.

Nevertheless, a major regulation of the Elbe river flow suggested at the end of the century the replacement of the *transport chain* ¹¹, and from 1898 onwards, the chains of individual routes were no longer renewed and chain navigation was discontinued, where competition from paddle steamers with economical triple-expansion engines increased (Zesewitz, 2017). Since the 1867, new boats were introduced into the Elbe routes and the technology of maritime engineering represented in this sense a catalysator for the acceleration of morphological metamorphosis that would have transformed significantly the ecological ecosystem of the Elbe river (**Figure11**).



Figure 11. The chain transport along the Elbe river as technological transport system. The scheme of representation of tugboats between 1869 and 1874 and the design of routes that boats used to at that time. Source: Die Kettenschifffahrt auf Elbe und Saale.

¹¹ Information about the use of the transport chain in the Elbe river are reported by the Waterways and Shipharts Administration of the Federal Republic of Dresden. Cfr. The historic source in: http://www.wsa-dresden.wsv.de

3.5 The use of the river banks as a commercial harbor; riverplain dynamics and alteration of natural ecological ecosystems within river breathing spaces.

Within the sequence of transformations along the *Dresden Elbe valley* there were interventions that involved the Elbe riverplain profile as much as modifications of banks. In this context, the set of operations contemplated the necessity to ensure easier condition of trading routes along the Elbe but also to attribute to Dresden a crucial role in logistic hub within the Saxony region. Particularly, innovation within the Engineering field allowed in a really short frame time the realization of three great hubs, which would have reinforced the *network of existing of infrastructures*¹², by connecting the existing road and rail infrastructure to the water system. The research aims to deepen *structuring processes* which have radically modified the spatial structure of the city, by having effects on ecological relationships within the city of Dresden and the river itself.

These projects, in fact, have visibly contributed to build over the time a consolidated image of a hydraulic structure artefact, which were seemingly able to conserve the environmental and spatial structure, but that have relevant effects on the alteration of natural and ecological ecosystem. The general process of construction/ reconstruction of the city (with those were necessary at the reconstruction of the Baroque city after the destruction of much of city urban fabrics during the Second Word War), contribute today at to consider the entire urban ecosystem as a *Built Landscape*¹³ in which the river represents the major spine (Viader, 2019).

Residual spaces and *suspended spaces* belonged to what Clement would call the *"Third landscape"*, areas principally reserved for used in the past as drainage system and as pastures, spaces for agriculture, all together participated at the process of transformation that suggested for them *"new life cycles of*

landscape infrastructures^{"14}and new forms of urban metabolism. Particularly, spatial metamorphosis that they produced have attribute new functions to those were rural and spaces for agriculture, by modifying uses and by making them more complex in terms of social, spatial and economic relationships between river banks and urban fabrics (**Figure 12**).

More than one area was interested by the realization of new harbors that worked both as interchange nodes and waterway stations. Initially, in 1856 was constructed the harbor of Pieschen, with a port basin long 500 meters and large 30 meters, which worked exclusively as commercial hub, until the maritime transport started to grow and required the realization of the *Alberthafen*, in Ostragehege area (**Figure 13**).

In occasion of the process of regulation of Elbe river carried on by the State, a private company in 1863, decided to build a winter port near *Loschwitz*, the construction of which began in September 1864 (Sächsischer Ingenieur und Architekten-Verein, Dresdener Architekten-Verein, 1878). By 1867, the company had created the *Loschwitz* port upstream of Dresden's former city limits and at its own expense in the course of this regulation of the Elbe, by extending and dredging a section of the river that had been won. The fact that in the 19th century a port on the Upper Elbe was financed privately rather than by the state was the rule rather than the exception (Fischer, 1907).

In that occasion, in fact, only the company used this port, protecting itself from the appearance of competitors even without a monopoly that would have demonstrated to be an obstacle within the own process of economic growth (Kaiserliches Statistisches Amt, 1908).

in the first half- century a crucial, the guarantee for companies and private entrepreneurs to use a transects of the Elbe river as private space for commercial purposes represented already a strong signal of pressure on public spaces and of dynamics of appropriation of spaces destined before to the *river breathing*¹⁵ of the river.

14 Cfr. the Italian research "re-cycle Italy" for the re-cycle of landscape infrastructure within the contemporary city. "L'ipotesi di conservare la "risorsa urbana", così come si conservano le foreste e i fiumi, naturalizza il fenomeno, ma rappresenta un passaggio fondamentale nelle politiche e nei progetti per la città. Riconosce l'esistenza di una progressione, dalla nascita all'invecchiamento, ma allo stesso tempo reagisce al declino sostenendo la possibilità e l'utilità di progetti, politiche e pratiche capaci di attivare nuovi cicli di vita", in: <u>https://recycleitaly.net/publications</u>, in particular the 2nd publication, New life cycles for architecture and infrastructure of city and landscape. Aracne, Roma, 2013.

15 The term "River breathing spaces" is used by Carlo Gasparrini to describe areas

¹² The theme of Framework of network infrastructures represents a key of lecture that embed both the theme of mobility and accessibility infrastructures and those of spaces connected to infrastructure. For a better comprehension Cfr. the Chapter "Infrastructure and mobility network" with schemes and representations of the author, in: Infrastructure and accessibility network, in: Gasparrini C., Terracciano A., (2017) Rome 2025, Resilient Osmotic Metabolic Ecological ListLab, Europa.

¹³ In occasion of the 2nd International conference of Landscape "Landscape at the centre, Reality and Interpretaion", Ana Viader Soler intervened with a concern about the city of Dresden and spoke in that occasion of it as "built Landscape", a phenomenon due to the several transformations of city and the river within the phase of reconstruction after the Second Word War.



Figure 12. Sequence of transformation due to the realization of the Alberthafen and the improvement of the Railway network. (A) Riverplain within the Friedrichstadt district in 1813, focus area: Ostragehege, Friedrichstadt district. Presence of flood channels within the area of intervention (Elbe river valley). (B) Riverplain within the Friedrichstadt district in 1845, focus area: Ostragehege, Friedrichstadt district. The water basin of the Elbe river valley was completely flooded during the extreme event of 31 March 1845. (C) Riverplain within the Friedrichstadt district in 1813, focus area: Ostragehege, Friedrichstadt district. The image shows the spatial condition in the same year in which the works for the realization of the Alberthafen (Commercial Harbour) began. All the representations c are realized by the author.





Figure 13. The Sequence of interventions within the Friedrichstadt district. (A) The image shows the spatial condi-

B tion 10 years after the realization of the Alberthafen (Commercial Harbour) in Friedrichstadt district. (B) The image shows the interconnection with the Hafenbahn. The Hafenbahn was realized in order to connect the new Elbe Harbour where a branch line was built from the marshalling yard of Friedrichstadt. The image is overlapped on the historical map "Plan von Dresden 1904". (C) The image shows the project of the Alberthafen, which was exclusively carried on by the General Directorate of the Saxon State Railways. The main task of the König Alberthafen was the handling of goods for the city of Dresden. All the images are realized by the author.

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A significant expansion of the port took place in 1877, although after a time frame of less than 100 years, the harbor would have lost its economic strength due to damaging effects of the air raids on Dresden (Dresdenstadtteile, 2018). Today, the harbor is used by two water sports clubs, which are the *Dresden-Loschwitz Water Sports Club* that built its own club there in 1978, and the *Elbe Dresden Motor Water Sports Club*.

Decisive for the abandonment of the port were also the Elbe flood in 2002 and the Elbe flood in 2013, which have severely damaged the surrounding areas of the Loschwitz harbor and the *"Körnerweg"* area.

Between 1891 and 1895, the realization of the Alberthafen harbor within the Friedrichstadt district occurred and supplanted the strategic role of the harbor situated within the Pieschen district, which started to lose in time its commercial function and to become increasingly a secondary port. The Alberthafen, in fact, is still considered the biggest port in Dresden, although in 1970 a great intervention occurred. At the time of its realization, it was characterized by a surface of 42 hectares¹⁶, articulated in a rectangular basin large 75 meters and two docks, the north dock which measured 730meters and the South dock 1000 meters. The port was constructed in a way that it could have been connected with the rail transport of that time, by ensuring the continuity and speediness of the economic circuits. Before the 1850, the Sachsen Engineer Friedrich Karl Preßler presented a plan for the city that expected a radical reorganization of transport infrastructures of the city, which included the construction of a Rail station (The current Dresden Banhof) and the realization of an important harbor which could furnish with transshipment mechanisms the rail system(Figure 14). At this scope, the entire project was exclusively carried on by the General Directorate of the Saxon State Railways under the Chief Finance Council Peters and on the basis of Friedrich Karl Preßler ideas, which helped to define a major interconnection and a more competitiveness of the Dresden hub with other cities. In realizing new quay walls were considered the water stage reached by the river during the flood of 31 March 1845, and was realized a flood channel that would have worked in case of a unexpected inundation (Dresdener Stadtteile, 2014).

Today, the river port is crossed by 2 suggestive bridges, one destined to the rail transport and one to vehicular, bikes and pedestrian traffics. In the phase of a



Figure 14. Dresden. Elbe with Kaditzer bridge (Flügelweg bridge) and Alberthafen towards Großes Ostragehege and Friedrichstadt, in 10.1930. Author: Hahn, Walter. Source: SLUB / Deutsche Fotothek.

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which are interested by the presence of a river and all the necessary spaces connected to it that are essential at flooding and water basin storage purposes. Cfr. Water confluence, river breathing spaces, large porosity areas and environmental enlargements, in: Gasparrini C., Terracciano A., (2017) Rome 2025, Resilient Osmotic Metabolic Ecological ListLab, Europa, pp 15-18

¹⁶ Cfr. data in: https://www.binnenhafen-sachsen.de

general reconstruction in 1997, docks length was reduced, and its width was approximately split in half. However, the main task of the *König-Albert-Hafen* was the handling of goods for the city of Dresden.

3.6 The creation of an interconnected harbour-railway system as structuring process of infrastructures modernization.

The *Hafenbahn* (harbor railway) was realized in order to connect the Albert harbor thanks to a branch line which was built in the marshalling yard in Friedrichstadt, by passing under Hamburger Straße toward the harbor area. According to designs by Bernhard Krüger, in 1893/95 two iron lattice bridges 433 meters long were realized at the entry point of the harbour in order to interconnect water traffic with the railway and road traffic.

From that point, the tracks continued along the north and south direction of quays and allowed easy loading from the ship onto the wagons and vice versa. As regard the production, grain and flour dominated, as well as ores, tobacco, wood and building materials, although the harbor basin was also used as a berth for ships in the winter months. In the early years, there were even public events here, such as the 24th Association Festival of the German Swimming Association in August 1910.

The strategical importance of this harbor was demonstrated in occasion of the air raids of 2nd World War when several parts of reservoirs, cranes and ships were destroyed by Allied for a purpose built. Furthermore, part of preserved facilities, including six modern cranes and tracks of the port railway were dismantled by Soviet Union in 1946. During the Second World War, the plant was only slightly damaged and was therefore able to resume production very soon. In 1958 the private owners of the *Hafenmühle*, a modern large mill of the Bienertschen Mühlenwerke built in 1912-14 on the southern edge of the harbour basin of the Alberthafen had to take up a state participation and in 1972 the *Bienertmühle*¹⁷ was completely nationalized. The technical equipment was reconstructed in 1984 while production continued. Since 1992 it belongs to the Dresdner Mühlen GmbH (today KG) and can process approx. 300 tons of wheat and 100 tons of rye per day. The building was reconstructed in 1996/97 in keeping with its listed appearance and technically brought up to date (**Figure 15**).



Figure 15. Dresden-Friedrichstadt. Alberthafen (1891/1895, reconstruction 1997). View over Matthäuskirche (1728/1730; M. D. Pöppelmann) and Hafenmühle (1912/1914; Lossow & Kühne). Aerial photograph - inclined towards northwest. Source: SLUB / Deutsche Fotothek.

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¹⁷ The name of the Mill derived from the Owners of the already existing plant in Plauen, Erwin and Theodor Bienert, who decided on a further location, which at the same time made it possible to unload the grain conveniently from the ship. As a connection to the *Bienertmühle* Plauen, an electric goods tram was also put into operation. Cfr. <u>http://www.dresdner-stadtteile.de/</u> Alberthafen

However, with the passing of time and the evolution of technology within the field of maritime engineering docks were physically mutated, by leading the harbor basin toward the realization of modern streets and lorry parks for enable easier interchanges. Today, the *Alberthafen* is considered not only a waterway station but a technological pole and an engineering advanced logistic hub that counts around 40 companies in the surrounding area and several employers (Sachsische Binnehäfen Oberlebe GmBH). Not far from here, the historic Elbe barge "*Waltraut*" from 1913, a loading crane (built in 1964) and several freight wagons from around 1910 commemorate the history of Dresden's Elbe harbor.

The following maps show the physical condition and the sequence of transformation occurred within the areas interested by the realization of the *Alberthafen,* by shedding light on both on the previous condition before the realization of the harbour and on the morphology of the spatial structure and modification of ecological systems after it.

3.7 Industrial grow and Phase of expansion of Dresden beyond old perimeters: Consequences of the urban grow in natural and high qualitative ecological environments

The great phase of grow of the city and the development of the railway and tramway system supported the expansion of urban fabrics beyond borders of the old city. In particular, the passage toward an industrial economy guaranteed a strong grow of the population, which started to occupy peripherical areas of Dresden.

The second half of the XIX century signed an historical step which revolutionized the spatial structure of the city and the morphology of places. Only in the time frame 1875-1895 the population of Dresden increased of 150.000 inhabitants, which settled mainly in the areas of proximity of industries (Helas, 1986).

Among several areas that were occupied, buildings localized outside the old perimeter settled within spaces coming up to the banks of the Weißeritz and defined the new layout of the expanded city. The pressure of new building s and the occupation of new areas conflicted with the presence of natural environments which were sacrificed in order to guarantee equilibrium within the city and a major use of free lands. As it has already mentioned the superimposition of flood plain with urban fabrics and the occupation of areas before the Weißeritz, demonstrated in 2002 that also a tributary of not relevant dimension, in determined occasions, can lead to severe damages for the entire



city. At this purpose the "Weißeritz-Regio" initiative was launched in 2004 at the suggestion of the Leibniz Institute for Ecological Research for monitoring and evaluating future risks. Triggers of the emergence were flooding events in August 2002, during which, like many other rivers, the Weißeritz caused considerable damages in the Weißeritzkreis and in the the state capital of Dresden (Ulrich, 2006).

In the first half of the century, the pressure on lands was not yet associable to risk conditions that have been

successively attributed at damaging and high vulnerability of flood plains like the Weißeritz (Figure 16)

Only by Shed light on the urban condition on the half of the XIX century and focusing one more time on the Lithography of Arnold (1852) is clear the representation of a Weißeritz tributary still in natural conditions and with a *flood plain* not yet invaded by buildings and roads.

Figure 16. Plan of Dresden, 1825. Stadtplan von Dresden, Kupferstich. Scale of the map:1 10.000, 1825. The historical map shows the area of the Altstadt and the Neustadt as principal inhabited areas of Dresden and provide an evidence of natural condition that surrounded the flood plain of the Weißeritz. Source: SLUB, Deutsch Fotothek

4. Characters of hybridity and flexibility in uses of the Elbe river as acquired capability over historic experiences.

Observing physical transformations that have regarded the river over the time and summarize them with the sequence of regulations that from the beginning of the XIX century until today have interested the river stream in its entirety, can be imagined as an assumption the fact the city together with the hydraulic system have incorporated a progressive attitude to the flexibility to multiple uses, which made the entire urban ecosystem an hybrid machine.

The deconstruction of the process of industrial development of Dresden in the XIX century, as well as the examination of the city's expansion around the river before, permits to track down traces and urban material, whose scope was temporary oriented toward the construction of a matrix of resistance at flooding events and at the same time to identify a necessary compromise of open spaces that would have been able of accepting the natural breathing of a river despite the phase of anthropic evolution.

Engineering interventions, as well as modification of river profile and its substrate, maintain seemingly those ecological characters that made this city one of a kind. The shape of the river, as well as the capacity of entertaining a relationship with spaces of proximity of ecological, functional, recreative value, give to the water apparat the meaning of multifunctional and multi scalar structure for the offer of public spaces and the management of Elbe river drainage system.

4.1 Physic resilience: spatial and morphological characters of flooding areas as constructor of multifunctional resilience.

Analyzing the history of temporal processes and the contribute that each of them has given in terms of modification of "territorial Landscape", can be assumed that these single actions have contributed in a manner more or less disputable or, sometimes controversial, to construct in a centuries-long time frame the physic resilience of the city at risk factors. In order to establish a basis for comparison that would not consider only factories and consequences within the city of Dresden, would be appropriate to put in relation Dresden with the list of European blue cities identified by EU, with the study of the European Environment Agency. This would help to not linger exclusively on the condition and on disastrous effects that the city experienced during the summer 2002, but to enlarge the sight toward a dynamic that is not distant

by other cities situated within the central Europe. Speaking of historical processes of adaptation to risk in the city of Dresden can be an hazard, although modifications of spatial entity as the regimentation of the river, the demolition of natural banks, interventions on the natural substrate of the river profile and the impoverishment of natural values, belong to a past made of efforts and attempts that have had to deal with others factors whose scope was to preserve the natural aspect of the river itself. Among them geographic and geomorphological factors as, as well as geological conditions of the territory, have contributed to limit phases of expansions in areas considered fragile (Figure 17). Furthermore, the determination of kingdoms to preserve areas within the Dresden Elbe valley represented in the XIX century (in part also before) a great effort through which not scarifying ecological, but also aesthetical and representativeness values (Figure 18 A and B).

The use of the spaces, in fact, has been conditioned over the time by geographies that have worked also as *limiting factors*¹ in the same manner as limiting factors of abiotic entity work in ecological systems.

However, by the consultation of historical maps, historical source of artistic entity, can be ascertained that the "riverscape" has since the origin entertained a constant relation with spaces of proximity, through a set of uses that have putted together the natural and the anthropic dimension. In the city of Dresden, spaces of contact with the river represented within the historical process of adaptation to water risks almost never a defined border in which administrative roles, technical standards decide who and when can utilize these spaces. On the contrary, city regulations and administrative acts have solicited over the time the community to use in a conscious way the floodplain of the Dresden Elbe valley as a multi-purpose space.

The concept of margin as "linear element not considered path" (Lynch K., 1969) that furnish the border between two different areas, comes to be turned upside down in the beginning of the XIX century by new regulations and theories of industrial development for the city of Dresden. Urban developments should be settled outside the perimeter of the historical city and all interventions within it had to be considered as accessories parts of a unique urban organism aesthetically and environmentally coherent (Helas, 1986). Furthermore, climate conditions and seasonal variations, suggested from time to time, ideal conditions for the habitability of these places as well as a pedagogic path toward a socio ecological education.

¹ The concept aims to explain that geographical conditions or also climates worked as limiting factors in the development of invasive and incoherent uses of spaces belonged to riverscape



Figure 17. Geological Map realized in 1846 on behalf of the Sachsen Region. Sections of map help to understand the typology of sedimentary rocks constituted areas of proximity with the river, but also to comprehend the altimetry of the territory. Source: map realized by the author with the "Geologische Karte von Sachsen (Königreich), 1:120 000, Lithographie, 1846", SLUB Deutsch Fotothek.

Figure 18. (A) Extraction of the floodplain of Dresden Elbe valley. The floodplain regards the area included into an elevation of <99-180m> (B) Geological map of Dresden, with the identification of the flood plain. "Ecologische Specialkarte des Königreichs Sachsen / hrsg. vom Königlichen Finanz Ministerium. Bearb. unter der Leitung von Hermann.





4.2 The narration of uses of spatial structure of the Dresden Elbe valley in two different matrices of time: temporary and ecologically oriented uses and constellation of representative and aesthetical sceneries of Landscape.

The physic resilience of areas included within hydrographical basin of Dresden has fostered the development of others forms of adaptation to critical conditions, which have allowed to consolidate a spread culture prompt to face and to adapt at severe phenomena. Nevertheless, the construction over the time of a "culture ecologically oriented", constituted by an ecologically wise and aware socio practical uses of these areas has had to accept the general condition of industrial development to which Dresden took part. The sequence of interventions for the modernization of river transport system, as well as the social production of wealth, corresponds always to a specific social configuration and to the social production of risks (Beck, ed. 2013).

The concept of habitability of the public space within the spatial structure represented by the Elbe river in Dresden certainly is structured into two matrices of time differentiated, which helped to identify within it majors or minor degrees of flexibility and mixes of uses. In order to simplify this concept, temporary and ecologically oriented uses of the banks and drainage basins (normally necessary for the hydrological safety of the water and for protecting the city by the flooding) constitute a category. As demonstrated by innumerable depositions furnished by historical depicts and lithography of places, opportunities of use of these areas were usually suggested not only by climate condition but rather by a cultural root deeply consolidated. Among the scenes, those more often represented are those of activities related to fishing, pastures, leisure, each of them in coexistence with activities more or less logistic.

These natural areas have doubtless influenced the process of construction of a resilient structure in which characters of indeterminateness turn out to be essential for the preservation of high qualitative aspects.

Belong to the 2nd category those places traditionally recognized by the community and by the kingdom as representative spaces or landscaping sceneries. Some of the most beauty castles and Palaces in Dresden rise on the riverside of the Elbe river, and this choose was principally guided by the capacity of imagining the spatial structure of the Elbe as narration of places which contributed together to the beauty of the surrounding landscapes. However, these Palaces were usually utilized only partially as summer residence of many electors and kings of Saxony, during a period in which the Dresden Elbe Valley.

All the areas that surrounding the river have worked over the time both as ecologically and as spatially unique system, by reducing conflicts and superimpositions.

On one side, the process of spontaneous acquisition of unusual spaces, or minimally used, has become gradually part of the general acquisition of the public spaces used by the community within the city. In processes of acquisition of spaces of Dresden can be recognized a more inside sub-process of construction of local identity that aimed to transform a fragile ecosystem into an area of priority for the consolidation of an "active citizenship"² (Bonomi A., Della Puppa F., Masiero R., 2016).

Elements of resistance to water damages as embankments and rock walls have had covered more the one function.

In Dresden, the fortification system has absorbed over the centuries a strategical role in the defense of the city against enemies, as well as an element of temporary protection in occasion of extreme events. However, still today the wall is considered a fragment of the urban palimpsest³ which is able of keeping together testimony of traces material and immaterial of the past of Dresden.

Nicknamed the "Balcony of Europe" this ensemble was demolished in the beginning of the XX century, in the course of the building of the Saxony "Ständehaus"⁴. Reconstructed and later completely destroyed in February 1945, during the bombing attack at the end of the second world war. Today this Terrace represents a strong element of cultural resistance, as well as a temporary flood barrier, but first and foremost, an urban material that the city considered now historicized (Gasparrini, 2015).

4.3 Water related Risks as urban factor capable of modifying the cultural sensibility of the community: "perceive and to build the landscape by combining ecological awareness with the propensity to defend the identities and memory".

The consecutive sequence of practices centuries-long represents a consistent part of those gradual processes of acquisition of technical skills and commons

4 The Ständehaus was built between the 1901 and 1907, and it is the House of the Free state of the Saxony.

² Cfr. the process of realization of an active citizenship, in: Bonomi A., et al. (2016)," La società circolare, Fordismo, capitalismo molecolare, sharing economy". 3 Cfr. "The land as a palimpsest" (Corboz, 1983)or even of metropolitan areas. Its very representation, until very recent ages held to be terribly abstract and reserved to technicians, today belongs to the public domain. Exhibitions bearing titles such as Maps and Illustrations of the Earth (Paris, 1980

awareness for the mitigation of risks.

In XIX century, the pre-existence of conditions related to water risk affected the process of urbanization in Dresden, by demonstrating of being a decisive factor for the metamorphosis of spatial condition and for the social and cultural configuration.

The theme of the risks has, in fact, on one side pushed the urban cultures to calibrate the instruments compared to geographic characteristics of this territory and, on the other side, has oriented the community to adapt at the fragility of this urban ecosystem, providing them the basis for the construction of a more responsible vision for the future.

Spatial metamorphosis related both to resilient strategies and spontaneous processes have had important repercussion, among which the conservation of ecological structures, which are today better integrated with urban settlements, but also the consolidation environmental relationship between the waterscape and the city that can be assumed as paradigmatic. With a double-thread process, the theme of the risk has guided the city toward a socio-cultural metamorphosis that has on one side oriented the community toward the comprehension of characters of fragility of this urban ecosystem and, on the other side has encourage them toward coherent uses of these fragile areas.

According to the author Eugenio Turri, the concept itself of Landscape assume a significant value that goes beyond the traditional definition, by approaching toward other dimensions that involve the human thought. It can be better described as *"The ability to perceive and to build the landscape by combining ecological awareness with the propensity to defend the identities and memory that are reflected in it"* (Turri, 1998). The author Turri suggests a key of lecture that identify in the human capacity the ability to construct a specific landscape in which themes of ecology and natural entities are strongly connected with a strong consolidated culture, by enabling the construction of individual scenarios.

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Abstract

In the light of a particularly complex emergent condition and of an imminence of a "new urban question" to which several risks are associated, this chapter refers to the last decades, aiming to figure out if climate change finds an already prepared city or a city that, despite the process of adaptation to these risks, still suffers from a preparedness of not being able to face these extreme conditions. The multifunctional and multi-scalar role of Green and Blue infrastructures, together with the exacerbation of risks, represents the opportunity to suggest positive outcomes in response to not only the coexistence of functions within areas that retain fragile, but issues related to the production of public space, which include oriented management of natural resources and the activation of processes of social inclusivity.

1. Opened Urban questions and extreme emergencies: a paradigm shift is occurring in the contemporary Dresden.

1.1 A summary report for the identification of urban questions within the city of Dresden.

There are several arguments of discussion that articulate today the "new urban question" and that make it a great issue in which converge multiple themes on which different expertise are increasingly working. The Urban questions that pertain to large and middle cities in all over the world and that can, therefore, be associated with dynamics that are affecting urban ecosystem at a global level.

However, each city is associated with a singular history and a series of historical processes that have contributed together to define a precise spatial structure and peculiar relations between different geographies over the time. In this respect, the case study of Dresden it is not an exception and its complex relationship between city and water resource cannot be subtracted from common observations already experienced in other cities.

As already discussed in the previous two chapters, Dresden presents a singular experience of historical coexistence with the water network and a particular approach at extreme events. The question of the water risks was consolidated over the time by facing continuously the theme of the water management of the city and the need for urban development. In particular, the city has experienced various extreme events which have helped to consolidate an approach capable of controlling natural processes and at the same time ensuring the use of the water network for different purposes. The capacity of managing during the history the specific relationship between the water network and the spatial or geographical structure has led the city to acquire an ambitious "hydraulic culture" (Viganò, 2012).

Nevertheless, the theme of the water management in Dresden conflicted in the XIX century with the great phase of modernization and with pressure of the use of hydraulic structures, especially of the Elbe river and its embankments that transformed radically the geometry of some transects and the geological structure of the river stream (Figure 1).

In relation to the conservation of a coherent relationship between urban progress and natural ecological values, the city of Dresden represents a paradigmatic case of a paradox city. On one side, physical intervention within the section of the riverside and in surrounding areas have caused the impoverishment of ecological systems and the loss of natural characters within contexts of particular vulnerability¹. On the other side, the sequence of these operation of urban metamorphosis has engaged with the capacity of administrators and kingdoms of that time that conserved a relationship of ecological and aesthetical value over time between the modern city and the Landscape of the Elbe river (Helas, 1986). Thanks to this ostensible relation of contrast between progress of the city and conservation of an urban Landscape, the riverscape is today unique in its kind. The city has developed over the centuries a complex spatial structure which offers at the same unprecedent opportunities of resilient development and occasion of reflection for the management of the increasingly risk condition related to the water network.

On one side, in fact, historical attempts of maintaining over the centuries a balance between grow of the city and protection of vulnerable areas have conducted toward the improvement of the resiliency of the territory. On the other side, however, dynamics of expansion and occupy of free Lands in the countryside occurred in the XIX century during the phase of economic and industrial grow caused the determination of several source of risk conditions that would compromised in the future the livability of these places (Figure 2). The phase of modernization signed the abandonment of a culture immediately aware to adapt to physical conditions determined by geographical and spatial characteristics, as well controlling natural processes generated by natural hazards.

1.2 Urban Crises and their cultural roots: Environmental emergencies, geographical and "spatial injustice" and counterweight of the Elbe river. However, the emergent condition of the city of Dresden is influenced by crises of different kinds, each of them has a temporal origin differentiated. The main purpose of this chapter is to shed light on different families of risk conditions which characterize today the "urban crises", by analyzing in depth cultural roots that generated them and emergent issues that they solicit. The question the research aims to answer is to describe factors that catalyze the urban crises in the current dimension of Dresden. A first crisis took place silently in Dresden already in the phase of maximum expansion of the industries and economic activities in territorial landscape situated in the countryside.

As Henri Lefebvre described in his book "the right to the city" in 1968, the crises of the city is a crises that refers to relationships between models of urban development and changes that these models implicated in spatial structures. Its crisis regards its society in its spatial declination and is a crisis closely linked

1 A particular reference can be the series of physical transformations occurred in the last decades of the XIX century in the area of interest in which the Weißeritz flows.



New water network for a new urban metabolism

- Hochwassermarken •
- dyke systems
- hydrographical basins >500 km2
- hydrographical basins >50 km2
- contours 25 m
 - contours 50 m

- above ground channels, but covered (e.g. by bridges)
- entrances covered or underground
- underground and intubated sections
- water network 2nd order
- water network 1 order

urban fabrics

- high dense populated areas_Regional ordinance after Flood 2002
- flooding areas idntified by Saxon State Office for the Environment, Agriculture and Geology (LfULG)
- Drsden_comune_WGS



to the development and expansion of the industrial capitalism system" (Lefebvre, 1968).

The crisis which the city of Dresden went through is similar to that one described by the author in the way in which the modification of the physical space induced also the modification of the concept of living these spaces, which aimed to exalt the exchange values rather than values of use of places over time. The city of Dresden experienced in specific historical steps the transition from the city as "place of participation" and of interaction within the community toward the city of efficient production. Furthermore, the physical transformation of areas historically declared of great values for the natural and ecological properties led the city toward the accentuation of associated phenomena of risk. Particularly in less than 150 years, it is exactly the process of domestication of water in urban settlements that produced the most disastrous consequences.

What happened within the Friedrichstadt and the Altstadt in occasion of the extreme event of August 2002 demonstrates how even a centuries long process of adaptation to risks and water management on a territorial scale has been disrupted in any event by a loss of consciousness about environmental issues that characterized the phase of modernization and a "lack of flooding experience" of the community on the consequences and damages of risks related to water (Kienzler et al., 2015). The increase of the economic prosperity and the "social production of wealth"² has, to a certain extend, conditioned "spatial organization"³ within territories in ecologically interesting areas, leading toward the creation of an "industrial society of risk" (Beck, 1986). The advancement of evolutive phases of urban development represented in these areas "dissipative processes"⁴ caused by productive, commercial, managing, logistic and housing cycles that produced the exhaustion of lifecycle and the consume of natural resources, as well as the exosystemic impoverishment associated to it (Gasparrini, Terracciano, 2016).

The second crisis which brings together cities from all over the world, each 2 Cfr. Viganò (2012) "Extreme City and Disaster Risk Reduction" in: Extreme Cities and Bad Places.

3 Cfr. Lefebvre, (1968), "The right to the city".

4 The theme of "dissipative lifecycles" has been discussed in order to describe the new categories of dross-mapping of the contemporary city. Cfr. Gasparrini C. (2016) "Drosscity. Raccontare la città degli scarti" in: Gasparrini, C. Terracciano, A. (2016) Dross City : metabolismo urbano, resilienza e progetto di riciclo dei drosscape. LISt-Lab, Trento.

with specific categories of risks,

regards the theme of climatic and environmental emergencies. On the background of an ascertained condition of risk related to water networks in the cities, it is essential to shed light on recent episodes associated with natural hazards in Central Europe and the acceleration of these events due to effects of climate change. This is a crisis that, compared to the first one, has a more recent roots and can be therefore considered as one of the factors which has taken roots exactly by those dissipative processes of various nature as aforementioned. Along with social emergencies, the crisis of the XXI century must be taken into account and, first and foremost, one of the three main issues which characterize the "new urban questions" described by Bernardo Secchi (Secchi, 2010). According to this definition, processes of transformation of spatial and social organization in the last years of the XX century together with the economic growth within the "30 glorious years" after the 2nd World War implies in the contemporary city the presence of three main thematic areas. Among them, the increase of social wealth problems and environmental losses, has lead the research toward the definition of a "new urban question" which requires a great effort in experimentation not only in the field of urbanism. The environmental crisis arose independently and occupies a specific position compared to the accretion of spatial injustices and the increase of social inequalities, although they are becoming increasingly thematic areas that turn out to be interdependent (Secchi, 2013b). These three thematic areas constitute the basis for the generation of a crisis which has different roots and have affected communities within cities differently, especially their welfare systems, but also led toward the formation of new spatial organizations, social relationships and assets (Secchi, 2011).

The environmental emergency is one of the issues that is compromising the livability within cities on a planetary scale, which are always the theatre in which these effects rage with all their strengths. The indiscriminate use of energy and natural resources in Dresden, starting from the end of XVIII century, touched on one had the ability of these resources to control natural processes that have not always been a circumstance but a persistent condition to which the community has become accustomed to. In particular, the reduction of those flood and drainage basins that are necessary for a not oppressed "river's breath", the lack of maintenance of dykes and ditches system and the regimentation of the river stream within the Elbe river in favor of a growing industrial or commercial economy. These mistakes are at first glance secondaries compared to the ability of preserving a natural image of the river within the larger anthropic context. Are those errors that have led the city to being



Urban fabrics situated within a buffer of vulnerability of 2nd order tributaries

- Hochwassermarken •
- dyke systems

---- contours 25 m ----- contours 50 m

- hydrographical basins >500 km2
- underground and intubated sections
- above ground channels, but covered (e.g. by bridges)

buildings situated within a distance of 100 meters from underground channels and water networks of 2nd order flooding areas idntified by Saxon State Office for the Environment, Agriculture and Geology (LfULG)

water network 2nd order

Figure 2. Conflictual relationships between water and urban fabrics. The map shows the conflictual relationships between water networks of 2nd order (tributaries of Elbe river) and urban fabrics settled in proximity of them. The distance considered for the realization of a buffer take into account extremely dangerous and vulnerable areas. All of them coincided with areas that were hit by extreme event of 2002. Source: Interpretative map realized by the author with official data from the Saxon State Office for the Environment, Agriculture and Geology (LfULG).

caught in the floods related to the acceleration of phenomena directly connected to the climate change.

The third crisis appears to be a thematic area distant from water management issues that have affected the city in last years and can therefore be faced autonomously. However, the German country and in particular the city of Dresden represents the image of a Europe opened to welcome mass of immigrants that escapes from poor condition and civil wars by arriving in a place that provides better living condition and more prosperous future.

1.3 Paradoxes operations of social integration and gated communities within the great area of Dresden

However, on the contrary, these cities are experiencing an historical negationism that offers always less opportunities of integration and reduced possibilities of accessibility to the fruition of spaces to particular social groups. Social tension and atrocious social climates in which we are living over the last decade due to occidental and oriental integration suggest of reflecting in depth on issues that belong to the excessive subdivision and negation of spaces for social participation in these communities. From this point of view the river represents a catalysator that can be able to construct new opportunities of social integration and a spatial system which is able of intercepting different communities, by slacking the tense atmosphere we are getting used to live.

Often, behind the histories of integration of minorities within a community, an equally large number of histories of social segregation are hidden in places where the opportunities of interpersonal exchange of ethnic groups and the use of recreative spaces are extremely reduced. By showing hospitality to new communities the city often, as in other context, responds adequately to the laws of the housing markets and by enduring at any chance of social integration. The paradoxes of these operations is that in the same time in which a city is dealing with efforts of integration and mixing ethnizes, the city itself is moving forward at practices of exclusion of these groups from the general community and what should be a temporary housing condition turn out to be a permanent creation of gated communities and, therefore, the aggravation of an already problematic subdivision between "the city of riches and the city of poor" (Secchi, 2013a)

The negation of the general accessibility for the use of public space for a specific ethnic group represent without doubts a contemporaneity a form of "spatial injustice" (Soja, 2010). The Elbe river as spatial structure furnished by high ecological and natural qualities represents the spatial container able of counterweighting the geography of injustice and the iniquitous distribution of resources, services and access, which together represent a fundamental human right. As suggested by the author Soja, the discourse on space in the last century has been conventionally dominated by physical and philosophical features and has been absolute, relative and relational dimensions especially among geographers. In the contemporary cities, the spatiality of human life is seen more as a "complex social construct" in which human and humanized geography define our contextual habit⁵. The presence of a limited amount of spatial resources and "places of participation" (Casaglia, 2014) in the peripherical areas of Dresden invites a reflection in which the river poses itself as a paradigm shift in the way of approaching to it and as a struggle which through its different imagination can be carried on for a more equitable distribution of opportunities in the future.

A considerable part of the urban crisis is now linked to another crisis that is expressed in the way in which development and the production of urban space defines relationships with citizens. We are witnessing more and more processes of regeneration that focus on the image and little on the importance of relations between "users" and urban spaces. This is what happened in the last twenty years of the twentieth century, and some European realities still show the signs of these urban transformations that have used the relationship between cities and resources almost exclusively for a greater ability to attract tourists and investment in real estate. The avant-gardist text of Lefebyre confirmed that the "essence of the city" is defined by the daily processes of interaction rather than by the form, which is difficult to define, and that the processes of segregation determined by the fragmentation of activities end up causing a profound crisis in relations and a difficult management of urban space by citizens. The theme of segregation and fragmentation once again represents a focal point in today's discussion and a general debate, which allow to highlight new issues concerning the social crisis, determined by new ways of social exclusion and new ways of segregation of activities.

⁵ In particular way the sense of space as complex social construct leads the argue toward a more profound reflection about the necessity of planners together with other disciplines to conceive the space as a social configuration and not only as product of physical quality. Cfr the paragraph: Toward a new spatial consciousness, in: Soja, (2010), Seeking Spatial Justice.

2. Return to the Landscape: Relationships Between New Communities and Urban Spaces, Increasingly Fragile and Strictly Dependent from the Value of Natural Resources

Starting from last decades of the XX century, together with the end of "Fordism", we contributed to the apparition of the "ecological crisis"¹ and thus to the subsequent accretion of fragilities of territories and the communities that live in them. Nevertheless, the crisis we are still living seemingly appeared not so damaging to raise general community awareness compared to the consequences that some orientations of urban processes and production of new urban spaces were having on the general balance of urban systems.

The crisis that we are leaving is fueled by different factors that are difficult to control on a urban scale. If it is true that the effects of the climate change represent a notable push in processes of degradation of ecological systems and impoverishment of large natural reservoirs, not less damaging are increasing factors of speed depletion of life cycles generated by grievous mechanisms for using natural resources for fostering processes of economic and industrial growth (Gasparrini, C., Terracciano, A., 2016)

In this sense, the city of Dresden has experienced a series of complex dynamics that had to be confronted with the theme of the "production of urban space"² and the reconstruction of symbolic architectures after disastrous events related to Allied attack during the 2nd World War and phenomena of reconstruction after historical Natural Hazards, as the one of the 31 March 1845. The theme of the reconstruction of public spaces and of a spatial structure coherent with efforts realized in the past focused on the great importance of ecological and Landscaping values expressed by the River.

In the contemporary city of Dresden, the "Landscape dimension ecologically oriented" of the project is associated to a different grammatic composed by new syntax and systemic relationships constituted by water, soil, "dross-

1 The ecological crisis represents by the author the beginning of a new form of crisis that would have revolutionized the entire spatial organization within cities and their social relationships. Before of that the entire globe was clamping down on the economy of the Fordism and the mechanization of the world economy. Cfr. Secchi, B. (2011), "La Nuova Questione Urbana".

2 Cfr the issue of the "production of urban space" in: Soja, E. W. (2010) *Seeking Spatial Justice*. Edited by S. Clarke and G. Gaile. Minneapolis, U.S.A. University of Minnesota Press.

capes" (Berger, 2007), recycle of resources and slow mobility, by catching a glimpse of the opportunities for recycling these landscaping and urban patterns and regenerating of structural resources represented by green and blue networks within a more complex metabolism of the city (Gasparrini, 2016).

2.1 Dresden Paradox city: conquered of an urban palimpsest more conceptual than physic.

The reconstruction of a spatial structure as close as the previous version of Baroque architectures and urban spaces that collide well-defined urban fabrics and the image of the historic city (with gradual but consolidated experiences of social conquest of urban space within the configuration of the spatial structure of the Elbe river), remains still today the principal dimension in which the community recognizes itself.

The impression in Dresden is that attempts efforted by the community have had a key role in the recent history over last 50 years in orienting the gradual re-acquisition of physical and natural characters, according to a continuous and evolutionary process. This process led to a condition in which a strong integration with the ecological sustainability and urban image is able, still today, of reconstructing those synoptic and biomorphic relationships between the city and the riverscape that belonged at that "city as an organism" (Geddes, 1915) conceived in the XIX century.

Nevertheless, urban approach used by the community and the city in general suggests a process of reconstruction and of re-imagination of a "urban palimpsest" after the 2nd world war that is more cultural than strictly physic and, therefore, focuses on the reconfiguration of a Paradox city.

2.2 Democratic public space: The Elbe river as a system of relationships between public/private spaces

In this complex operation, the Elbe river describes an ecological and spatial substrate that is fundamental for dealing with emerging and widespread crises that are threating the livability within the city and inescapable allied in the in the realization of a long-term project of "coexistence and resilience" with water related risks.

The theme of "return to the Landscape" in Dresden identifies a process that has created the necessity for the urban structure to resist not only climate change, but also urban policies and practices that are sometimes in favor of a spatial and morphological modification which are characterized by controversial spatial declinations and contrary to an idea of a "democratic public space".

"Democratic public space involves complex relationships between ownership, agency, occupation, control, and freedom...Democracy provides citizens with "the right to the city," which includes the right to participation and appropriation in their shared urban environment. By citizens, we use Henri Lefebvre's term, which combines citizen (a citizen of the nation-state) and denizen (an inhabitant of the city, who is not necessarily a citizen of the nation-state)"³(Purcell, 2013).

According to the author, this concern leads toward a new identification of public space that abandons the idea that it would be recognizable on the basis of the ownership, but instead that a space belongs to that categories when respects few important characters of distinctions. Those are, in particular, aspects that recognize a democratic public space if that space is openly accessible, and/or uses common resources, and/or that has common effects, and finally is used for the performance of public roles (Parkinson, 2012).

This thematic area has occupied within the city of Dresden over time a relevant and strategically avant-gardist position in facing problems of a different kinds which range from the way community face impacts and effects of climate change to the way they can resolve conflicts of social natural and of integration within the urban space. Beyond the challenge imposed by the European community that solicit cities within the barycentric area of interest for extreme and flooding disasters in Central Europe to apply instantly measures and provision that can help these cities to reach a major status of preparedness in the future (Kienzler et al., 2015), a common vision takes shape. This latter recognizes in the spatial structure of the Elbe river a meaning of "openness of open spaces" (Lynch, 1972) that goes beyond the question of the accessibility, by taking this into account, and facing issues that reclaim a more complex vision for a long term resilience of the city.

2.3 The question of the "openness of open spaces" as a potential tool for the resolution of interdependent risks: a question of physical and cultural re-formulation of relationships within the hydrological system.

In particular, the issue of "openness of open spaces" is intended to address together problems that, as we have already anticipated, are apparently independent, but if they are observed with a careful eye of the multidisciplinary

approach, they are strictly reciprocal. First and foremost, the question of the effects and impacts of climate change, that imposes new researches and reflections in order to manage water resources, biodiversity and energy, and to construct "new alliances with nature scientists"⁴ for urban development that helps to avoid getting stuck in strategies for representatives and quantitative of space distribution.

In the case of Dresden, the openness of spaces within the hydraulic basin represents an operation that is already in act, first conceptually and then physically, which works in a symbiotic manner on two question that are closely linked to themselves. The first belong to the capacity of these spaces to be permanently open to climatological variants and therefore to their used strictly dependent on the periodical condition of accessibility to places for the community. This intrinsic temporality is today indissolubly tied to that "hydraulic culture" that has adapted itself over the centuries to natural hazards and consequently to those opportunities of use that atmospheric conditions offer during the year. From this point of view, this dynamic can be described as the enhancement of a resilient culture constructed on the basis of centuries long experiences.

The close-range fieldwork has allowed over time to imprint a frame of more or less 1 year social and common behaviors in using the spaces of pertinence of the Elbe river and to compare these behaviors with possibilities and different occasion in terms of temporary uses.

A second question is more related to the physical capacity of floods and drainage basins of interpreting themselves one time as collecting basins in case of catastrophes and another time as platforms for temporary experiences that never conflict with the natural breath of the river. "The return of Landscape" is well conceived into this dimension as the capacity of a transformation of areas reserved for private use before the extreme event of 2002 (e.g. private spaces, private enclosing within areas of risks, "Klein Garten" etc.) in favor of a spatial structure that more closed to the acquisition of larger open spaces in which uses are regulated by nature forces and not by private intentions. For this reason, within the new palimpsest of permanencies of "urban material historicized" (Gasparrini, 2015) of the riverscape they confront themselves with more recent traces which are related to experiences of contemporary urban resilience and compatible use of water basins.

In the city, the relationship between water and space is highly complex and in history has been characterized by efforts aimed to construct occasions for dialogue with the issue of risks, while at the same time ensuring important

4 Cfr. Secchi observation about the climate change, in: Secchi, B. (2011), "La nuova questione urbana", Crios.

^{3 &}quot;Democracy is a mode of living together in which people manage for themselves the conditions of their own existence through collective decision making", Cfr. the theme of research explored by CMG in: Kevin Conger, "Democratic Public space, in: www.cmgsite.com/democratic-public-space

relationships in term of use and coexistence with them. Nevertheless, recently this approach has to face and reflect the consequences of climate change that can schematically reduce possibilities of use in case of a raising water stage, an increase in periods of drought or, on the opposite side, an increase in the intensity of rainfall, but also specific right tools which can be able to propose approaches and solutions for designing of scenarios within the "extreme city" (Viganò P., Fabian L., 2010).

A second trajectory traced by the conception of an open space within the Elbe river valley intercept the theme of "spatial declination" as a potential tool capable of remedying the general flattening process and homogenization, guided more by the interests of politicians and property investors than by local administrators that have promoted the interest of the community.

Particularly, on an urban scale it has given the planners and architects air to contribute to the proliferation of spaces and architectures that have brought out the essence of the landscape in the city.

The Result of these processes of transformation of spaces within the city of Dresden has given rise to those spaces that Marc Augè has described as "nonlieux", namely, places that cannot be defined as identity, relational and historical, due to the fact that the role they cover is primarily the promotion of the transformation of landscape into places of consumption, according to the rule of globalization (Augè, 1992).

In this sense, the imagine of a riverscape as public space works as a counterbalance to the operation of economic investments that aim to transform the image of the city into a standardized, globally recognizable entity.

"The last XX century was dominated by the emerge of autonomy of individual with a consequent reject of the institution help and the appearance of perspective of day life by guiding individuality as dimension and horizon for individuals and social groups, and leading towards the increase of corporal dimension of practices of use of urban spaces" (Secchi, 2011).

The "solitude of the global citizen" (Bauman, 2014) triumphed in these places , increasing individual freedom and goes towards the detriment of collective dimension⁵, by contributing at fleeting and by assisting to "commodification of the landscape" (Casaglia, 2014). The "crisis of the city", related to neoliberalist 5 For a better comprehension respect to the theme of the detriment of the collective dimension in the society, cfr. The afterword of Alessandro del Lago, in: Bauman Z., (ed.2014) "La solitudine del cittadino globale". Giacomo Feltrinelli Editore, Milano, 2014.

politics, described by Lefebvre in the sixties of the twentieth century, bring to light different ways through which dynamics of development were taking out part of the community and how the conversion of places characterized by a value of use were going to be transformed into places in which the value of exchange was predominant. In this respect, common uses and promotion of social practices within the risk areas, especially when they are solicited by the city council and the administration, cover a special significance in terms of teaching to people how to live with "extreme territories" and for the capacity of enhancing the establishment of inclusive practices within the city.

3. Contemporary processes of transformation and commodification of the urban Landscape and production of new social morphologies within the city: the river spatial structure as a cultural and spatial counterbalance.

The city of Dresden has experienced a double process of modernization which is in part coherent with the wider phenomena that are responsible for the creation of the "global city", which involved several cities all over the world that , by producing similar results in terms of a production of flatting spaces and architectures but also a radical modification of economies, are always more sustained by mass of individuals that lives in precarious condition (Sassen, 2001). On the other side, the process of reconstruction of a modern city after the Allied bombing of 1946 guided by political and social inspirations belonging to the DDR (Deutsche Demokratische Republik), has conducted towards the creation of local autonomies and a hermetic process of social and cultural nature. Today, state of tensions still governs the sharing of spaces within the city and mass of people are still claiming for the autonomy of rights and a contrariety in sharing it with new masses of immigrants¹. In particular, the eastern part of Germany is still experiencing the presence of national movement (e.g. the Germany Pegida's movement) which are fighting for a return to old nationalism status.

It is clear that social battles and perverse mechanisms of this type cause crisis efforts of social integration that the nation is dealing with.

These social dynamics produced on a medium and long term a new social metamorphosis and a clear solicitation towards the consolidation of what are already mentioned as gated communities, which remains one of the serious problems that urbanism should take on in order to avoid the production of major fragmentation and "social segregation" in the production of new spaces. Furthermore, these processes are also responsible for the creation of new categories of individuals, whose seem to be more passive and subdued compared to the working class of the 1960^s described in the book "the right to the city" (Lefebvre, 1976) which used to come to the streets in order to fight for a common right. The labor market policies, the economic crisis caused by globalization, together result in an increase of uncertainty levels and the construction of a "risk society" (Beck, 2000).

The theme of increasing interest in constructing individualistic societies and strongly anchored to a "daily horizon" conflicts with the idea of a well-integrated community, even though it appears at a distance, constitutes a cultural bridge for dialogues focused on different "spatial declinations of green and blue infrastructures" (Gasparrini C., 2017) that can be achieved in the reorganization of spatial structures within the contemporary city. The increasing and visible "spatial injustice", the growth of environmental emergencies and ascertained impacts of climate change² represent at same time criticalities as well as opportunities for a radical modification in the way of looking at the urban project and on the systems of different ecologies like the "urban metabolism".

In the city of Dresden, part of this process is already ongoing and communities and administrations are working together on the basis of a consolidated experience with the water related risk. In fact, the theme of risks, has teach the community over time how to interpret different spaces that constituted the great spatial structure of the Elbe in different periods of the years and how to react in occasion of extreme vulnerability. This process of domestication of water resource has guaranteed a major awareness compared to the concept of "openness of open spaces", which in a certain sense intercept another great condition of these spaces better known as temporality.

Beyond dynamics of incessant attempts of privatization and transformation of "territories in crisis", not only from an economic and social point of view but especially from an environmental point of view, the space dedicated to water scapes turns out to discovering new significance. The riverscape overcome technical limits imposed by an extremely rational culture and explores scenarios in which the river itself becomes the ideal place for the consolidation of relationships between natural cultural values. Over time, the river has demonstrated a strong cultural reticence against those brutal forces that are economically oriented and the community has been able to identify and interpret, in a double key, the Landscape of the Elbe river as a metaphor of "Landscape as theatre" (Turri, 1998), in which each scenario can lead toward

¹ In order to comprehend the state of tension that characterizes the city in this phase of the history can be interesting to acquire major awareness about the Germany Pegida movement: https://www.bbc.com/news/world-europe-50266955?SThisFB&fbclid=IwAR2zOXyr0K7nwgkQpclEao6gg7OgUKUn-q_Llg83o6epNGKreQ_Wu-NvdUY, (BBC news- what is the Germany Pegida movement)

² The research refers these data to the report realized by the IPCC "The Intergovernmental Panel on Climate Change" regard effects and impact registered already since the anthropogenic era and on future scenarios. Cfr: https://www.ipcc.ch (report 2019)

the reconcilement of social values and identities that the globalizing world tries to remove.

The theme of "Landscape as theatre" by Eugenio Turri conflicts with the discourse of the patchwork that crosses different themes of the contemporary city, by counterbalancing the figure of the "patchwork metropolis"³, in which the figure of the fragment prevails as an element capable of explaining not only the territorial asset but also its social and economic structure fomented by the neo liberal forces.

Instead, the spatial structure of the Elbe river recomposes segments of themes that are apparently separated and attributes a structuring and multi-purpose role to the public space.

3.1 The river as Supporting structure of the city in the generation of Systemic relationships between open spaces and the community: a leading role for the "resistance/resilience" not only to the environmental emergencies and ecological crisis which follows, but rather to the risk phenomena of social exclusion.

The emergent condition suggests that the community's awareness of the inevitable necessity of establishing a coexistence between the amount of water-related risks and the use of urban material contributes to transforming ideologies of individuals, by accustoming them to perceive the riverscape as expression of their own culture (**Figure 3, A, B, C**).

The risk condition can be considered as a catalyst for triggering community reflections on environmental emergencies and a tool that educates to see the specificity of this Landscape as factors intrinsically related to this society, by acting on the way they interact with it⁴.

Since the origins of urbanization, water risk phenomena have conditioned the relationship between river banks and the spaces in close proximity, through centuries of consolidation not only categories of hybrid spaces for water breathing and production of public spaces, but also new categories of users. The methodology of research applied to the observation of historical sources of an artistic and figurative kind, puts in shied a set of different uses of the spaces and the presence of different individuals, which, however, seem to preserve the scene of the contemporary landscape.

The temporal limit and a specific economy guided by the development of industrial sectors, allows to show the presence of daily figures like naval merchants, boatman, hunters, dock workers that were usually addicted at the delivering of goods for the aristocracy in the XIX and XX centuries. However, do not miss habitual figures that were not strictly linked to a specific economic sector, but rather to the presence of spaces that were already able to construct systemic relationships in the old city⁵. The advantage, on one side, of being a city crossed by the river made it possible at that time to benefit from the coexistence of uncommon landscapes that appeared to be welcoming and suggestive spaces for the community⁶.

However, like the majority of other cities in Europe⁷, the city of Dresden has experienced the consequences of Neoliberalist politics and the consecutive transformation of districts of the city, by making those characters of homogenization and identification clear and evident with "transform values of use of the spaces into objects, indeed in values of exchange". The author Marc Augè describes the creation of this new world as a world in which all transit points and temporary occupations are multiplied and held together by a strong network of transports and infrastructures, which often also become inhabited spaces. In addition, is also a world in which silent gestures take place,

^{3 &}quot;In 1989 Willem Jan Neutelings (1959) was commissioned by the municipality of The Hague to study the urbanisation process of the southern section of the so-called Randstad conurbation in the west of the Netherlands, in particular the area between The Hague and Rotterdam. For the southern edge of The Hague around the A4 and the former "Ypenburg airfield, Neutelings" presented a varied landscape for different lifestyles. Also on a socio-cultural level, the city is no longer seen as belonging to one clearly homogeneous society, instead the starting point is an amalgam of different subcultures and lifestyles with a large biodiversity which, just like the physical morphology of the carpet metropolis, is subject to constant change".

Cfr.:<u>https://totalspace.hetnieuweinstituut.nl/en/habitat-expanding-architecture/</u>patchwork-metropolis

⁴ The landscape as demonstration of the personal feeling and the own culture it is a concept developed by Eugenio Turri in order to express the cultural and moral value that are intrinsically related to the physic presence of it. Landscape as Theatre is also an invitation for the society toward an "education to see" the Landscape in the sense

above recalled.

⁵ The Old city corresponded with the Historical city, in several German cities called Altstadt. All the rest of the city that is constructed successively is considered Neustadt, that is the new city.

⁶ This part of the text wants to highlight a specific characteristic that made these spaces extraordinary compared to other places. It is not a case if the majority of the institution and the Castles were placed on the sponge of the Elbe river.
7 Despite the effect of the globalization and the commodification of the landscape are phenomena highly spread in all over the world, the comparison between Dresden and other cities within the European dimension allows to better focus on some aspects that are more similar among them and therefore, more comparable.





Human advances and the water retreats

The sequence of combinations maps-images aim to shed light on the multifunctionality of Elbe river plains, that in periods of low water stage turn out the great quantity of spaces into public open spaces. The informality of these spaces and the lack of specific roles allow them to guarantee a a better social integration between the riverscape and the city, which are compatible with the hydrological functions of the Elbe river.

multiplicity of temporary uses and











Figure 3. (A, B, C, D) images show the use of the flood-prone basins during periods in which the water stage is to different months of latest spring low, which generate a large quantity of public spaces that are used by citizens, users, tourists. These processes of acquisition of spaces are spontaneous, although the city authority catalyzes them by promoting vast programs of events and temporary uses of public space. Source

maps and photography are realized by the author. Pictures are referred summer 2019.

270 271



Central Europe. The image shows urban fabrics situated within this perimeter that were inundated by the severe natural hazards. Map realized by the autohor with data of Saxony Environmental Department. 272 273



Elbe river Tributaries of the Elbe river Digital perimeter of flooded areas in 200 Urban fabrics damaged by the flood in 20 "a world promised to the solitary individuality"⁸, and where everything can be described as ephemeral and fleeting. In this respect, the presence of a consolidated spatial structure and the conservation of customs and traditional social practices committed in these spaces over time guarantee that the river plays a leading role in "resistance/resilience", not only compared to the environmental emergencies and the ecological crisis that follows, but rather risk phenomena of social exclusion and marginalization of categories of inhabitant from the collective dimension of the city.

In deconstructing the emergent condition that characterizes the city of Dresden, the research does not only aim to examine the persistent condition of risk related to environmental emergencies, which today are catalyzed by increasing effects of climate change, but rather insists on a fieldwork that might be able to intercept common behavior at this regard and future perspectives.

3.2 Water resource as common good and as instrument for the conquest of inhabitant rights: Public events at no cost and temporary use within the fragile dimension of the river-landscape.

The encouragement for conscious use of contact spaces between the river and boundaries of the city describes in Dresden an approach perpetrated over the time by administrators and citizens. Recent experiences of compatible uses have supported the enhancement of this consciousness in relation to limitations and opportunities that derive from living "under pressure". The attribution to the water resource of the value of "common good" found its justification in more than one spatial and environmental characteristic that the river itself is able to cover thanks to spatial and environmental qualities and sustainable practices of flood prone areas (**Figure 4 A, B, C and D**).

These coordinated and programmed events contribute to the definition of trajectories of resilient use spaces of uncertain entity at the same manner of programs and actions coordinated at national and Europe levels. Among them can be attributed characters of hospitality that refer back to the aforementioned openness of this public space. In other words, to the capacity of these technical areas of hosting inside social functions that do not impede to the river of carrying out with ecological and biological functions that are equally essential for the maintenance of the environmental balance. The method of research applied in this stage is primarily focused on investigating those special characters that make this space a great smart infrastructure. The public space along the Elbe river in the city of Dresden cannot be imagined as a circumscribed space within a delimited area and therefore controllable. Instead, this is a space that human vision perceives as areas formed by uncertain and unlimited margins. In this sense, the openness of this space can be also interpreted to the community by offering itself as place of participation. The lack of certain margins and of excessive fragmentations make this space unique in its kind. Although the lack of delimited spaces, this area is predilected by the community on the basis of a recognition of characters that are constructed by a progressive and gradual consolidation of uses and costumes, which over time helped to reach "the self-conscious creation of public space" (Frampton, 2015).

Openness and hospitality of these areas lead towards the identification of other characters that intercept more the social and human dimension. For several years in the city of Dresden, the administration is carrying on program of events, by stimulating the participation of citizens in experiencing the urban space of the Elbe river, not only as a slow mobility infrastructure, but

⁸ The text is referred to the description of the differences between "luoghi e non luoghi". Cfr. The chapture: Dai luoghi ai non luoghi in: Augé M., "nonluoghi, introduzione a una antropologia della surmodernità". Elèuthera, 2009, Milano.





Figure 4. Sequence of events organized in different seasons along fragile areas of the Elbe river. Perimeters of these urban spaces correspond to areas flooded in several occasion. son. Source: Toni Kretschmer (A)Open air Cinema (Filmnächte am Elbufer" in Dresden), Source of the pothography, Elbeufer website. (B) World Cup — 14 Jan 2018 , skyiing the river in winter time. Source: TOKO Racing Service: Andrej Neff.

(C) Concert within a flood prone basin, Dresden. Source: Der Messe Dresden. (D) Concert during "Filmnächte am Elbufer" in Dresden starten in 29. Sai-





rather as a public space for excellence. This way of seeing these spaces is also catalyzed by a spread attitude of the community in using these spaces in different ways throughout the year, without having a significant impact on the pre-existent spatial morphologies of this Landscape.

The temporary use of the space leads to reflections on the existence of numerous possibilities to discover a new model of a sustainable and complex use of spaces without having a consistent effect on the physical elements. The case study of Dresden aims to criticize those efforts made in last decades by strategical planning urban design visions in order tore-imagine "the sense of the Landscape"¹ within a contemporaneity dominated by risks and uncertainness, as well as a lack of public funds to invest in production of public space. A great part project of construction of the Landscape and public space within the contemporary city public space ended up being transformed into a scenario more aesthetic than functional and not highly used by the community. According to John Beardsley definition, "combining elements of architecture and sculpture with knowledge from natural sciences, landscape architecture today is struggling to meet profound environmental, social, technological, and artistic challenges".

In last years, the physical accessibility to the water banks had been favored by condition of risk and geographical and environmental aspects. In fact, on the basis of the experience of the extreme event in 2002, for safety reasons, several private spaces situated along the Elbe river have been converted in open spaces again, by removing most of the enclosing and fended areas that could have provoked damages for the safety of the community in the future. After the flooding of 2002, that destroyed various parts of the private properties and made the surrounding areas more vulnerable, it has also decided to evacuate the spaces where garden closures and sporting field were. Despite an initial protest advanced by owners who have seen the dismantling of their properties, the municipality has undergone this operation that turns out to be extremely crucial today.

The third characteristic is given by the inclusivity, in other words by the capacity of these spaces within the spatial structure of the riverscape to be an inclusive space for different categories of users and ethnic groups. In particular, this capacity intercepts a fundamental theme within a spatial temporal dimension

that is distinguished from other contexts in Europe. According to statistics², a large mass of immigrants arriving in Europe finds place in Germany, by catalyzing often conflictual reactions among citizens in favor and anti- immigration movements³ (Figure 4 A and B). In the city of Dresden, the theme of inclusiveness is as complex as it is important and constitutes an issue of discussion which solicits reflections also in the field of the "production of public space". The city of Dresden is inhabited by numerous new cultures, most of them non-EU members, which experience sometimes major difficulties in starting a new life, by adapting and integrating with the local community. It is not uncommon to come across demonstrations which take place in the city center every week. Despite revolts against any form of integration and inclusion attempts with the new cultures are organized in the city center, they come from cultures deeply rooted in peripherical contexts and small villages attested in the Saxony region.

As anticipated a few years ago by the sociologist Zygmunt Bauman⁴, the phenomenon of immigration in Europe is proceeding at an intensity and a velocity without precedents, by alarming the urban communities that consider this phenomenon as news and therefore it is easy to find them unprepared. Reasons indeed lie in the fact that these new individuals are unrooted by our contexts and exhibit behaviors that don not belong to our everyday routine, and therefore they are considered fear-bearers. "Our ignorance on what to do in front of a situation that we do not control is the main reason for our fear" (Bauman, 2007). For a certain perverse logic these individuals are seen by the communities as enemies and as the principal responsible for precariousness and uncertainty within the city. Instead, they are scapegoats of a phenomenon that is interesting all over the world and that attribute faults to them that do not belong. A symbiotic vision of Elbe Riverscape as a necessary condition for a more inclusive idea of public space

¹ An Interesting explanation of the subject is furnished by the paper "a Wor-Id Landscape Architecture" in: http://www.harvarddesignmagazine.org/issues/12/a-word-for-landscape-architecture

² Cfr. Migrants and migrant population in, Eurostat: https://ec.europa.eu/eurostat/statisticsexplained/index.php/Migration and migrant population statistics#Migration flows: Immigration to the EU from non-member countries was 2.4 million in 2017. 3 Cfr. also, the Pegida (Patriotic Europeans Against the Islamisation of the Occident) movement in Dresden:

⁴ In occasion of an interview, Zygmunt Bauman tried to reconstruct the situation of immigrants in Europe, by giving also an explanation on what lead us to being scared of new individuals, among which immigrants. Cfr: Baumann Z., "Siamo ostaggi del nostro benessere per questo i migranti ci fanno paura", di Goldkorn W., La Repubblica.it, in:





Figure 4. (**A**) One of the banners displayed at the anti-PEGIDA rally states 'Together against the shift to the right in Europe'. Source: DW Journal and news, Germany. (**B**) Crowd of demonstrators in Prager Straße, in occasion of the weekly demonstration against the not EU members. Photo took by the author, 2019.

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Research into spatial ecological and environmental relationships between the water and the city does not strive to thoroughly investigate the crucial as much us relevant social condition in the city and the difficulties in terms of social integrations. However, the spatial characteristics of these spaces together with a consolidated culture in the sustainable use of green and public space, touches in a transversally way, the ongoing social dynamics. The experience of adaptating to climate change effects carried on by a sustainable and conscious use of water related space opens up a different perspective compared to the potential of these spaces to work as an incubator of different experiences, by facilitating processes of social inclusion. It is necessary to begin by considering that the open space⁵, characterized by characteristics described above, represents the first instrument indispensable for the realization of initiatives with an inclusive and social scope. The symbiotic vision within a social, ecological and spatial dimension of the Elbe river allows in part (outside the logics of real estate market and building speculation) to carry on complementary processes of management of the common goods and distribution to the entire community.

The theme of coexistence between the awareness of water risks in the water basin and the organization of zero cost events represents an important step for the solicitation of widespread processes of social integration and towards a pedagogic use of these fragile spaces. Different seasons offer adaptive solutions in terms of use to communities of people, whose find opportunities in these spaces for a rediscovery of ecological and recreational values offered by individual and collective experiences with the nature and the city.

The purpose of this chapter is to examine the water resource from a potential perspective that considers the construction of a public space not as a matter of urban decorum, but rather as a process of integration among communities within the physic space of risk. In the contemporary society there is a war taking place that is principally between rich and poor, the latter victims and not guilty of neoliberalism competitiveness, in favor of urban decorum and safety and of all kinds of things that can determine whether they are inside or outside (Bukowski, 2019)."With the arm of the ornament, it impedes living, crossing and frequent the cities to some specific categories of people, by using the public space in a way that it can be adapt to the end of consumers, tourist and citizens, and no one else. Poor migrants, citizens that do not consumes much and active citizens, politicized"⁶.

3.3 Proven experiences of social practices of resilient and sustainable use of green open space in Dresden. The history of the "kleinGarten".

The "kleinGarten", which the name derives from the small dimensions of allotments of 400x400 square meters represents a cultural heritage of sustainable use of free land in Germany's history. By travelling though Germany it is easy to get a chance to see these extensions of green areas and the variable typology of use that German make of it. In the Saxony Region, these are basically allotments Gardens that are under Federal control and that were distributed to the inhabitant and associations of Dresden several years ago in order to guarantee the maintenance of agricultural practices (Figure5). What makes these small parcels very interesting are subtended scopes that also regulate the distribution among the citizens. In fact, these allotments are allocated free of charge according to the Federal rules for the management of these opens spaces with the scope of producing horticultural products for personal use, as well as for social recreation objectives of inhabitants.



Figure 5. A major area in Neustadt characterized by presence of "KleinGärten". Dresden-Neustadt, Weinböhlaer Straße / Bärnsdorfer Straße. Kleingartenanlagen (ehemals Kleingärtnerverein Erholungsheim). Luftbild-Schrägaufnahme von Süden. Source: author of the picture: Hahn, Walter, 1933. SLUB, Deutsch Fotothek.

⁵ The open space in question is, in the case of Dresden, those that belong to river banks, opened and flexible to multifunctional activities.

⁶ Cfr: Bukowski W., La buona educazione degli oppressi. Piccola storia del decoro. Edizioni Alegre, Roma, 2019.

These private spaces constitute together a complex of values that are socially and ecologically oriented, other than crucial areas for the conservation of biodiversity. Each of these gardens is situated inside a common natural complex, constituted by individual allotments, but also by public paths and common "club houses" which are normally used by people to meet each other (**Figure 6**).

These spaces today covered a significant role within the contexts of extreme water risk, which thank to the maintenance of horticultural and the "openness of space" are able of guarantee a safeguard not only to water risks but also to speculative real estate interest. These spaces are often assigned to association and/or organizations that also take care of the management of spaces and urban paths. In order to become a temporary owner, all organizations need to be recognized officially and to be inserted in the register of associations, which are also recognized by the government as a "no-profit association".

Among the criteria of assignation appears to be relevant scopes related to the use of these areas for operations of urban resilience protection of natural environments. In particular, the protection of the environment, the safeguard of Nature and the management of the Landscape⁷, are all aspects that are highly taken into consideration for the transfer of these spaces to the interested subjects. In the Ostragehege area, a flood prone basin of the Elbe river, the presence of these organization, together with the conservation of spaces exclusively for temporary uses carried on by the administration of Dresden, identifies a set of social practices of urban resilience and a sustainable use that also have been experimented in other places with great results. The stimulation of "nature based solutions" or practices, as well as the realization of a thick program of events in which the community is always welcome, represents a crucial segment of various directions in the city of Dresden in which the resilient project of the contemporary city try to follow.



Figure 6. Allotments in Dresden Kaditz. Dresden-Kaditz, Kolbestraße 10/Roscherstraße/Peschelstraße. Wohnhäuser. Blick vom Bahndamm über die Kleingärten. Source: author of the photography :Starke, Werner, 1991. SLUB, Deutsch Fotothek.

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⁷ The attribution of these criteria can be founded in the Federal Rule. Cfr. presence of Klein Gärten in the city of Dresden: http://stadtplan.dresden.de/(S(w5klcy3j2l5lyxa-tbhmz2cgd))/spdd.aspx?TH=GA_KLG&noRedir=true&lang=en

4. Flooding experience, new Objectives/addresses at European, national and local scale.

The definition of objectives and addresses at European and national level corresponds to the acknowledgment of an emergency status which since the event of August 2002 has raised consciousness that has for long time been supplanted by the lack of knowledge. Among aspects that were considered highly damaging, indeed, the lack of knowledge about an appropriate behavior such as weakness of the flood risk management and a poor maintenance or "missing of flooding protection structures" (DKKV, 2004). However, this event far exceeded other events that damaged the city in history, included the similar one in June 2013, which today is considered the highest damage record in the history of Germany. "EM-DAT contains essential core data on the occurrence and effects of more than 22,000 mass disasters in the world from 1900 to the present. The database is compiled from various sources, including UN agencies, non-governmental organizations, insurance companies, research institutes and news agencies". For this historic period, the extreme event in August 2002 remains the highest recorded (EM DAT, 2004).

4.1 European Floods Directive: historical background, purposes and programs

After the event in 2002, several acts and strategies were lunched on a European, national and local scale. In Europe, the catastrophe that signed the entire Central area was delt with the creation of a European Floods Directive that solicited a shift of paradigm in managing water related risks (Thieken et al., 2005). Technically oriented flood defenses have been replaced by more "integrated flood risks management" that considers non-structural measures to minimize adverse effects of flooding, but rather an environmental and nature based solution (Kienzler et al., 2015). This Directive, which was proposed by the European Commission in June 2006 and immediately inserted in the Journal, had the first and foremost scope of requiring Member States to carry out a preliminary operation of identification of flooding risk. However, the European Flood Directive is a strategy that requires a strong integration with others European and national policies, such as the "Water Framework Directive" and flood risk management plans realized at national level. The theme of water management within protection and mitigation policy is extremely complex and the results, as well as requirement of this Directive, showed that it is not possible to isolate and adjoin operations at national levels, and that the issue requires assessments and measures that exceed administrative borders (Official Journal of the European Communities, 2000). Among the prerogatives of the European Directive, is the requirement for all Member States to assess whether all water courses and coast lines are threatened by flooding, to map the flood extent and assets and humans at risk in these areas and take adequate and coordinated measures to reduce this flood risk. Furthermore, the Directive requires from all Member States strategies and long terms solutions that could potentially address the problem of climate change, by working towards a more sustainable land use and paying attention at life cycles of natural resources (Figure 7).

In synthesis purposes of the Directive are:

- Assess if water courses and coast lines are at risk from flooding
- Map the flood extent
- Assets human at risk in these areas
- Take adequate and coordinated measures to reduce this flood

Water management programs include:

Prevention: preventing damage caused by floods by avoiding construction of houses and industries in present and future flood-prone areas; by adapting future developments to the risk of flooding; and by promoting appropriate land-use, agricultural and forestry practices;

Protection: taking measures, both structural and non-structural, to reduce the likelihood of floods and/or the impact of floods in a specific location; Preparedness: informing the population about flood risks and what to do in the event of a flood;

Emergency response: developing emergency response plans in the case of a flood;

Recovery and lessons learned: returning to normal conditions as soon as possible and mitigating both the social and economic impacts on the affected population.

Historical background:

Despite the fact that the European Floods Directive would be the product of a consciousness recognized after the flooding in 2002 in Central Europe, the background of this European strategy would be attached to a more far and remote identification of crucial issues.

Early European water legislation began, in a "first wave", with standards for those of our rivers and lakes used for drinking water extraction in 1975 and culminated in 1980 in binding quality targets for our drinking water. It also in-


cluded quality objective legislation on fishing waters, shellfish waters, bathing waters and groundwaters. The main emission control element was the Dangerous Substances Directive.

The purpose of this water legislation was to tackle pollution from urban waste water and agriculture.

In 1988, the Frankfurt ministerial seminar on water¹ reviewed the existing legislation and identified a number of improvements that could be made and gaps that could be filled. This resulted in the second phase of water legislation, the first results of this were the adoption in 1991 of the Urban Waste Water Treatment.

Directive, which provides for secondary (biological) waste water treatment, and stringent treatment where necessary, the Nitrates Directive addressing water pollution by nitrates from agriculture.

Other legislative results of these developments were Commission proposals for action on a new Drinking Water Directive, reviewing the quality standards and, where necessary, tightening (adopted November 1998), a Directive for Integrated Pollution and Prevention Control (IPPC) adopted in 1996, addressing pollution from large industrial installations, later transformed into the Industrial Emissions Directive.

Nevertheless, among different purposes, there were also problems of human losses. "Between 1998 and 2009, Europe suffered over 213 major damaging floods, including the catastrophic floods along the Danube and Elbe rivers in summer of 2002 (**Figure 8**). Severe floods in 2005 further reinforced the need for concerted action. Between 1998 and 2009, floods in Europe have caused around 1126 deaths, the displacement of around half a million people and at least €52 billion in insured economic losses"(Parliament European, 2007).

4.2 National and regional strategies for a long terms flood protection: a change of direction toward a more integrated and ecologically oriented approach

At national level, Germany took precautionary measures against flooding in 2005 (Bundesgesetzblatt, 2005) and several operation were also conducted at regional and city level. In Particular at regional level, the "Regional Climate



¹ For a better comprehension of the background and the processes that led before to the Water Directive in 2000 and then the flowing, consult the website: Directive 2000/60/EC of the European Parliament and of the Council of 23 October 2000 establishing a framework for Community action in the field of water policy, on: https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32000L0060&from=EN;

Change Adaptation Program Dresden Region (REGKLAM Modellregion Dresden) is working on the integration with the German Adaptation Strategy (DAS) and the "Adaptation Action Plan" (APA) of the Federal government's Adaptation Strategy to Climate Change. According to the strategy Climate Change is viewed as a risk as much as an opportunity that can lead in specific locations towards the realization of strategic perspectives.

The Regional Climate Change Adaptation Program for Dresden peruses a vision in which the strategic ecological network constituted by open spaces and natural environments can contribute to the creation of a large scale Multifunctional infrastructure that ensures ecological functions, recreational areas and that provides "flood safety" in case of extreme events. An interesting example is the reconversion of the "Windeberg Park" in the city of Freital, where the green space has been created into an area that is extremely exposed to flooding, by improving the microclimate and at the same time increasing recreational values (Bernhofer, et al. 2013).

In Dresden, the "Flood Protection Plan Dresden", is responsible for the management and maintenance of surface and sub-surface waters, as well as wastewater infrastructures. After the extreme event of 2002, the main purposes of the Food Protection Plan Dresden are to specify targets and measures in order to protect all the districts of the city and to achieve a more resilient and water risk adaptation in a step-by step process. Conscious of the disaster in 2002, the municipality of Dresden adopted in 2013 a "Flood protection system" that worked through the installation of Mobile Flood protection barriers in areas of particular vulnerability and extremely exposed at inundations. This operative trajectory belongs to the category of interventions that are recognized as technically and temporary oriented and generally identify by that behavior or "resistance" to water risk which has been mentioned earlier and that has structured a large part of the modernization phase. However, the set of these strategies, apparently disconnected, appears to be changing direction towards the comprehension of issues that cannot carried out only with temporary and technically oriented interventions, but rather through the reinterpretation of open spaces and flooding areas as new urban material for the design of new functional spaces within strategies of adaptation and of mitigation to climate change effects. The way seems to be still long and crossed by different, sometimes deviated interests that still aim to transform ecological patterns of areas that should be considered crucial for the water management risks into welcoming places that aim to still intercept the demand of the construction of new urban fabrics.

4.3 Maps of consciousness: Independent flood experiences. Results by social network. Flood keywords and ecological emergencies.

Part of the research aims to examine people's awareness today compared to the presence of water related risks, in particular in comparison with the existence of ascertained awareness in relation to an ecological and environmental emergency.

The ecological crises that have been discussed in this chapter is a crisis that belong to the behavior of communities, but even before to the capacity of them to recognize consequences and impacts that perverse trajectories are having on the balance of urban ecosystems (Figure 9).

Thanks to the use of specific application related to search engines as "Google" it is possible to trace trends and to identify on average how much a word is investigated in a geographic context of interest. The collection of this data is instrumental for the construction of a "cultural database" which, in case of association with a geographic data (e.g. a map of the territory), allows to systematize and to localize this information, by designing maps of consciousness in relation to flood risks, ecological crisis and environmental question.

Although they are apparently not significant, these data can intercept a cultural segment that even earlier of the design of strategies for a physical and spatial resilience can be enhanced with interventions of social and cultural impact.

The methodology of research focuses on a database that collects words that increase in terms of trends related to a global condition of ecological crisis and the pressure of climate change and can be applied first on national level and then at regional, local level.

The result of these surveys contributes to clarify important or subordinate information from people regarding to a problem of global interest (e.g. climate change and ecological crisis) and at regional and local level when these geographical data are placed in relation to the evolution of "flood experience" and changes in preparedness, as well as response and recovery after the extreme flood of 2002 (Kienzler et al., 2015).



Figure9. Relationships between Flooding areas (with return of 100 years, EEA European Environment Agency) in Central Europe urban fabrics and major rivers. Source: Map realized by the author with data of EEA, CLC Corinne Land Cover 2018.

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II Keywords

"Nature Based Solution"; "KleinGarten";

"Flooding Experience"; "Hydraulic culture"; "Industrial Society of Risk"; "Social Production of Wealth"; "Spatial organization"; "Dissipative processes"; "Spatial injustice"; "New urban question; "social integration"; "Places of participation"; "Environmental emergency"; "Spatial consciousness"; "Gated community"; "City of riches and city of poor"; "Human Spatiality as a Complex Social Construct"; "The right to the city"; "Urban Crisis" "Water management"; "River's Breath"; "Essence of the city"; "Ecological crisis"; "Landscape dimension ecologically oriented"; "Urban Palimpsest"; "Democratic public space"; "The Openness of Open Spaces"; "Urban Material Historicized"; "Extreme city"; "Commodification of the Landscape"; "Global City"; "Spatial Declinations of Green and Blue Infrastructures" "Territories in Crisis"; "Patchwork Metropolis"; "The Solitude of the Global Citizen"; "Under Pressure City"; "Missing of Flooding Protection Structures"; "Integrated Flood Risks Management";









City as key scale of implementing broad range of environmentally policies: a comparative view between Dresden and other european cases

In the last decades, the theme of relationships between the water and the city has led urban disciplines to reflect on several issues which are modifying ways to design cities and urban spaces. Among these issues, there are certainly those strictly associated to the demands of urban sustainability, as long-term objective to respect in order to ensure the liveability in context always more fragile. As already mentioned, the sustainability of our cities is a theme that cannot be enclosed within limited thresholds, whereas "city-related ecological conditions" operate on a diversity of geographic scales which are interdependent on each other. According to this assertation, cities itself incorporate a range of scales on which a given ecological condition works and, in this sense, both for conditions and for effects that they produce they could be consider as multi-scalar systems (Sassen, 2009). The theme of scales in urban planning is an issue that the scientific research has raised more times with the scope to examine a series of contemporary urban conditions that also if they are engendered within a circumscribed area, they produce multi-scalar effects that consequently alter the urban metabolism (Wolman, 1965). In particular, in cities like Dresden the study about the theme of multi-scalar effects and impact has allowed to understand and to justify a range of historical interventions that have been realized over the centuries with the aim of reducing water-related risk conditions at a wider scale. In this respect, seems that the city itself represents the physical space for the proliferation of environmental and ecological crises, but also the solution to a range of environmental phenomena that are interesting diverse geographic areas in Europe, with a particular attention to water risk phenomena and its consequent policies and strategies^{[1}. Beyond international approaches, the city is considered to be the key scale for implementing a broad range of environmentally policies and also the strategical place in which struggling for the environmental quality of life for different social and economic classes (Satterthwaite, D., et al., 2007).

Particularly, it has been necessary both the trespassing of interests of the various disciplines which worked previously with cities in a completely autonomy and a major interdependency of questions in order to deal with the complexity of the contemporary city. On these issues several urban designers and landscape architects, as well as the scientific community, have recently

debated, by identifying in the Landscape a medium through which look at multiple conditions and in the emergent works of the landscape urbanism the capacity of uniquely responding to temporal change, transformation, and adaptation to contemporary urban conditions (Charles Waldheim, 2016). According to this way of thinking, in these statements there is the exigency to define new trajectories of approach in which to the already post-modern criticism advanced at the end of XX century, is added the intention of seeing in landscape a "model for process"^{[2} associated to the increasingly changeable city. In the last years, especially in European cities, ecological and environmental conditions have conducted cities to rethink its own relationships with natural resources and to engender new large scale designs in which the landscape has been conceived as complex system capable of articulating at multi-scalar level urban infrastructures, events and indeterminate urban features (Corner, 1999).

The city of Dresden has been subject of different phases of transformation that have sensibly modified the original spatial structure of the Elbe river and altered its relationships with surrounding spaces. Among them, those already mentioned that occurred between the end of the XVIII century and the mid-XIX century, many of which regarded the great phase of infrastructuring of the Elbe stream and the designing of interchange places annexes to the Elbe river. However, have to be considered relevant all the efforts made with the aim of domesticating water over the centuries and dealing with persistent water-related risk conditions, which have included the realization of dykes, the shortening of the Elbe river streams, as well as the realization of artificial flood prone basins to be use in case of flooding.

Lastly, the graveness of events occurred on February 1945 has led the city over the recent years to the realization of interventions that were dictated principally by emergency conditions and by inexorableness of reconstructing a credible image of the city after the Allied attack that razed to the ground Dresden during the II World War. This event, in particular, has not only conditioned all the successive phases of reconstruction of the major hit areas, but has also induced these latter to confront with an urban "palimpsest" ³ that that was completely upset down and that has had to be associated more to the memories and imagines that the city conserved rather than on the constellation of intact rests of the previous city.

¹ Cfr. the previous chapter on European policies on water-related issues.

² Cfr. James Corner, in: Recovering Landscape: Essays in Contemporary Landscape Theory, 1999.

³ Cfr. Corboz, A., The Land as Palimpsest, in: Diogenes, 1983.

Despite visible alterations of reconstruction phases that have occurred recently within the historical areas of Dresden and that have been in part conditioned by a re-design of urban fabrics strongly antithetical compared to the desire of re-acquisition of a Baroque image, water-related risks conditions together with a rooted culture on themes of flood experience has given over the time a great importance to the conservation of ecological spaces and water basins which constitute today the other side of that palimpsest, that on the contrary has been replaced in other European realities by dissipative economies and urban stratigraphy highly damaging. In particular, what makes Dresden different from other cities is the aptitude to keep over the centuries constructed and unchanged relationships with the spatial structures of the Elbe river Landscape which are essentially "ecologically oriented"^{[4}. The river itself, is today a complex structure which can be seen as the result of a sequence of intelligent adaptation to water risks and of exploitation of water resources to pursue dynamics of economic development. The current configuration of this structural mutations together with the more recent water management attempts conserve an evident and perceptible Landscaping matrix that also in the light of the rapid contemporary process of urbanization helps to make recognizable the reading of an ecological and spatial relationships at multi-scalar level. The emergency of the River as a "self-organizing"^{[5} and potential structure stands up to all programmatic changes that are transforming physically the urban environment. Particularly, the continuity of the spatial structure of the Elbe river, as well as the capacity to create spatial and ecological connections with the wider and fragmented and porous areas of Dresden, represents in the contemporary condition a Landscape framework through which can be kept together open spaces, infrastructures, urban and natural ecologies, as well it can be interpreted as the principal ordering mechanism of urban conditions.

What is happening in other cities is essentially an invitation to reflect on issues that for a long time have been taken a backseat to the idea of a realization of a city aesthetically and reductive working, and that now are claiming for a re-appropriation of spaces subtracted by economies and urban policies partially undeserved. Based on several issues, these trajectories of intervention expect an involvement more or less intensive of urban-ecological spaces and actors that work on it. Particularly, these great strategies are increasingly more the result of a constellation of interventions that attribute their strength on the catalyst effect capability that they can engender in other areas.

These case studies have to be considered as a useful model of exploration of response design to recent dynamics and phenomena that are interesting particular geographic as well as cultural environments in Germany. They are used to emphasize those positive aspects that are possible to intercept also in Dresden and that can be interpret in this city today as the result of a consolidate and constant attention to themes of water-related risks, but also to highlight those design orientation and their cultural trajectories that if they work in a good way in other contexts and are considered to be innovative and highly interesting, they can be used as alarm warning lights to highlight critical aspects not yet resolved in the city of Dresden in order to be used as catalysators for new interventions. The limited number of projects has been selected based on adherence to themes and important issues associated with the water-related risks in the contemporary city, but also based on their capacity to transfer knowledge and food for thoughts for the future challenge regard sustainable and resilient design of cities.

Berlin, the "Bathing ship" in the Spree, 2004.

Within a national scale of interventions, have to be considered particularly interesting cases in which the relationship between water and the city has seen as occasion for the establishment of new opportunities of uses of the public spaces, as well as prototype for a general concept of re-cycle of natural resources highly contaminated by urban pollutions. In Berlin, the "Bathing ship" project in Berlin is a clear example of this trajectory. The natural-ecological conditions are determined by a lowland river, which is in part favoured by the "Spreewald forest" and presence of lakes outside Berlin, that work as retention areas and keep the water fluctuation extremely low. The use of the Spree as public has been highly obstacle by the bad quality of water, which has been used for a long time by ships and polluted by industrial use. A re-conversion of the place into an ecological Key appeared at the beginning an illusory operation. However, grave circumstances of impoverishment of water quality and lack of public spaces nearly the historic centre, have been catalysator for using the river more increasingly again. A water balcony, clean water in the middle of the river, restoring access for the citizens of Berlin to their river in the midst of the historical east port'^{[6}, as the description of the architects suggest. "In spring 2004, an old barge was converted in a nearby shipyard, its

⁴ Cfr. Mohsen Mostafavi, in: Ecological Urbanism, 2010.

⁵ I refer to the capacity of an ecological system to be seen as a self-organizing and potential structure. Cfr. "Autonomy, Indeterminacy, Self-Organization", In: Waldheim C., Landscape as Urbanism, ed. 2016.

⁶ Cfr. Gil Wilk, in: [http://www.gil-wilk.de]

superstructures were removed and it was flexibly moored in order to adjust to the different water levels of the Spree. With a water depth of approximately 2 m and a length of 32 m, a pool floating on the Spree was thus created, the bathing ship" (Prominski, M., Stokman, A., Zeller, S., Stimberg, D., Stimberg, V., 2012). The strength of the bathing pool project does not lie into an intervention of urban restyling of the old shore of the Spree, but rather into the capability of allowing a revival of the old traditional costumes of bathing places that have been taken place in Berlin in the XIX century, when the riverscape was not yet polluted and was used also a bathhouse (Figure1 A and B). The intervention in Berlin, has been one of catalysators for the realization of a pool ship in Vienna and Hamburg⁷. This micro-action within a large-scale connector as the Spree river solicits to become conscious about opportunities and consequences that a small intervention can have on the perception of the riverscape for the community. Besides, the realization of a public space opened to the community encourages a further reflection on the theme of the accessibility to riverscapes, that in the contemporary city have been wiped out by dynamics of privatization and the increasing fragmentation of properties.

Munich, Isar Plan, 2000.

As early as the middle of the XIX century the Isar river was canalized and its riverbank was straightened. Over time, several interventions have been realized and they expected the realization of straight weirs that restricted the flow rate, as well as the reinforcement of the riverbanks. In the south of the city of Munich, the river was diverted in order to engender new parallel channels for the production of electricity. At the beginning of the XXI century, the city of Munich, together with the Free state of Bavaria decided to undertake a new project that assumed the re-naturalization of the previously artificialized river. The intent of the "Isar Plan", in fact, was to improve the relationships with nature, by allowing better water management in case of flooding and increasing opportunities in terms of new activities along the riverbanks. Among the actions, the broadening of the width has been an essential intervention^{[8} that would have allowed to better manage the drainage of the river stream in case of a flood, as well as to provide new public spaces for the community. The concept has been to hand over to the territory the image of a wild river and to give back to the river its original momentum. "The river's gravelly banks are





Figure 1. (A) The re-use of the old ship for the realization of a swimmingpool and the realization of a public beach which can be used during the summer season. Source: imagine captured from the "River space Design" book 2015, Prominsky et al. (**B**) Use of the Spree riverfront as space for the community and as terrace. Image courtesy of Wilk Salinas Achitekten.

⁷ Cfr. River Space Design. Planning Strategies, Methods and Projects for Urban Rivers. Birkhauser, 2012.

⁸ The River design expected a broadening of the river from 50 to up to 90 meters width, which would have allowed to better manage the drainage of the river in case of flood.

subject to continuous change and are used by Munich's residents as a large urban beach in the summer. It's the perfect place for bathing, barbecuing, sunbathing and for ballgames"^[9]. In correspondence of bridges, the necessity to seal the river brought to the realization of stone steps, which have absorbed the multi-purpose roles of reinforcement the riverbanks and the creation of new seating areas for people.

However, the intervention is to be considered an interesting case that goes to the direction of the case study of Dresden as it interprets effective exploitation of a process ongoing in which the Landscape works as a medium that helps to re-establish "large-scale morpho-dynamics" (Prominsky et al., 2012), a new contact between nature and the city, as well as to prevent risk phenomena. In 2005, the floods destroyed what was planned for it, and that represented in that occasion an opportunity to improve and to better monitor the Isar riverbanks, that from that time have been objected to new interventions. All the elements used in the project are normally known as elements for a re-naturalization project and the interesting thing is that these can be used today into a city to create recreational areas of high ecological quality. Dead woods and mass of rocks were placed in the river not only to create a natural atmosphere, rather to make greater friction and divert the flow of the water, by allowing also the migrating of fish and the creation of new variety of habitats. Moreover, the realization of not accessible Islands (e.g. the Willow Island), which are made possible through the creation of new branches within the river plain allows creating ideal ecological conditions in which rare habitats of animals and plants can grow, becoming a safe refuge for them (Figure2 A and B). Without a doubt, the preciousness of the intervention is to be found in the capacity to offer ecological conditions that work both as a water management feature in case of flooding and as a catalysator for the creation of new ecological habitats within contexts predominantly characterized by contemporary urban conditions.

Losse Delta, Kassel, 2005.

Before the re-design, the Losse river used to flow into a narrow and sealed channel before entering into the Fulda river by crossing an undeveloped area. The intervention in 2005, transformed the narrow profile of the Slosse river into a Delta of 5 hectares within which low-lying sections of the river flowing into the Fulda river.

The changing small rivers are constantly shaped by different water stages and

9 Cfr. Dynamics River Landscape in: River Space Design, Project Catalogue, Prominsky et al. 2012





Figure 2. (**A**) View of the ecological island in the middle of the river. (**B**) Masterplan of the Isar river. Source: Weideninsel mit Reichenbachbrücke und Corneliusbrücke im Hintergrund, Wasserwirtschaftsamt München Gesamtplan, Wasserwirtschaftsamt München.

are surrounded by small water bodies and meadows that are normally under the water only in case of a flood. The entire area is naturally and ecologically protected by paved earthen walls which avoid inundation in adjacent agricultural fields. Despite difficulties in realizing the intervention (mostly related to permission and planning authority for this channel) the confluence re-design in Kassel was made possible only by conserving the previous channel, which is now hidden into the area by a row of alders (Figure3). The innovation of the intervention is mostly associated with the ability to transform a narrow confluence into a Delta and a recreational area that can be used by the community when the water stage is shallow. Besides, it is also an area in which are dominant criteria of conservation and natural resilience, which seem to be both in contrast with the high use of adjacent fields for agricultural purposes and the previous water confluence that used a system extremely artificial. However, the recent wave of visitors in the area has raised doubts and worrying about the future, that for now are taken as opportunity to foresee "new process-oriented works on the river and the creation of new design and ecological qualities".

Ihme Park, Hannover, 2014.

The Ihme is a 16 km long tributary of the Leine river and passes through the city of Hannover. After several extreme flooding, the Hannover authority decided to re-design its profile. In particular, the aspects that were retained essential for the project aimed at the improvement of the retention capacity of the river itself upstream, the defense of the city by constructing new dikes, floodwalls and by widening the river's profile. The interesting aspect is that most of the interventions regarded the Ihme tributary, which accommodates about 90% of the excess of water of the Leine river during the flooding. The undersized dimension of Ihme's discharge and the bottleneck shape of it made difficult the conveyance capability. Thus, the hydraulic design demonstrated that by excavating a flood area and by transforming the narrow riverbanks into a flood plain, the water levels could have been lower, by avoiding flooding into the surrounding urban fabrics. Furthermore, lowering the water level has affected pressure groundwater, which arises normally during flooding and causes severe damages. In the new design of the river's profile, the riverbanks were designed as a flood plain with several wide terraces that gradually descending to the river. In the new design of the river's profile, the riverbanks were designed as a flood plain with several wide terraces that gradually descending to the river. The terraces were covered by loam layers which would have the scope to hinder the erosion and to avoid the rising-up of the groundwater during flooding, as well as to provide comfortable places for

Figure 3. (**A**) Losse Delta, Kassel, 2005. Source: imagine captured from the "River space Design" book 2015, Prominsky et al.

Figure 4. (**A**,**B**,**C**, **D**) View of the Ihme Park in Hannover in normal and under the pressure of storms. Source: imagine captured from the "River space Design" book 2015, Prominsky et al.













recreational uses. The entire water retention area has been transformed into a park that provides in some sections "gentle dike"^{[10}, which becomes steeper in narrower spaces. Besides, the park is provided by new urban furniture for visitors that can be also submerged in case of high flows, as well as functioning as a defense system during extreme flooding. The riverine vegetations constitute reinforcement systems and allow at the same time the gradual flooding of the area. In this respect, also the choice of planting high stem trees is not casual, and that has been made so as to not obstruct the natural flow. In addition to the more resilient and nature-based solutions, the area has been furnished by low dikes elevation and low flood walls that can be temporarily closed at their entrances in case of an extreme event (Figure4 A,B,C and D).

The strength of this project has been demonstrated in occasion of extreme flooding, when the new parks has worked as water retention area and has hindered damages to urban fabrics. In particular, the re-design case study of the Ihme tributary in Hannover can be retained as an example and a model of knowledge transfer for other contexts of high vulnerability. In this respect, the regimentation and the creation of a narrow profile with concrete riverbanks in the Weißeritz tributary, together with particular geomorphological conditions have been considered to be for the most part responsible for damages occurred in the inhabited areas during the flood in August 2002, by overcoming damages provoked by the Elbe river itself.

Conclusions

The field of work in which the research moved has analysed the Conclusions in order to transfer Knowledges on issues crucial that interest today the complex dimension of the contemporary city. These questions are articulated and debated separately in this chapter and have the purpose to give an overall comprehension on different themes strictly connected to water risk condition, as well as to highlight open and uncertain issues in the city of Dresden. Furthermore, also the challenges that are ongoing in order that they are transforming the way to conceive Green and Blue infrastructures according to a cross-collaborative and trans-scalar approach.

1.1 Why GBI can be traced back to the past in order to understand emergent conditions

The field of research that has been carried out examine the crucial theme of the Green and Blue Infrastructures" in depth, by analysing different fields of exploration, critical aspects, opportunities and approach modalities consolidated over time and applied today within the dimension of the contemporary city. The analysis of the case study has been able to highlight conditions of water risk in a specific geographic area, which are far away from being considered as a direct consequence of impacts of climate change pressures. Although pressures of dynamics of climate change have acted as a catalyst for the acceleration of these phenomena, would be reductive to associate the recording of catastrophic phenomena exclusively to an anthropogenic footprint which has in itself a shallower root compared to the occurrence of extreme events and Natural hazards registered over the time (Weikinn, 1965). Despite being a field of exploration that has only been build-up in last decades, the research on "Green and Blue Infrastructures"^[1] is closely tied to both a remote temporal framework in which phases of maximal expansion or industrial growth started increasingly to modify the system of relationships between the city and ecological systems, by producing at the same time risks (Beck, 1986), and to environmental emergencies that are affecting today the

¹⁰ The term gentle dyke is referred to the creation of dykes that work both as water retention areas and as public spaces. For a better comprehension cfr. Prominsky et al., River Space Design. Planning Strategies, Methods and Projectsfor Urban Rivers, 2012.

¹ At European level, "Green and Blue Infrastructures" made their official appearance in 2013, with the European strategy on Green and Blue Infrastructures. However, the emergence of this term was a result of terminologies and cultural declination that goes back to studies and proposals that led to plans and strategies which worked on a "Green infrastructure concept" that may best managed practices that would achieve more holistic stormwater quantity management goals for runoff volume reduction, erosion prevention, and aquifer recharge. Cfr. Schueler, T. (1987) Controlling Urban Runoff: A Practical Manual For Planning And Designing Urban BMPs.

contemporary city.

This retrospective examination on the Green and Blue Infrastructures and water risk conditions have allowed to deepen dynamics that preceded in time within the city, by verifying current conditions that they have determined. This assembly and disassembly of processes have been helpful for examining the fragility and virtuosity of operations of adaption to water risks, by focusing historical efforts that made this city culturally and technically prepared to exposure at risks in order to guarantee development in different sectors.

Over the time, application to practices through "Green Infrastructures" has far trespassed the initial etymology of the word that imagined it as tool for "holistic storm water quantity management goals" (Schueler, 1987). Today are different issues that characterizes the "new urban question" and are leading us to reconsider the semantic of the term and to apply it into field of works that requires an intersection of knowledges by different multi-disciplinary teams(Secchi, 2013).

The work of research on different temporal horizons has allowed the study on Green and Blue Infrastructures to trespass prefixed limits of definition of the term and its application within trajectory of study relatively recent. In particular, it helped to explore diversified and transient cultures which have had attributed over the time multiple significances (more or less sensible at environmental issues) to water resources and green spaces.

1.2 The historical condition of water risk and progressive/gradual phases of adaptation

The observation of phenomena and great plans within a certain geographical context has given important results back compared to fundamental stages which have contributed to forge cultures and to attribute ecological, social and spatial values to green and water resources but also to resolve issues of technical nature within hygienist cultures. All together, these interpretations have enriched the field of urban design with different "declination of Green and Blue infrastructures" (Gasparrini C., 2017).

In particular, the case study of the city of Dresden differs from other cities for two questions of great relevance if they are contextualized within contemporary reflections on environmental emergencies and on the beginning of the "ecological crisis" (Secchi, 2011). The persistent condition of risk of the city at extreme water events, confirmed by an experience in flood records that goes back to the AD 1021^{[2}, and the occurrence of two great catastrophes respectively on 31 March 1845 and September 1890, which signed in particular way the phase of modernization that in the beginning of the XIX century was affecting different cities in Europe.

Although the city has not avoided the processes of urban transformation associated to the industrial growth, it is relevant to confirm that the presence of a great water infrastructure such the Elbe river and persistent risk conditions have had substantial consequences on the preservation of large areas that have always worked as flood prone basins (Figure 6).

However, European economic interests sorted after the end of the France revolution, seen the Elbe river as a crucial waterway infrastructure that would have ensured the city not only the possibility of being insert within an international network of economic relationships^{[3}but also to enhance the independency of the city through the realization of autonomous harbours.

The official documentation of the Congress of Vienna containing the guidelines for the European shipping law particularly signed the declaration of navigability of the Elbe river, as well as the solicitation for the concretization of further mandates containing rules on the use of Elbe stream, banks and dykes (e.g. the "Elbestrombaumandat"). The writing of these official Agreement led toward the beginning of infrastructural interventions that would have transformed the relationship between the water and the city physically. With these key passages we were witnesses not only of a European restauration and of members agreements for the European trading, but also of a phase of modernization that in the name of the progress produced territorial mutations that interested the ecological and environmental dimension.

On the other side, the conservation at that time of a structural awareness towards aesthetical and landscaping values that still characterizes today the "Dresden Elbe valley"^{[4} meant that the majority of the physical transformation

² Cfr. Weikinn's Compliation, in: Weikinn, C. (1965) 'Katastrophale Dü rrejahre während des Zeitraums 1500 - 1850 in den Flussgebieten der heutigen Deutschen

Demokratischen Republik', Acta Hydrophys., 10, pp. 33 – 54. 3 at this purpose, can be useful to read the 2^{nd} chapter regards the creation of the "Vienna Treat" in 1815, which expected the 1815, which was signed by several members in Europe for the first documentation that contained official guidelines for European shipping law, in which the Elbe river has been declared navigable. 4 In 2004, the area that extends 18 kilometers along the river from Übigau Palace and Ostragehege fields in the northwest to the Pillnitz Palace and the Elbe River Island in the southeast was nominated by UNESCO committee for the inclusion on the World Heritage List. Among criteria of nomination, there were considered landscape features, architectures and garden that have been a reference for the development of Central Europe in 18th and 19th century. Cfr. World Heritage Scanned Nomination, File

for the realization of new industrial complexes would have interested peripherical areas. According to the Kingdoms of that time, the city would have keep criteria of unicity and coherence with a vision of spaces and of the architecture more organic (Helas, 1986). Either way, the substantial consideration of persistent water related risks, as well as of particular geographical conditions and, on the other side economic impulses, together led towards metamorphoses of ecological and spatial entity. These have interested the structure as a whole and the profile of the river stream more than the surrounding spaces which, on the contrary, have acquired over time a cultural and environmental meaning for the conservation of ecological qualities and resilient practices putted in place by the community. For this reason, walking along the Elbe river today can results as a unique experience of revisiting of historical spaces characterized still by uncertain margins, designed paths and paths furrowed temporary uses, and by a constellation of representative spaces and architectures that together constitutes the stratigraphy of the "urban palimpsest" (Corboz, 1983) or even of metropolitan areas. Its very representation, until very recent ages held to be terribly abstract and reserved to technicians, today belongs to the public domain. Exhibitions bearing titles such as Maps and Illustrations of the Earth (Paris, 1980 of this area.

1.3 Morphodynamical processes of the Elbe river as a result of complex developments.

As it known that each river has an individual "flood pattern" and that the water level of a river changes continuously, although in general only the extreme floods and low water are noticed. The sequence of interventions on the flood pattern of the Elbe river in Dresden, as well as the regimentation of several transects of Elbe stream (Internationale Kommission zum Schutz der Elbe, 2003) in order to address challenges posed by industrialization phase determined the occurrence of a specific phase of modification that interfered "Morphodinamic processes". The driving force of the Elbe river, which should account on numerous and complexes sub-processes and that confers to the river channel a changeable pattern, met particular conditions in the city dictated by a spatial structure that have seemingly modified more flood prone basins with sedimentation that the river profile. "The flow of water causes erosion and sedimentation along the watercourse that subjects the river space to continuous morphological alteration...Sedimentation shifts in the watercourse are mainly expressed through the characteristics and structuring of the riverbed and are to some extent reversible" (Prominski, M., Stokman, A., Zeller, S.,

Name: 1156. UNESCO Region, Europe and North America.

Stimberg, D., Stimberg, V., 2012). What happened in Dresden is, therefore, a Morphodinamic process that has substantially modified over time that were malleable areas through migrating gravel banks the shaped the surrounding Landscape, but the "flood pattern" of the river channel remained unchanged.

1.4 The production of Urban Public Space: a conquest obtained by spontaneous and gradual processes of adaptation by community to "river breathes". Looking back at the historical sources represented by photography, depicts and lithography it is possible shed light on those particular dimensions in which emerge uses and daily social practices that often escape by eyes of the urban observer, which is more intent to keep phenomena of urban scale under control. However, the application of a methodology of research based on the use of visual experience has enabled to construct a basis with the purpose of describing physical, social and economic dimension of the waterscape (Figure7).

Photography, as well as figurative arts permits to deeply examine the aspects of cultural and interpretative roots that belonged to a precise moment in history. As recognized, the function of photography is to let both the photographer and the viewer play a role in the production of meaning. For this reason, photographers prefer to talk about "data production" instead of "data collection" (Conord S., Cuny, 2014).

The methodology of research applied to the case study has enabled to move the comprehension of relationships of social and relational character between the community and the riverscape forward that have occurred over the centuries and the dynamics of the use of public space, dictated principally by a severe water risk condition and by consequent cultural declination . The "production of open space" in relation to specific geographical conditions and to a consolidated "flood experience" (Kienzler et al., 2015) toward water related risks, as well as to progressive and gradual adaptation behaviors, has made it possible to define a Spatial structure in the city of Dresden which is unique in its kind. Ecological and spatial relationships between different systems have constructed a strong relationship with the constellation of "historicized urban material" (Gasparrini, 2015), with which they have become their elf historicized element that today describe the complexity of the urban space within the riverscape.

These spaces have with great determination resisted the pressure of neoliberalism market (e.g. in the general phase of reconstruction of the city after the Allied attack), which has increasingly transformed historic urban areas into



Figure 6. Heavy rains in Central Europe over the past few weeks have led to some of the worst flooding the region has witnessed in more than a century. The floods have killed more than 100 people in Germany, Russia, Austria, Hungary, and the Czech Republic and have led to as much as \$20 billion in damage. This false-color image of the Elbe River and its tributaries was taken on August 20, 2002, by the Moderate Resolution Imaging Spectroradiometer (MODIS), flying aboard NASA's exceed \$100 million.

Terra satellite. Source: image courtesy of Jacques Descloitres, MODIS Land Rapid Response Team at NASA GSFC. In Dresden, Germany, portions of the Elbe River rose from the usual summer high of 6 feet (1.8 meters) to over 30 feet (9.1 meters). The water, which reached levels not seen since 1845, seeped into the historic buildings and threatened precious works of art. City officials estimate that the damage to Dresden would probably

districts for conventional trading that are interesting "global cities" (Sassen, 2001). According to the "new urban question" described by Bernardo Secchi mentioned before, the XX century has been connotated by three phenomena of which one is referred to emergence of a daily horizon in individual and social groups, with the following consequences of the increase of the "corporal dimension" of practices of urban spaces (Secchi, 2011). The presence of resilient spaces to phenomena of marginalization on the one hand, and privatization on the other, still guarantees today to interpret the spatial structure of the Elbe riverscape as a public space for excellence. Are not functions and activities that take place within different seasons to define the role of use of this landscape, which are equally based on a culture of temporary uses spread in all over the city, but instead the sense that the community is able to attribute it, based on the construction of "significative and systemic experience of the open space" (Secchi, 1968). The spatial structure of the riverscape is described as a succession made by interconnected open spaces that are always variable and that are withdrawn and returned to the community on the basis of atmospheric conditions, heavy rainfalls, drought periods, flooding, and contributed together to define to construct the complexity of this place over centuries.

1.5 Accessibility and inclusivity of the Urban public space and role of Green and Blue Infrastructures.

Years of reconstruction of Dresden after the Allied attack in the II World War have played a crucial role in the imagination of a scenery of the new city according to criteria of urban development and growth of global economic finances. One of the historical urban fabrics that connects the "Bahnhof" of Dresden (the main central station) with the Elbe river, through the "Augustusbrücke" (the most ancient bridge in the city of Dresden) and then with the Neustadt, has been the subject of a series of interventions that have replaced old buildings with a new urban district in which commercial buildings, offices, important chain of hotels constitute today the sight of interest for Tourists and daily users that spend time in numerous shopping malls.

The increase of prices, as well as reduction of opportunities of meeting different social groups (especially for new residents associated to the great waves of immigration) make urban spaces that surrounding the neighborhood of the Altstadt a exclusive place of urban "gentrification". Only a reduced part of residential buildings constructed during the DDR period (Deutschland Demokratische Republik) resist in the area, as it was a symbol of a memory that is still strong in the mind of the community and still not trespassed. On the other side, the river appeared as a place of democracy and the public space for excellence able to ensure to everyone "the right to the city"^{[5} which includes the right to participation and appropriation in their shared urban environment.

The "openness of open space" (Lynch, 1972) recognizes a democratic public space if that space is openly accessible, and/or uses common resources, and/ or that has common effects, and finally is used for the performance of public roles (Parkinson, 2012). As an example, these aspects flow from several no cost initiatives organized by the administration for the community in areas that work temporarily both as "place of participation" and as water basins in case of perturbations or in spread experiences of KleinGärten^{[6}, which associate purposes of sustainable use of public soils through the free transfer of public allotments for horticultural practices with wider scopes of social inclusion. In these areas a new human dimension can be discovered capable of restoring human dignity through direct involvement in productive activities which on one side catalyze a locally grown circular economy and on the other side an "active citizenship" (Bonomi, A., Della Puppa, F., Masiero, 2016). This approach leads us to give more importance to the theme of informality and to spaces not quite designed which have disappeared within a global market (Sennet, 2015). The dynamic of public space can be easily associated to what is happening with the theme of open markets, suggested by Sennet. In the informal markets, people can more interact, and also very poor people have to participate in the economy of the city by doing something other than manufacturing. The concept of informality attributes spaces the capability of being entry points for people in the economy of the city within an urban dimension that is continuously evolving.

The question that the research poses with regard to the production of public space is mainly focused on the physical space and the people who govern it, and the guestion of how these spaces can allow people (without exception) to participate and be involved in it.

This concept can be applied to public space in terms of capability of involving people, and when expressed in terms of social class, in the meaning of who

⁵ While in 1960 the protest against the negation of rights was carried on by the class of workers, today economic models and new trajectories suggest new individuals that have equally to fight for the right to the city", but for different purposes. The text which the research refers is the contribution of Lefebvre H., in: "Il diritto alla città" (Lefebvre, 1968)

⁶ In order to obtain a more precise definition of KleinGarten, consult the third chapter, or Cfr the website: https://www.dresdner-gartenfreunde.de/stadtverband/satzung



Figure 7. Morphodynamics of the river and relationships between water and contemporary patches. Source: map realized by the author.



August 14, 2000



Before and after the flooding

The comparation of the 2 satellite images took by the NASA show the water stage before and after the flooding of the Elbe river in 2002. The flooding hit several cities in the Saxony region in less than a week, by provoking several milion of damages and a limited number of peope death. Puropse of the comparation is to highlitght the distructive rate of extreme events in cities like Dresden.

(14 - 20 August 2002).

Figure 8. South of Wittenberg. As can be seen, the river resembles a fairly large lake on the right-hand side of the image just south of the town of Wittenberg, Germany. Earlier in the week, the floodwaters inundated Dresden to the south. Source: Image courtesy Jacques Descloitres, MODIS Land Rapid Response Team at NASA GSFC. (B) Image courtesy of Jesse Allen, NASA Earth Observatory; data provided by the USGS EROS Data Center Satellite Systems Branch.

can engage in it. According to this theory, "unused and abandoned space" (Berger, 2007) can also serve other purposes in the contemporary society, and can also be places that anyone can colonize. The question that the research poses in terms of the production of public space is mainly focused on the physical space and the water management of these latter. The river has responded partially good to this objective, but surely with highest results compared to other cities in Europe and the interference of administration and governments in general can help to keep this effort active. In particular, interventions for the creation of small and spread free activates, temporary uses, but also the capacity of letting different spaces open for a community, always wider and diversified, can help stopping forms of gentrifications that transform pieces of city into "non lieux" (Augè, M., 2009).

Climate change and future challenges: the catastrophe of August 2002 as catalyst for the implementation of strategies of resilient adaptation and mitigation of impacts.

The extreme event of August 2002 signed a moment of general terror for all Central Europe which the generations of that time have never experienced (Figure 1). Previous natural hazards that can be comparable with the latter dating back to the extreme event on 31 March 1845, when the water stage of flooding was almost critical to that of the 2002 event (Mudelsee, M., Börngen, M., Tetzlaff, G., Grünewald, 2004). However, the flood of 2002 is considered an unprecedented event that was determined by meteorological causes induced by the low pressure that travelled on a path which led to prolonged rainfall, had a water stage of 940 cm stage, and a 4700 $m^3 - s^1$ runoff (Figure 8 A and B) that was never registered in history of Dresden (Ulbrich et al. 2003a, 2003b). The surrealistic condition was that major damages were provoked not by the flood of the great Elbe river, but rather by the runoff dynamic of "Weißeritz", a small tributary that flowed through a dense inhabited area of Friedrichstadt and that overflowed into the nearby Altstadt, the old city of Dresden. A few years after the event, several researches and studies on this theme debated on the issue of a lack of "flood experience" and about the necessity to enhance the preparedness of the community in forecast of future events (Kienzler et al., 2015).

However, seems that the spatial structure of some urban fabrics urbanized during the phase of expansion of the city in the XIX century turn out to be major vulnerable and not physically set up to face a further severe extreme event. This data of conflict is juxtaposed with forecasting regard major pressure and acceleration of phenomena induced by climate change, which transform also Dresden into an "extreme city" (Viganò, P., Fabian, L., 2010).



Figure 3. Mobile Flood protections in action during the Flood 2006. Dresden. Source:

What is certain is that an effective match of those preoccupations found place effectively within short period of time with events of April 2006 and June 2013 that, although they were less damaging led to water stage of rivers and tributaries at alarming levels.

The theme of risks arises especially in connection with the presence of peri-urban contexts and small villages of ancient origin that surrounds the city of Dresden and that have been subject over time of a process of expansion that led to the creation of a "spread city"(Indovina F., 1999), thanks also to the growth of industrial sectors during the XIX century or simply in response to healthier environments requests. However, each of these territories come up with greater problems associated to an extremely fragile territory in which they are settled and the presence of the water network constituted by a capillary network of 2nd order channels. The water network, in fact, has been subject of interventions of regimentations, impoverishment of their ecological environments over time through the destruction of riparian systems and the construction of urban fabrics in correspondence of fragile areas in proximity of water embankments and burial of water channels.

However, the flood in 2002 in addition to being a catastrophe which caused damages to human life, environment and buildings, can be considered a catalyst through which a series of programs and actions have been realized at European, national and local levels, which have led the city towards the consideration of a vision more integrated regarding climate change. In the Dresden region, policies like "REGKLAM" (The Regional climate Change Adaptation Program for Dresden) is an example of how this approach focuses not only the realization of technical solutions for the future, but rather it also includes the realization of more integrated program that aims to enhance the adaptation to long term strategies. In particular, these expect the use of nature-based solutions in fragile areas and the re-conversion of impermeable soils into more permeable spaces which are designed both to ensure recreational purposes and as tool for "controlling natural processes" in case of extreme events. According to European Directive and local strategies and in response to a necessity to find efficient solutions in case of extreme events, the authorities of Dresden city activated the "Flood protection system" after the event in 2002 that worked through the installation of Mobile Flood protection barriers in areas of particular vulnerable and extremely exposed at inundations (Figure 3). Despite the necessity of securing the community against severe catastrophes, "the spring flooding of the Elbe in 2006 and, particularly, the major June flood of 2013, underlined the importance of flood protection while at the same time indicating the limits of technical solutions" (Bernhofer, C., 2013).

All of these efforts arises in relation to water risks and solicit a crucial reflection on the balance between "resistance and resilience", which in the city of Dresden activate Flood prevention technologies in case of extreme events, which temporarily protect territories but leave them always fragile and easily strikable by extreme event. Either way, the coexistence of an increasing risk du to climate change and the complexity of this city solicit again the necessity to refer to those "hydraulic cultures" (Vi-ganò, 2012) become an extremely important part of contemporary urban design and planning for these reclaimed (bad that were superseded during the modernization phase in XIX century and to enhance resilient strategies of wider view and long term.

The acceleration of risk phenomena associated to climate change suggest that the challenge is hard and extremely complex and requires a collective effort in which city authorities needs to be at the front line in order to enhance the realization of policies that are able to conjugate a safeguard culture and the capacity to re-design fragile areas in order to make them more resilient over the time. In particular, the efforts made to guarantee the combination of temporary uses in water drainage basins (as previously shown) represent a segment of actions that goes towards this direction. The capacity to allow temporary flooding and to return them to regular use is an approach that allows an ecosystem to endure and persist, despite periods of instability and heterogeneity (Holling, 1973).

Is a great work of city authorities not only those of carrying on programs and actions for the mitigation of impacts associated to climate change, but also of educating newly the community to reacquire the "flood experience" (Kienzler et al., 2015) that acts as prerequisite in fragile territories such Dresden.

In particular, events in recent years associated to the debate concerning the densification of areas previously inundated for the interests of Real estate markets and for the realization of new houses remains one of the main purposes to pursue in order to guarantee safety conditions in case of new extreme events. From this point of view, the riverscape (**Figure9**) of Dresden needs to be seen in its entirety and through a cross-collaborative and trans-scalar approach that provides the "instrumental equipment", such as the management of risk in this case, to best handle the complexity of the contemporary city (Bèlanger, 2012).







Figure 9. View of Dresden Elbe valley from the Frauen Kirche Couple. Source: Photography of the author.

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Acknowledgment

After a 3-year Urban planning Ph.D. experience exploring the continuously changing urban landscape and important challenges we have to deal for the future of cities, the journey has come to an end. In these years I have had the occasion to confront with the work of colleagues, professors, experts of the field of research to which I owe a lot.

Before moving on to the next stage of my career I want to thank all the people that made these last 3 years such an intense, exciting and educational experience. Thank you all!!

I wish to express my sincere gratitude to my Tutor Prof. dr. Carlo Gasparrini

I am very grateful to you for giving me the opportunity to work with you. The first time I met you I was a master degree student following a course which you still today teach. After the graduation, I started a professional experience in your studio cooperating in interesting projects. Later, I participated in the national competition to become Ph.D. which I won and you became my tutor. I can say that you guided me through my education, helping me to progress tremendously on professional and personal level.

As we already discussed, I would like to continue to continue to take advantage from your knowledge.

I thank also all the research group of the University of Naples thanks to which I could reached this scope. In particular Anna Terracciano, Sabrina Sposito, and Daniele Cannatella. They were precursor in this long path of research.

Stefania: we met each other in the university almost ten years ago and together we have shared not only the educational path that led to the Ph.D. dissertation, but also personal and friendship experiences that made me a different person.

Also, many thanks go to the Head of the Department Prof. Ana Viader Soler for letting me join her research group of the Technische Universität Dresden at the Institute of Landscape Architecture. In particular, I feel the necessity to thank the group of researchers and assistant professors Laura Veronese, Anne Oberritter, Annegret Stöcker. Beyond their academic experience, they are really kind persons. I cannot help thanking Friedrich Wakker, a special person with who I shared great part of my experience in Dresden. His passion for Italy and our culture has made possible to construct an intense estimated friendship that I will conserve for the rest of my life.

To my family.

All this would never happen without the support of my family. To my father, the person that more of than anybody else has transferred to me the value of the culture and the self-sacrifice. Despite you are not anymore with us, I will always try to not fail you. I am certain that my academic and professional experience in Germany would have make you proud of me. In the meantime, I learned the German language!!

To my mother and her incredible courage that helped her in the life and the capacity to encourage me during these years. To Andrea and Marco, my brothers. Your support in everything I have done meant a lot to me. You all are the most important value of my life and my proud.

The latest thank goes to kim Visser, the person that supports me in everyday life and comprehend in this academic experience my preoccupations and doubts. On the other hand, it is thanks to the doubts that this research has produced some results.

