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Doctoral Thesis

Exploring New Approaches in Urban Water Governance: Case Studies in Mediterranean Areas

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Doctoral Co-direction Programme in Geography;
Directed by
David Saurí Pujol (UAB)
and
Spatial Planning and Public Policies
Directed by
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"Water is the most essential, invaluable element, often lacking, always irregular.
Mediterranean civilizations have always mastered water, transmitting a huge heritage of constructions and know-how."

Fernand Braudel. The Mediterranean. 1987

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I have firmly wanted the co-direction of the two universities UAB and IUAV, in order to make possible the realization of this Thesis in co-direction and for establishing research cooperation and a scientific network. Therefore, I thank the two Heads of Doctoral Schools Antoni Durà Guimerà (UAB) and Alberto Ferlenga (IUAV) and the efficient secretariat staff of the two Universities.

In 2012, I took part in the European Project: Trust - Transitions to the Urban Water Services of Tomorrow, developing the Task 2.2.2 (M1-16 UCRAN, IWW) titled “Customer perspectives on new urban water services” at the Cranfield Water Science Institute, Environmental Science and Technology Departament, School of applied science (Cranfield University - UK).
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I could not be prouder of my academic journey… especially because… "We are the scientists trying to make sense of the stars inside us…" (Christopher Poindexter).

Barcelona, June 2014

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“La vida de qualsevol persona està feta de preguntes. De mil preguntes. Cada dia en surt alguna. A voltes, una d’elles, sense que siguem capaços d’evitar-ho, s’instal·la al nostre cap i no ens abandona fins que no trobem una resposta satisfactòria.

Hi ha qui opina que la resposta no es el que importa; hi ha qui pensa que la pregunta i com la resolem es el que dona sentit a les coses de la vida. És tal vagada el repte de d’interrogar-se, d’aproximar una solució, d’intentar-la i, finalment, de trobar-la, el que pren valor.

El procés, el joc, el mecanisme, és el que diuen que val la pena.”

Joan Massagué. 2008. In, Sopars alb les estrelles.

1. Introductory chapter

The introductory chapter presents the background of the research problem and introduces the motivation, aim and objectives, the research questions, and hypothesis that were formulated during the early stage of this research. The chapter also describes the structure of the thesis and the research approach regarding how the study was conducted.

1.1. Background

Many of the world's coastal cities are becoming increasingly urban and many of them are shifting towards tourism, one of the fastest growing global economic sectors. Water is a key element for development and sustaining urban functions and new tourism facilities (UNWTO, 2013; Gössling *et al.*, 2012). However, rapid urban changes and transformations are stimulating a growing concern with regard to water resources. In particular, as new urban developments grow in complexity, dense networks of water flows intensify within the urban tissue and pose a major challenge for urban water governance.
Whereas the last century defined and represented the phenomenon of water as a material substance (H_2O), 21st century research has thrown into doubt such a perspective.

Social scholars have recently demonstrated (see e.g. Cook and Swyngedouw, 2012) the physical approach is no longer sufficient to deal with present and future urban water challenges, uncertainty and governance. Most importantly, new evidence has called for new discourses and representations of water cycle in urban environments and its governance model.
Geographers and political ecologists, in particular, have put forward the concept of the "hydro-*social* cycle" which integrates both the physical and socio-political nature of water. By employing this concept, through the lens of Urban Political Ecology, they have showed how water is closely linked to social, political, cultural, and economic systems and how they govern different flows of water through societies, shaping the formation of urban environments.

Research in urban water management and governance has mostly been from a functional and physical perspective, and more recently from a social and critical perspective concerning who in society benefits from water resources and who controls and governs it. Moreover, the way by which water flows, circulates, interacts and interweaves in urban systems dominated by tourism models (for example, mass tourism), has been little investigated in conceptual and methodological terms from Urban Political Ecology discipline and through the hydrosocial cycle concept.
However, as I argue throughout the chapters of the Thesis, addressing the research towards these issues might reveal increasing knowledge about hydro-social relations, to better manage and govern these important and dependent sectors: water and tourism in urban contexts.

For these reasons, both physical and social perspectives are analyzed, integrated and pursued in this Doctoral thesis and investigated in Mediterranean urban coastal areas where water is a critical resource to sustain the tourism leading economic sector.
Venice (Italy), Benidorm (Spain) and Mykonos (Greece), were selected as study areas particularly characterized by mass tourism model with high flows of yearly visitors. After analyzing their urban systems and transformation process, these were considered as candidate cases through

exploring the hydrosocial cycles and their governance systems, to reveal particular hydrosocial configurations.
From these cases, Venice was selected and investigated more in deep to explore the above issues and provide more knowledge about the relations among urban systems, water resources, tourism models, and their governance.
So far, studies about the water cycle have been scarcely applied in urban areas oriented towards tourism. Therefore the theoretical and methodological framework provided in this thesis was set out to expand such knowledge.

The thesis argues that new dialectical discourses and representations of the hydro-*social* cycle may open new windows to scrutinize water politics and governance. It also points towards the notion of "hydrosocial cycle" and argues for deeper engagement with the fields of urban political ecology and critical geography, to analyze, trace and assess physical and social water flows and their governance in tourist coastal cities.
The Thesis conclude that additional research is needed to extend these findings and investigate more case studies for identify strengths and weaknesses in the hydrosocial cycle analyses.
Staring from these premises, the Thesis hopes to be a useful basis of research for future investigations in theoretical and methodological terms.

1.2. Objectives and research questions

The aim of the research was to extend knowledge of the urban water governance in coastal cities dominated by tourist models for reaching better water governance system and policies.

The central objective of this thesis was, therefore considering different urban tourism systems and reconstruct, theoretically and empirically, their physical and social urban water cycle, to reveal urban hydro-social relationships and their models of governance of water.

The main research questions that has guided this research was: how hydro-social flows can be investigated and represented in different and complex coastal cities of the Mediterranean having different models of urban tourism?

The secondary research question was: how such characterization can help to explain different models of governance of water in urban coastal areas, and help to address better urban water policies?

The two most important expectations from this study were:

- To create a framework to analyze the hydro-social cycle from a physical and social perspective;
- To analyze an urban system to than move the analysis to explore the water cycle acting on such systems;
- To reconstruct the hydro-social cycle of a selected case study;
- To illustrate the hydro-social cycle of case study;
- To evaluate such hydrosocial cycle to provide more knowledge for improve the water governance issues.

1.3. Thesis structure

The Thesis is composed of a cover essay which includes an introduction to the research topic, and conclusions, and integrates the main body which is in turn divided in three chapters (figure 1.1). The paper presented in chapter 2 has been published in a scientific journal, and the other 3 and 4 chapters have been submitted for publication in international journal as well.
The papers have been carefully reviewed by the Supervisor David Saurì and the Co-Supervisor Giuseppe Piperata, as well as other anonymous reviewers and researchers, experts on the topic, which provided me useful comments to improve the chapters the main body of this Thesis.

Figure 1.1 describes the process by which the thesis has been structured and developed

PhD Thesis Structure			
Research Questions (RQs)	Cover Essay		
	Introductory part	Chapter II	*Results*
	Thesis Metodology	Chapter III	*Conclusions*
		Chapter IV	*Future research directions*

Source: Own elaboration

One of the most important decisions made in the course of publishing a scientific article is the choice of a journal. In fact, we know that such decision determines the audience reached.
Scientific journal has multiple functions; they provide a forum for scientific communication and certify the scientific value of a research work and access to reliable knowledge. For these reasons, I am convinced that the structure of scientific papers is suitable to synthesize and present new theoretical and methodological approaches of research into the research community and practical evidences from study-cases.
During my dissertation I sought to select scientific journals looking to water governance-issues and their relation with economic, political, social and environmental systems.

Therefore, after a general introduction to the research topic, chapter 2 presents the theoretical and methodological background used to develop this study and a framework to analyze the hydrosocial cycle governance in urban tourist environments.
This contribution attempts to examine first how different theoretical and methodological perspectives from Geography and environmental sciences explore water flows and their physical and social dimensions in the city as well as their changes in response to the emerging urban complexities and challenges. Using in particular the framework provided by Urban Political Ecology, I look at how the physical and social dimensions of water flows unfold and influence the urbanization process and, in turn, are influenced by urbanization. In the second part, attention is paid to urban coastal areas of the Mediterranean as candidate laboratories of analysis under urban political ecology since they are subject to rapid processes of social environmental change in which water plays a fundamental part. Case studies included to examine physical and social dimensions of water flows include heritage towns (Venice) and mass tourism resorts (Benidorm).

Chapter 3 analyses the processes of transformation of tourist coastal cities in the Mediterranean, and their urban complexity, through Urban Political Ecology perspective. The chapter also selects

Venice, Benidorm and Mykonos as tourist city-cases and systems of analysis where hydrosocial cycles and their governance might assume and reveal particular configurations.
Cities located in coastal areas are changing rapidly. Much of this change is attributed to tourism, which is considered one of the most responsible for urban transformation, and one of the main drivers of global socio-environmental change.
There are extensive studies on urban coastal landscapes analyzing how their change is facilitated by tourism. However theoretical and empirical understanding of new contemporary issues occurring in coastal cities, where tourism is a main activity, remain poorly addressed.
In the attempt of providing a critical examination of these emerging questions, the article adopts the Urban Political Ecology (UPE) discipline, as an emerging research field for socio-environmental change analysis in urban areas. First, it considers the concepts provided by the UPE, for analyzing change processes in coastal cities from global to Mediterranean scale. Then, it investigates and describes the Mediterranean cases of Benidorm (Spain), Venice (Italy) and Mykonos (Greece) as paradigmatic examples of changing coastal cities.
Coastal cities evolve, change and reconfigure themselves through physical and social, internal and external processes and relations infused in their continuous urban metabolism. The Framework provided by UPE may help to understand how cities produce and reconfigure new urban landscapes

In Chapter 4 the hydrosocial cycle governance analysis is applied to the Venice case revealing past and present complex hydrosocial cycle governance configuration. This paper explores the increasing relations between water cycles in Mediterranean coastal cities dominated by tourism, to develop more adaptable and sustainable urban water policies and governance systems. Water cycle largely sustains the socio-environmental system of these cities, as well as economic activities like tourism. However, these issues remain less investigated in conceptual and methodological terms.

This study attempts to explore these aspects through an empirical analysis of the hydro-social cycle in the historical center of Venice, in response to concerns over water resources arising from a massive tourism model, and excessive urban and social carrying capacity. I employ the “hydro-social cycle” concept which incorporates the water’s social nature. It has been defined in literature as an analytical tool for investigating hydrosocial relations. To do this, I first focus on the geo-historical aspects to understand how hydro-social relations have co-evolved, shaping the historical center of Venice. Secondly, I reconstruct the current hydro-social cycle by combining the urban ecology discipline by identifying and quantifying the water flows, and that of Urban Political Ecology by describing the discursive composition of water cycle, the powerful actors’ interests, the governance and control of these flows in the city of Venice looking to the role of tourism.
In conclusion, the framework provided by this study is suggested for further representation and critical understanding of governance systems related to hydro-social cycles in coastal cities characterized by dominant forms of tourism.
Results from this study indicate how the hydrosocial cycle analysis is useful to think about and improve better water policies linked to the tourism sector and the water governance issues.

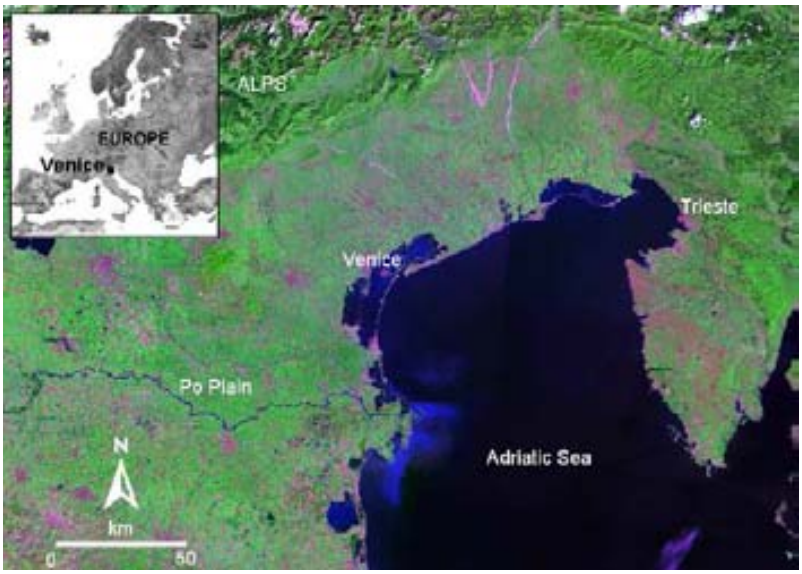
1.4. Study areas

Study areas – Venice (Italy), Benidorm (Spain) and Mykonos (Greece) - were selected from the Mediterranean context and analyzed, in chapter 2, 3 and 4, as systems of analysis to observe more

in deep how in these different urban environments characterized by different models of tourism the cycle of water might assume a particular configuration.

These cases are all dominated by a mass tourism model. However, distinctions can be done. Venice is characterized by a tourism cultural model, while the Benidorm and Mykonos characterized from a "sun and beach" model which is, oriented towards more sophisticated and independent travelers (business), but continuing to maintain the traditional offer for families and young, and quality tourism, respectively.
From the analysis of these three cases, it is interesting to note that a part their different tourist model characteristics, they have some element in common. For example, they initial process of urban development, as described in chapter 3, present many similar elements. Then different social processes and use of natural resources forged these urban contexts. In particular very different economical, socio-cultural and political features have influenced their current configuration. In Venice and Benidorm, new urban processes such as the proliferation of new urban forms, such as housing development with green gardens and private swimming pools, golf courses and new water amenities and tourist facilities, are taking place in their surrounding triggering generating new processes of landscape change.
As the tourism market represents the dominant economic sector for all these cities they are moving towards global logics of competitiveness.
Water is today a critical resource which largely sustains these cities and their economic activities like tourism.
Moreover, the three cases have distinct models of water management and governance:
The hydrosocial cycle of Benidorm shows an important presence of private interests, especially regarding supply. While in the case of Venice, where water supply is public private interests, refer more to the lagoon waters and flooding management (Chapter 4).

Figure 1.2. Satellite image of Venice location



Source: Carbognin et al. 2010

Then the research has concentrated more attention on the Venice case (Figure 1.2) which was selected among the previous ones to investigate how the water cycle and its governance system

takes place in its urban space, and to reveal the relation among water tourism and the urban environment.
As argued in chapter 4, the study case of Venice was selected because it represents a paradigmatic case to show how, since ancient times, hydrosocial cycles have shaped this city in dynamic ways. Water management experimented in this city, as well as its control and the power on this resource has largely influenced many other Mediterranean cities along the history.
Its current water cycle configuration and its water governance system are profoundly linked to hydrosocial relations of the past.

1.5. Methodology

The methodology of this Doctoral thesis is based first on an extensive Literature Review, and secondly on different fieldworks. A mixture of quantitative and qualitative methods has been used to address the objectives and the research presented above.
The fieldwork in Venice took place at different times and started in October 2010 when I was selected for participating in the 4th Advanced Curse of the Marie Curie Actions-Initial Training Networks (ITN), of the project: European Sustainable Water Goals (ESWG) titled "*Challenges in water resources management: vulnerable zones, risks and water* resources preservation", held at the Venice International University – VIU, Venice, Italy. The course topic was focalized on the analyses of the emerging water governance issues in different countries around the world, and relative policies and planning solution to cope the new water challenges. In particular, the Mediterranean basin was taken into consideration as analysis system. Case studies showed practical advice on these issues and were presented by water scientists and experts, researchers and PhD students, policy-makers from different European countries, as well as city council managers, and other practitioners dealing with water management. From the closing discussion emerged that the increasing relationships between water resources and tourism sector is already one of the most critical issues especially for many Mediterranean countries, and for their water governance systems.

During this training some visits were organized with the objective to observe the physical cycle of water in the Veneto Region which and the management this water in the Venice historical center (Figure. 1.3).

Figure. 1.3. Visit to one of the most important Veneto's spring, known as "Grotte di Oliero", on the Altipiano di Asiago.

Source: Own Pictures

1.1. References

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Gössling, S., Peeters, P., Hall, M., Ceron, J. P., Dubois, G., Lehmann, L. V., Scott D. 2012. Tourism and water use: Supply, demand, and security. An international review, Tourism Management, 33 (1) 1-15.

Chapter II

Exploring the Urban Hydrosocial Cycle in Tourist Environments

A similar version of this paper has been accepted for publication in the Journal *Investigaciones Geográficas*, Instituto Interuniversitario de Geografía. Universidad de Alicante

Ridolfi, E., Exploring the Urban Hydrosocial Cycle in Tourist Environments. 61, 17 - 38. (2014).

The preliminary version of this paper was also presented in the GRATS group's Research Seminar.

Ridolfi, E., 2013. Physical and social dimensions of water flows in Mediterranean tourist destinations. GRATS Seminar, Session "Els fluxes d'aigua als entorns turístics" (Water flows in tourist environments). Universitat Autònoma de Barcelona (UAB), Barcelona, Spain, June 10-11, 2013.

2. Exploring the urban hydrosocial cycle in tourist environments

Abstract

This contribution attempts to examine first how different theoretical and methodological perspectives from geography and environmental sciences explore water flows and their physical and social dimensions in the city, as well as their changes in response to the emerging urban complexities and challenges. Using in particular the framework provided by Urban Political Ecology, I look at how physical and social dimensions of water flows unfold and influence the urbanization process and, in turn, are influenced by urbanization. In the second part, attention is paid to urban coastal areas of the Mediterranean as candidate laboratories of analysis under urban political ecology since they are subject to rapid processes of social environmental change, in which water plays a fundamental role. Case studies included to examine physical and social dimensions of water flows include the heritage city of Venice and the mass tourism resort of Benidorm.

Keywords: Hydrosocial cycle, water, governance, Urban Political Ecology, tourism, Mediterranean region.

2.1. Introduction

Water remains a vital flow for the formation, growth and development of every urban settlement (UN-HABITAT, 2011). It is considered part of the complex web of relations between society and nature (Gandy, 1997) and one medium of social relations (Linton, 2010) through which urbanization will progress, thrive or decline (UN-HABITAT, 2011).

In coastal cities, possibly the most urbanized and populated areas around the world, water has played, and continues to play, an important role in determining urban expansion and transformation and sustaining the functions which depend on these trends. Tourism, one of the most growing global economic sectors, already represents a fundamental economic strategy of urban development for many of these cities that tends to diversify and specialize. Several western coastal cities have transformed themselves into important tourist destinations, with new urban patterns and tourist models. As tourism and others global forces of socio-environmental change are increasingly taking place in cities, new urban developments to accommodate people, activities and infrastructures will be needed. These developments will generate new urban configurations or will adapt themselves through new functions. The tapping of new water resources or the increased use of existing ones are key elements to sustain such needs. However, as Page and Hall (2003) have noted the scale, complexity and diversity of consumption characterizing these new urban configurations are leading to a growing concern with regard to actual and potential pressures on existing social and natural resources such as water. In this regard Gössling *et al.* (2012) argue that although direct tourism-related urban water use will not become significant even if the sector continues to grow, the situation may differ at regional level because tourism is concentrated in time and space, and often in destinations where water resources may be limited. This is particularly the case of many cities of the Mediterranean region where water is “a vital resource” but also “increasingly scarce and limited” (UNEP/MAP - Plan Bleu, 2009). Here tourism attracts a large concentration of visitors and is already the most important economic sector (UNWTO,

2012). It in large part influences urbanization and new urban forms and amenities (e.g. swimming pools, golf courses) which are highly dependent on water resources and that would be unavailable without it (Rico-Amoros *et al.*, 2009; Gössling, 2006, 2012). Physical and social factors are therefore raising special concerns regarding new uses, production, practices, management, control of urban water flows which are intensifying and posing major challenges of governance in the Mediterranean region, and elsewhere.

The main task of this paper is to explore the characteristics of water flows in coastal cities, increasingly specialized and diversified by tourism. For a long time, as the paper outlines below, flows of water have been discussed and treated from a physical perspective. First they were represented and conceptualized by scientists and engineers through the "hydrologic cycle"; a diagram tracing and explaining the process of natural water flow and its circulation in the environment. Then, through the "urban" - "hydrological cycle", also called "urban water cycle" the integration between "the natural and managed pathway that water follows in an urban ecosystem" (PAP/RAC, 2007) was sought after. This interaction was conceptualized by observing the increasing relationships between water and urban areas, in order to ensure water services to the urban population and to cope with emerging urban water-related problems (UNESCO, 2006: 3). Nevertheless, in the last decades, as rapid processes of global socio-environmental changes have made the urban system more complex, social scientists have observed that physical approaches and models of water management, have led towards a fundamental separation between the nature of water and its social context. Therefore, it was no longer sufficient to deal with present and future urban water challenges. From the social sciences came the idea that water in urban environment is not just a physical entity or a quantification matter, but rather a social issue (Linton, 2010). Geographers, in particular, have critically focused on the "socio-ecological nature of water". On the one hand, questions have been raised attempting to address the problems of water in the environment and in urban systems. On the other hand, the concept of "hydrosocial cycle", which incorporates newer approaches drawn from water political ecology and social studies of science, has been adopted (Budds, 2008, 2009; Kaika, 2005; Linton, 2008, 2010; Swyngedouw, 2004). From this perspective the hydrosocial cycle is defined as "the sum of the human and physical interrelationships pertaining to water in cities" (Keil and Young, 2001: 1), attempting to show how the social, political, cultural, and economic systems govern the flow of water through societies (see for example: Swyngedouw 2004, 2005; Bakker 2002; Swyngedouw *et al.*, 2002). In practice, the study of the hydrosocial cycle in urban areas involves a "big picture" "tracing the flow of water and examining the physical and socio-political discourses surrounding it, to illuminate the functioning of urban space in all its complexity and contradictions" (Gandy, 1997: 339). While much research on water has been conducted from a physical perspective, recently a growing number of contributions have tended to analyze its social dimensions. As this paper will attempt to show, practical applications of hydrosocial cycle concept on case studies selected worldwide are emerging. The review of these cases reveal that the concept remains in theoretical and practical terms, not fully defined, and is likely to become case dependent (Bardati, 2009; Fonstad, 2013). Furthermore, the variety of approaches and methods can also bewilder water researchers and practitioners (Fonstad, 2013). However, new dialectical discourses and representations of the hydrosocial cycle may open new windows to scrutinize water politics and governance.

Starting from these premises, this paper asks how the concept of hydrosocial cycle may help to analyze, trace and assess physical and social water flows and their governance in tourist coastal cities.

After framing the co-evolving relations between water and urbanism, their complexity and new challenges for governance, the first objective of this paper is to review the development of the hydrosocial cycle concept largely through academic research and previously published studies. This part endeavors to elucidate what we know about this concept and how it continues to change over time.
Second, the paper reflects how and to what extent this concept could be extended to hydrosocial cycle in urban tourist contexts. The cases of Venice (Italy) and Benidorm (Spain) are briefly presented in this respect as paradigmatic tourist coastal cities of the Mediterranean and very relevant to investigate the specific applicability of this concept.
The paper concludes by stressing the main results that have emerged from this study, and the potential to extend the hydrosocial cycle to urban tourist cities for further new ideas and representations of water governance in tourist urban areas.

2.2. Water and urbanism: co-evolving relations, complexity and new governance challenges

"It is the interaction between these two ecosystems (water and the city) that is both complex and fascinating."

Timmerman and White (1997)

Since ancient times water and urban environments have co-evolved continuously through complex interrelationships that are temporally contingent, spatially variable, and shifting through nonlinear processes and rates, giving rise to new urban and resource configurations. In recent centuries such interrelationships have intensified significantly becoming closely interlinked since urban communities have become even more dependent on water: first for the satisfaction of their basic needs and then for the increase in the large scale production and consumption of water-based goods and services (Castro, 2013).

According the latest *World Water Development Report* (UNESCO-WWAP, 2012) as the world's population is growing by about 80 million people a year, freshwater demand is increasing accordingly: about 70 percent of the world's water is used for irrigation, 20 percent for industry, and about 10 percent for domestic use, including new economic sectors like tourism. In the last century world water use has increased by six times, and between 1900 and 1995 at global level, the increase has more than doubled the rate of population growth. At the same time, urbanization and globalization process have been accompanied by profound changes in socio-political and cultural systems, economic power, environmental contexts, and by the development of several forms of social interaction at all levels (Goudsblom, 1992; De Vries and Goudsblom, 2002). Cities, more than rural areas, have captured all these changes and also the socio-environmental problems associated (UN-HABITAT, 2012).

According to the *Final Report of the United Nations Human Settlements* on water and urbanization (UNHABITAT, 2011) in a rapidly changing and urbanizing world, the dimension of water has become complex. Although the term "complexity" seems a recent feature of contemporary cities, Batty and Marshall (2012) highlight that urban complexity was observed already in the past by different social scholars. Geddes, for example, one of the first town planner

pioneers that dealt with urban complexity, noted that "towns or cities are a mixture of urban elements that grew out in a complex web of causes and effects and its interrelated parts interwoven throughout time" (Batty and Marshall, 2012: 24). Van der Brugge *et al.* (2007) argue that complexity about water problems is generated by the economic, ecological and social functions of water; and because water differs in time, place and manifestations, represents multiple values, is characterized by different forms (e.g. rainwater, groundwater, surface water, sea water) that manifest in different issues (e.g. water scarcity, and the alteration of the hydrological cycle). These authors argue that water problems are deeply rooted in the new types of societal structures and institutions characterized by significant complexity, uncertainty, and the high stakes for the wider diversity of stakeholders involved.

They also add that the complexity of the interactions of broad societal trends (characterized by significant complex societal interactions, structures and institutions) and physical (natural) processes lead to problems of management and governance of water. In this regard, Castro (2013) and Peña García (2007) note how human societies have established different forms of control over water to govern, allocate and manage this resource and political and economical decisions also have determined social relations with water. Norman *et al.* (2012) state that the complex interconnections of human-environmental issues, and more specifically the complex nature of flow resources such as water, continue to complicate and challenge current governance systems. In this connection, all the talk about the "water crisis", of the last decade, has been recognized as a "crisis of governance" (GWP, 2000), for the lack of proper consideration of the social, cultural, economic, environmental and political dimensions in which water is embedded (Rogers and Hall, 2003).

However, new recognitions about the social dimension of water are emerging and opening new perspectives to beyond physical issue. For instance, the UNESCO's *Third World Water Report* (2009) has emphasized how "alongside the natural forces are the actors who make or influence broad socioeconomic policies that affect water". This report also argues that the cycle of water begins with the interaction of political-process actors – government, civil society and business – deciding on socio-economic development and formulating policy and operational decisions influencing the water circulation in the society (UNESCO – WWAP, 2009).

The next section attempts to show how in the last decade, scholars in geography and environmental science have endeavored to conceptualize, theorize and represent these issues concerning the complex co-evolutionary relationship between water and urban society bringing to light the nature and multiple dimensions of water and the new challenges of governance through the concept of the hydro-*social* cycle.

2.3. Development of the concept of hydrosocial cycle: the long journey of water flows through discourses and representations

2.3.1. The Hydrological cycle

Since ancient times water, flowing and forming part of humankind and its surrounding environment, has always stimulated in people and civilizations interest and questions about its nature and the way in which it circulates on Earth. It has also become one of the central areas of interest in the discipline of Geography since its foundation (Fonstad, 2013).

Linton (2008; 2010) explains how the need to understand the functioning of water for basic human needs and the provision of water supply has offered a variety of observations, explanations, hypotheses, representations and visions from the antiquity to the present. Until the seventeenth century, when the first ideas concerning the circulation of water and its cycle, were developed, water was recognized as the "blood of the Earth" and its flow were considered a subterranean, natural, divine, spiritual and theological affair (e.g. Tuan, 1968). The first theories was based on observations of rainfall and river flow in the Seine basin, and on the idea of evaporation from the Mediterranean simulated by Edmond Halley (Goudie, 2000) (Figure 2.1).

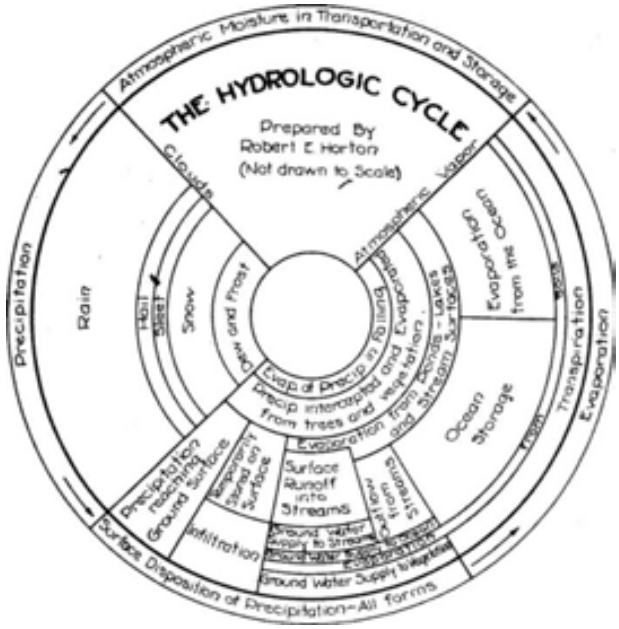
Figure 2.1. The subterranean flow of water Athanasius Kircher ca. 1664

Source: Adams (1938: 437) *In*, Linton (2008)

In time, these ideas and theories have evolved and have brought hydrologists to conceptualize water as a physical substance (H_2O), governed by the so-called "hydrological cycle", a concept explaining the "continuous circulation of water through the ocean, land surfaces, water bodies and atmosphere at a variety of geographical scales" (e.g. Jones, 1997), and "fuelled by solar energy, driven by gravity and proceeds endlessly in the presence or absence of human activity." (Maidment, 1993). The development of this term "hydrological cycle" (United States 1931) and the diagrammatic form by which it is typically represented has become the most important concept in the hydrology science by conceptualizing water behaviour in a consistent, uniform and rational manner. In the United States, in the 1930s, it was adapted to the needs of the state planning agencies to sustain the largest program of fluvial transformation ever undertaken, for the purposes of accounting and controlling water flows; promoting the coordination of national resource conservation and development, and for rationalizing and centralizing water planning. Karen Bakker and others have described this way to use the hydrological cycle as a means to guarantee water supply by the State or, in other words, the "state-hydraulic paradigm". As Linton and others have observed, from its conception, the "hydrologic cycle" has produced "scientific" ways of knowing and representing water, but at the same time, it artificially abstracted water from

its social, cultural, religious and ecological contexts, reducing it to a single substance H_2O, suitable for technical applications (Figure 2.2).

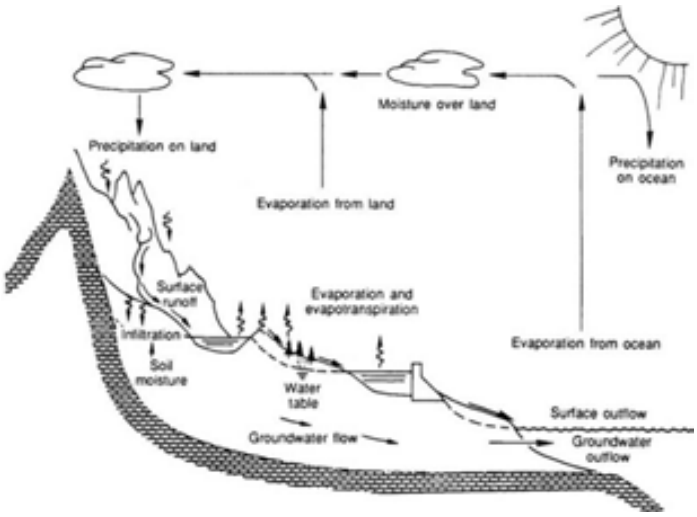
Figure 2.2. The Horton's hydrologic cycle



Source: Horton (1931: 193) *In*, Linton (2008)

This abstraction that Linton (2010) calls "modern water paradigm" helped to underpin the hydrologic cycle discourse with human intervention and development needs. In the Western United States such discourse, justified by the aridity issue, was responsible for, from the mid-1930s to the mid-1960s, thousands of dams and reservoirs that were built turning and managing every major river by the federal government (Figure 2.3).

Figure 2.3. The hydrologic cycle adapted for dams and reservoirs



Source: National Research Council (1991: 18) *In*, Linton (2008)

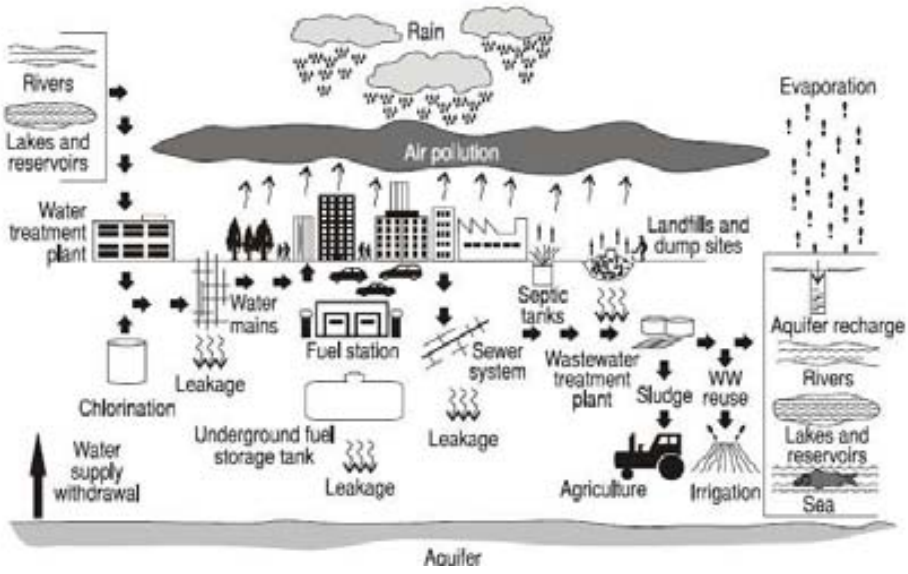
The hydrologic cycle started to be used as a tool of control, management and planning of water resources in different ways and for different socio-environmental interests as well as according to specific historical and geographical circumstances (Linton, 2008: 630). In this connection, the hydrological framework has been central in many environmental analyses so far, from hydrological water balances (Thornthwaite and Mather, 1955) to the characterization of hazards and risks for humans and waterscapes (White, 1945). Much of these analyses has focused particularly on the hydrological cycle and its influence on climate and global warming (e.g. Ohmura and Wild, 2002; Held and Soden, 2006; Oki and Kanae, 2006; Rind *et al.*, 1992). Mariotti *et al.* (2002) for example, analyzed the hydrological cycle and its implications for climate variation in the Mediterranean region.

Although hydrologists and physical scientists consider the study of the hydrological cycle fundamental for the knowledge of water flows, many social scientists state that its cyclical representation establishes a norm that odds with the many different environmental and social contexts regarding social experiences with water (e.g. Linton, 2008).

2.3.2. The hydrological cycle in urban environments

Discussion about the hydrological cycle has increased significantly in the last decades with the development of urban phenomena. It was observed how the hydrologic cycle was becoming more complex in urban areas because of the many anthropogenic influences and interventions (McPherson and Schneider, 1974; Brilly *et al.*, 2006). As a consequence, the resulting "urban" and "hydrological cycle" were then called "urban water cycle" (UWC) (figure 2.4).

Figure 2.4. The urban water cycle



Source: UNESCO-IHP-VI (2006)

The term "urban water cycle" has been defined as "the natural and managed pathway that water follows in an urban ecosystem, that includes the hydrological cycle and artificial systems to support human life and economic activities, health, hygiene, safety, recreation and amenities" (UNESCO, 2006). In practice, it encompasses the quantification of inputs, consumption and

outputs of water flows in an urban region (UNEP-MAP, 2007). Since then, the hydrological cycle framework has incorporated the urban social dimension leading to the development of the science of urban hydrology. Urban water cycle analysis has been, and is still considered particularly important for urban planning (i.e., providing water services to growing populations) for identifying problems associated with urbanization (Lee *et al.*, 2010) and for coping with urban water challenges as well as global environmental change (Fletcher, 2013). This concept has put together the interdependence of urban water resources and human activities, and the need for integrated management. In this connection, the concept of total urban water cycle management was introduced in Australia and defined as the collective consideration of the water supply, storm water, waste water and ground water components of urban water service. Components of a total water cycle within urban water management include: (a) re-use of treated waste water, (b) integrated storm water, groundwater, water supply and waste water management, and (c) water conservation approach through reduced water demand and recycling provision (Mitchell, 2006).

2.3.3. The integrated urban water cycle

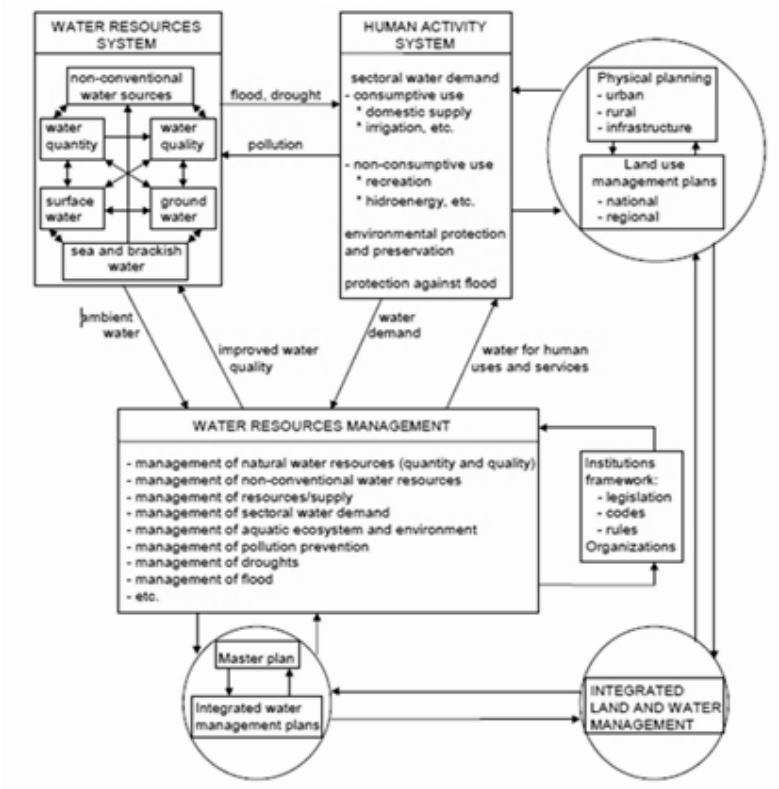
The understanding of all flows and balances of water is essential for an integrated management of urban water. For this reason the *Integrated Management of Urban Water* (IWRM) has become an empirical concept which promotes the co-ordinated development and management of water, land and related resources[1]. In this regard, many efforts have been made, some of which have been addressed to the Mediterranean basin.
In 1997 the *Regional Activity Centre for the Priority Actions Programme* of the UNEP's *Mediterranean Action Plan* acknowledged coastal water resources as a priority issue, because a large part of the basin was already experiencing water scarcity due to the rapid population growth, urbanization processes and mass tourism. In the attempt "to support an integrated approach to water resources planning and management" the hydrologic cycle representation was adapted to the Mediterranean coastal cities (Figure 2.5) "to integrate the relevant knowledge in the physical and social sciences and to create a theoretical and practical basis" (PAP/RAC, 1997).

Despite this attempt, water problems have become more persistent due to a scant attention of the land, sea, river basin and coastal zones interface in the context of resource management. Additionally, as international and European institutions, agencies and several programs, activities and directives such as the *European Water Framework Directive* (2000) covered only distinct parts and issues important to the urban water cycle, new guidelines have been provided to address this gap through the integrated framework called *Integrated Urban Water System Management* in a Coastal Area (IWSMCA) to promote the coordinated planning, development and management of water, land and related physical and human resources in coastal urban areas (UNEP-MAP, 2007). This framework considers, besides water flows pertinent to towns and cities along the Mediterranean coast (UNEP-MAP, 2007: 19) they interactions with factors such as culture; social groups and power relations; history; perceptions and ideologies; political organization; urban form; economic structure and development. These guidelines intended for engineers, urban water resource managers, urban planners, and expanded to social scientists, provided a new representation of integrated water flows in coastal urban systems (UNEP-MAP, 2007: 4). A similar representation of the flows of water for the city of Barcelona was provided by Barracó et

[1] The IWRM is a concept widely accepted and defined by the Global Water Partnership. Initially, many parts of the concept were identified during the first global water conference in Mar del Plata in 1977. After Agenda 21 and the World Summit on Sustainable Development in 1992 in Rio the concept was extended in practice.

al. in 1999. It included supplementary sources of water: bottled water and water-containing foods, considered of particular importance in urban areas especially in coastal tourist cities (UNESCO, 2006: 30).

Figure 2.5. Schematic presentation of the integrated development, management and use of coastal water resources

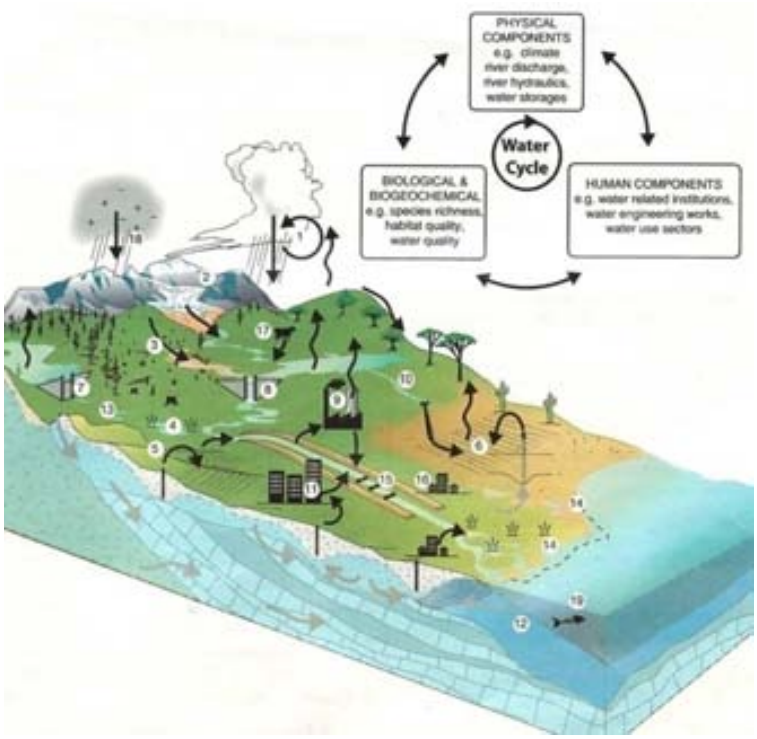


Source: PAP/RAC, 1997

In attempting to investigate and integrate all physical water flows in urban areas and coastal areas to be safely used, reused and returned to nature through their management, the urban water cycle (see figure 2.6 conceptualized by Vörösmarty *et al.*, 2004) has provided important methodological and empirical advances so far.

The use of hydrological models, quantitative assessments (e.g. in the Mediterranean, Amores *et al.*, 2013), and indicators to assess the sustainability of urban water cycle (Van Leeuwen *et al.*, 2011) has then been set up and retained "essential for understanding changes in the water cycle as a result of urbanization and for the recovery of a comprehensive water cycle system in urban areas". In particular, the models have been developed and applied to demonstrate their functionality in estimating and/or forecasting the water demand in urban areas worldwide. Such models and cities include the *Aquacycle model* in Canberra, Australia (Mitchell *et al.*, 2001) and in Seoul (Lee et al., 2010), the *City Water Balance* (CWB) model (Last and Mackay, 2010), the *Life Cycle Assessment* (LCA) methodology in Alexandria, Egypt (Mahgoub, 2010), as well as the *Urban Water Optioneering Tool* (UWOT) (Makropoulos *et al.*, 2008). The Alexandria's study, for example, focused on the assessment of the urban water system and provided scenarios encompassing technical interventions, better management procedures, and generally, new solutions for improving the systems in the future.

Figure 2.6. The global physical and social water system



Source: Vörösmarty *et al.* (2004: 509)

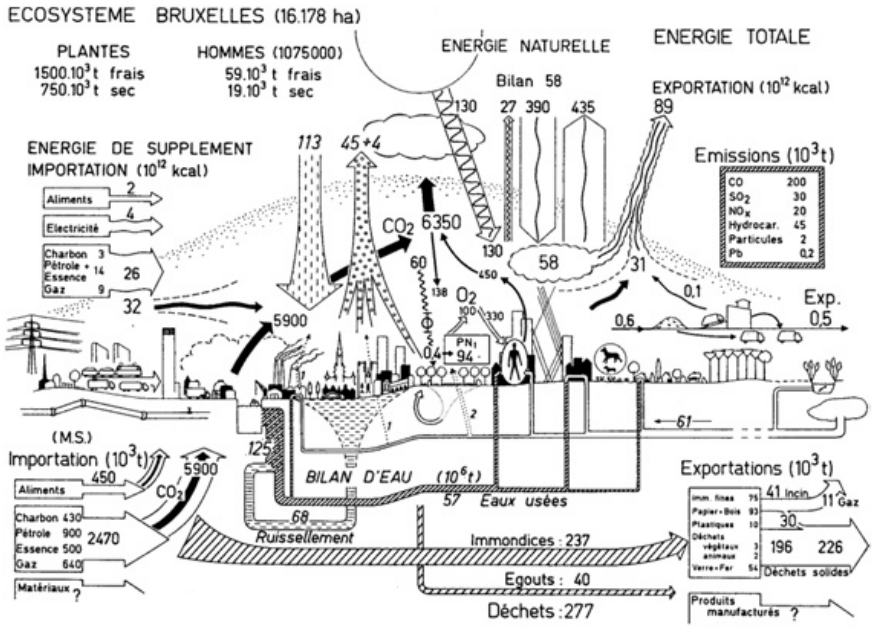
2.3.4. The integrated urban water cycle and its metabolism

In pursuing the objective of providing detailed information and expanding knowledge on water flows in the city, models of the hydrological cycle continue to evolve. Rozos and Makropoulos (2013) for example, have recently argued that the models mentioned previously that include the distribution system, the consumption and the drainage of wastewater and storm water consider only a part of the urban water cycle. For a complete study of the urban water cycle, they have redesigned the *UWOT model* as an *urban metabolism model* "to provide a common modelling environment for the whole urban water cycle from source to tap and back" (Rozos and Makropoulos, 2013: 140). According to these authors this holistic approach applied to the case of Athens, Greece, and integrates the basic rationale behind the urban metabolism concept, which suggests that the relationship between the environment and an urban system can be described by systematically recording all flows to and from the environment (Minx *et al.*, 2010). In this direction, a new model able to analyze every flow related to the urban metabolism is now being developed by the EU project *TRansitions to the Urban Water Services of Tomorrow* – TRUST (TRUST, 2013). The latter is done by taking into account the economic, social and environmental conditions as well as local circumstances and existing systems (natural, engineered, and socio-political) of urban water governance.

The concept of urban metabolism, first developed by Abel Wolman (1965) in response to the rapid urban expansion and deterioration of air and water quality in American cities, is still recognized as an important means to achieve sustainable urban development (Kennedy *et al.*, 2007). In practice, it involves the quantification of the inputs, outputs and storage of energy, water, nutrients, materials and wastes for an urban region (Kennedy *et al.*, 2011).

Among all these components water is considered the largest and closely linked with other components such as energy (Kennedy *et al.*, 2007). Kennedy *et al.* (2011) has charted out a history of urban metabolism studies, including urban water issues and has maintained that such studies have practical applications to urban designers and planners as an adaptive approach to technological and socio-political solutions and their consequences (figure 2.7).

Figure 2.7. Water cycle into urban metabolism of Brussels, Belgium (1970s)



Source: Duvigneaud and Denaeyer-De Smet (1977)

The concept of urban metabolism has been particularly employed by the new discipline of Urban Ecology discipline. From this perspective cities are seen as ecosystems embedded in a larger system. According to Grimm *et al.* (2000) the city studied as an ecosystem allows for the analysis of flows of energy, materials and information together with the interactions between human and non-human elements of the system so that the complexity of urban systems can be fully captured and interpreted (Grimm *et al.*, 2000; Mehmood, 2010; Newman, 1999). Scholars in this field focus not just on understanding the ecology of cities but on problem identification in the functioning of urban systems in order to develop and address urban planning, policy and design interventions. Alberti and others (1999; 2008) have shown how urban ecosystems consist of multiple interlinked subsystems that continually interact among each other in which humans and their activities, rather than being external, become incorporated into these ecosystems (Alberti, 1999; Grimm *et al.*, 2000).

According to Rapoport (2011), in recent years the concept of urban metabolism has been employed in a diverse range of disciplines thus expanding our knowledge about resource use in urban areas and increasing our understanding of the relationship between urban economies and the environment and, as it will be shown next, providing a critical perspective about the way in which the urban is produced by the relations between social and natural processes.

2.3.5. The hydro-*social* cycle

Hydrological sciences have made great advances in providing knowledge, techniques, system modeling technology, as well as numerous international and national efforts in global and regional water resources assessments and applications. In particular, over the past ten years, these advances have included a growing awareness of the ecological and social implications of "water management".

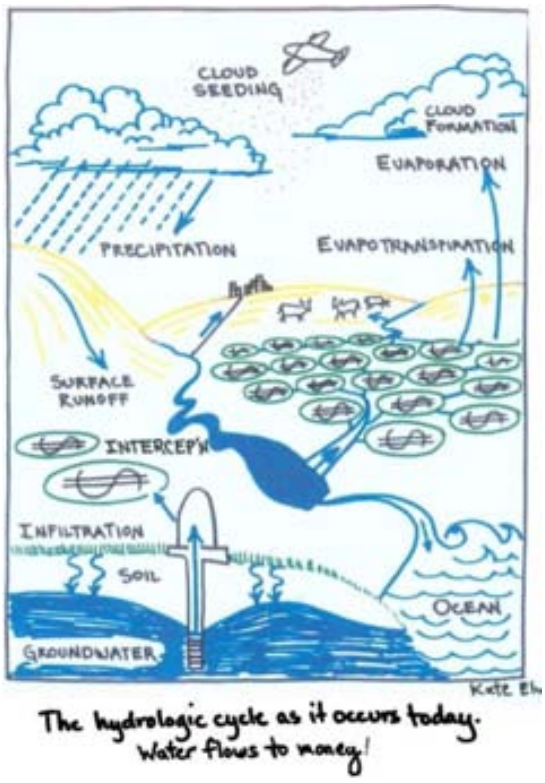
However, as increasing types of water flows have become ever more powerfully interdependent with the growth of world population and its economic activities of production and consumption, these views have fallen under scrutiny from social scientists. Intellectual, political, economic and social factors have given rise to new ways of understanding the nature of water (Linton, 2010). Contemporary complexity of water in urban spaces has gained the attention of many scholars in particular from the geography and social science disciplines. On the one hand, they have raised questions attempting to address the problem of water in environment and urban systems. They wonder not just how much water there is and for what, but who has access? Who controls and manages it? What are the power relations in the society through which this water circulates? How water flows influence the urbanization process and, in turn, are influenced by urbanization? (Swyngedouw, 2009). On the other hand, they have put forward the «hydrosocial cycle» concept, which incorporates newer approaches drawn from water political ecology and social studies of science (Budds, 2008, 2009; Kaika, 2005; Linton, 2008, 2010; Swyngedouw, 2004).

The political ecology of water explicitly considers how the relations among political, social, economic and power action, force and dimension influence current, or give place to new, water flows becoming socials. This perspective has attempted to analyze how the flow of water may influence the urban space and how this resource is embedded in the social dimension of the city. Therefore, the complex relationship between water and society has been conceptualized with the emerging "hydrosocial cycle" concept. In particular the concept has been developed by geographers working in the tradition of the political economy and political ecology of water (see e.g. Boelens, 2013; Barnes, 2012; Wang, Otto, and Yu, 2013; Gandy, 2008). For the last 15 years, the hydrosocial cycle concept has attracted significant attention in the context of contemporary debates about nature-social interactions and among critical geographers. From the political ecology perspective the hydrosocial cycle helps to disclose how flows of water are produced by, and acting on dynamic social, political and economic power relations at various nested and articulated geographical scales, also among actors and institutions (Cook and Swyngedouw, 2012). It encloses water's symbolic and material dimensions (Linton, 2008) and has been used to reveal capital accumulation and inequalities of access to water induced by water management practices as well as the processes of water commodification and its social effects (Cook and Swyngedouw, 2012).
During the last decades the political ecology discipline has been appropriately extended to the foreground of "urban" through "Urban Political Ecology" (UPE). According UPE scholars, it provides an integrated and relational approach that helps untangle the interconnected economic, political, social and ecological processes that together go to form and shape urban landscapes. Many studies drawn on this approach have explored how nature and city can be viewed as a process of socio-physical metabolism under the current capitalism, and infused by relations of power in which social actors, institutions and scales play a fundamental role (e.g. local, regional, global). Through the notion of metabolism UPE scholars have moved away from a society-nature

dualism to seeing the city as a process of metabolically transformed nature, even a socio-natural hybrid or a cyborg of machine and organism (Kaika & Swyngedouw, 2000; Gandy 2005).

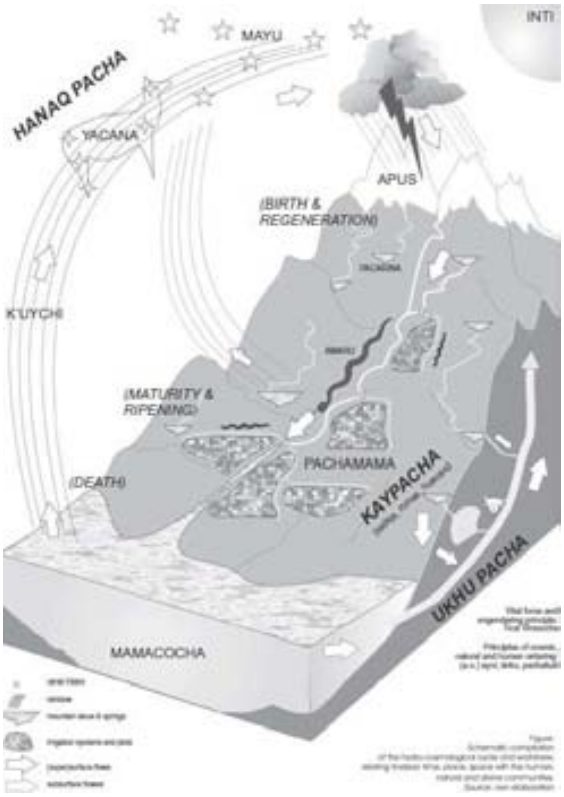
Studies on urban political ecology have particularly focused on water resources. A relevant contribution was provided by Erik Swyngedouw (1997) with "Power, Nature and the City. The Conquest of Water and The Political Ecology of Urbanization in Guayaquil, Ecuador: 1880-1980". With this study Swyngedoyw reconstructed both theoretically and empirically, the political conditions, social and economic and power relations that lead to the current water flows, both physical and social, in the city of Guayaquil (Ecuador).
This contribution has become an important reference in the field of urban political ecology and continues to address many recent emerging studies, also providing new discoursers and representations of water flows in urban areas and social environments (figure 2.8 and 2.9).

Figure 2.8. The postmodern hydrologic cycle



Source: Kate Ely (2008)

Figure 2.9. An extension of the hydrosocial cycle concept: the "Andean hydro-cosmological cycle"



Source: Boelens (2013)

The next section provides a review of works elaborated on the base of these concepts (see table 2.1).

2.4. Chronological review of hydrosocial cycle studies

This review shows how many studies have emerged on the basis of political ecology and urban political ecology perspective, focusing on hydrosocial flows, opening new perspectives to understand different urban water governance models through the hydrosocial concept.

Table 2.1. Cronological review of hydrosocial cycle studies

Author/s (year)	City/Region of study	Thematic focus	Disciplinary Approach	Methodology
Swyngedouw (1997; 2004)	Guayaquil - Ecuador	Urbanization; water scarcity; water circulation; power; political-economic transformations	Urban political ecology	Historical analysis
Kaika (2006)	Athens (Greece)	Urbanization; water scarcity; metabolism; water circulation; power; political-economic transformations	Political Ecology	History analysis; Political ecology concepts
Fleury (2003)	Montreal Metropolitan Region (Canada)	Water supply and management; urban governance	Political ecology	Historical analysis
Castro (2004)	Mexico Metropolitan Area	Social struggles over the access to and improvement of water services	Political Ecology	Political Ecology concepts
Bakker (2005)	England and Wales	Commodification initiatives in England and Wales; water crises; reregulation of the water supply industry and drinking water quality	Geography; Political ecology	Political Ecology concepts
Loftus (2006)	Durban's waterscape (South Africa)	Water supply	Urban political ecology	Spatial-temporal dynamics of capital accumulation
Gandy (2008)	Mumbai Metropolitan region (India)	Social inequalities within the postcolonial metropolis. Water and sanitation crisis; capitalist urbanization	Political Ecology	Political ecology concepts
Budds (2009)	La Ligua river basin (Chile)	Water resources; Policy; Technocracy	Political ecology Groundwater Science	Hydrology Modelling Policy
Bardati (2009)	St. Francis River Watershed (Canada)	Exploration of the socio-physical dualism inherent in a specific watershed planning process in response to the Quebec Water Policy (2002)	Political ecology	Political ecology concepts
Kallis (2010)	Athens Metropolitan area	Urbanization; water scarcity; water circulation; power; political-economic transformations	Urban political ecology	Historical analysis
Zimmerer (2011)	Calicanto area (Cochabamba, Bolivia)	Landscape technology; Irrigation; Development; Landscape; Water resources Agrobiodiversity	Resilience ecology, political ecology, and actor-network theory	Political ecology and actor-network theory concepts
Barnes (2012)	Egypt	Drainage water reuse; Agriculture Irrigation Hydrosocial cycle; Non-conventional source	Hydrosocial cycle framework	Hydrosocial concepts

Budds and Hinojosa (2012)	Peru	Waterscape; Resource extraction; Hydrosocial Governance	Political ecology	Politics of scale in water governance
Clarke-Sather (2012)	Semi-arid Zuli river valley in (China)	Food-water relationship; Hydrosocial Governance	Political ecology	Politics of scale in water governance
Norman (2012)	Salish sea, Pacific Northwest, (Canada, US)	Transboundary water governance for indigenous communities	Political ecology	Politics of scale in water governance
Perramond (2012)	New Mexico (US)	Water rights; Adjudication process	Political ecology	Politics of scale in water governance
Vogel (2012)	Columbia river basin (Canada, US)	Historical environmental analysis of the management of the Columbia river basin to critique watershed and river basin management	Political ecology	Politics of scale in water governance
Wang (2013)	Zhuolu County, Guanting Watershed (China)	Village-level irrigation management in water scarce northern China	Political Ecology	Institutional framework
Larrabeiti Rodríguez (2013)	Alicant (Spain)	Hydrosocial cycle and urbanization; water scarcity; Metabolism	Urban Political Ecology; Political economy	UPE concepts
Mollinga (2013)	Tungabhadra Left Bank Canal, (India)	How human agency transform hybrid and multi-scale water control system	Geography of the hydrological cycle	Hydrological cycle concepts
Banister (2013)	northwest Mexico's RíoMayo Valley	Account of irrigation politics, the flows of matter, and nonlinear dynamics in northwest Mexico's Río Mayo Valley	Political geography; Ontology of flow Geophilosop.	Political ecology concepts
Boelens (2013)	Mollepata (Peru)	Socionatures; Water management; Cultural politics; Cosmology	Political Ecology; hydrosocial cycle	hydrosocial cycle analysis
Bury (2013)	Santa River Watershed (Peru)	How ecological change and societal forces shape the future of water resources and water governance in the region	Political Ecology	Coupled historical analysis
Bouleau (2013)	Rhône and the Seine river basin (France)	Hydrosocial cycle to account for the way in which the course of water and that of human affairs were intertwined in the Rhône and the Seine river basins	Political ecology; Social studies of science	Political ecology concepts
Bourblanc & Blanchon (2013)	Catchment areas (South Africa)	Construction of interbasin transfers; power struggles	Geography and political science	Hydrosocial cycle as framework; Institution analysis
Fernandez (2013)	Garonne watershed (Southwestern France)	How technologies of government, practices, devices and discursive regimes contribute to shape specific hydrosocial cycles; water scarsity	Political Ecology	Historical Analysis; Actor analysis

Source: Own elaboration from literature review

2.5. Extending the urban hydrosocial cycle framework to tourist coastal cities

2.5.1. Mediterranean basin as laboratory of analysis

The Mediterranean basin is considered by many scholars an interesting laboratory for exploring current processes of socio-environmental change (see e.g. Gössling and Hall, 2006; Carraro, 2009). Centuries of transformations have created this very complex socio-environmental mosaic. Natural resources needed for settlement, first among all water, have influenced most human-induced changes in the basin. The evolution of this landscape has been governed by major interaction of water flowing across the land with human social actions (Bratina-Jurkovi, 2011; Barton *et al.*, 2010). Coastal areas are the space where this interaction has taken place and where water also represents the most vulnerable resource. This laboratory may, therefore, be particularly interesting for exploring how these interactions continue to shape the hydrosocial cycles in coastal cities.

The Mediterranean is generally identified as a unique entity, where physical, cultural and social processes are rich, complex and uniform. However, Violi and Lorusso (2011) point out that as soon as we start investigating this supposed unity, it breaks down into a thousand different entities, images and local realities recognizable from the outside, but also extremely differentiated from the inside. Indeed the basin is a space that contains substantial differences. The Western Mediterranean is the most urbanized area and is characterized by the strong development of tourism (Unep/Map, 2012). While over a half of the world population is considered urbanized, in the Mediterranean countries, two out of three inhabitants already live in urban areas mostly located near the coasts (UNEP/MAP, 2012) and expected to grow significantly by 2025 (UN/MAP/BP/RAC, 2009). Rising demand of water is the result of growing urban populations and visitors to tourist destinations. Tourism is a vital economic activity for many of these countries. 12 percent of the Spanish GDP, for instance, is generated by tourist related activities.

Drawing upon their geographical location and characteristics, Mediterranean destinations are by far the largest global tourism destinations, attracting almost a third of the world's international tourists, and generating more than a quarter of international tourism receipts (UNWTO, 2012). In parallel, the compact traditional form, typical of the many Mediterranean cities, has experienced profound transformations resulting in more dispersed form. This so-called "urban sprawl" phenomenon has become a very a remarkable characteristic of urban development in North America and then in Europe, and it is now expanding in the Mediterranean. Initially, it was caused mainly by changes in socioeconomic and political systems, and the incapacity of planning in the South to control urban expansion (Gaspar, 1984; Munoz, 2003). Urban sprawl and scattered development in the vicinity of urban hubs are still today encouraged by current socio-economic change processes and especially by the growth in the so-called residential tourism. In particular, sprawl raises concern about its potential negative and irreversible effects for urban sustainability (PB/CAR, 2003; European Commission Joint Research Centre, 2002; EEA, 2006). Studies have demonstrated that dispersed forms generally produce wider environmental impacts than compact urban forms, including land and fresh water (Rico-Amoros *et al.*, 2009). Further, in rapidly developing urban areas water system infrastructures may suffer losses in the distribution network, often exceeding 30 percent of the distribution input (UNEP-MAP, 2007).

Tourism has also facilitated the process of urbanization and urban sprawl. Some authors explain how tourism urbanization has produced a particular urban form in the Mediterranean (Gössling and Hall, 2006) with the increase in comfort requirements and the development of facilities to diversify leisure activities (swimming pools, golf courses, etc.). Therefore tourist activity takes the traits of a true "regional brand" influencing and being influenced by the global scale (Ashworth and Page, 2011).

In the Mediterranean basin, water consumption from tourism is relatively low compared to other sectors such as agriculture. However, according to existing estimates (WTM, 2007, Blue Plan, 2008) water for tourism is a critical resource that is expected to experience the largest increases in demand by 2025. As observed (see e.g. Rico-Amoros *et al.*, 2009; Hofa and Schmitt, 2011) water availability, demand and consumption vary according to the type of urban and tourist settlement, and the water requirements of future expansions will probably depend on these forms strategically chosen for development (Kent *et al.*, 2002) which are also likely to increase and intensify the hydrosocial flows. Seasonality is a particular feature of tourism in Mediterranean coastal areas, intensifying water problems such as shortages and conflicts of use with other sectors during the summer months.
Moreover, global climate predictions point at an increase of aridity conditions in the Mediterranean areas as well as sea level rise in the Eastern Mediterranean. These trends may affect direct physical water availability requiring substantial changes in the sources of supply. In Spain desalination plants have often been chosen as a solution to produce and ensure fresh water, but this and other solutions such as dams or transfers also have important environmental impacts (UNEP-MAP, 2007).

Finally, but most importantly, decisions, management, power and social control of flows of water, as well as different water governance models, for example private or public, may substantially influence or be influenced by, the urban hydrosocial cycles. Hydrosocial cycles will vary therefore according to whether urban water flows are controlled by public or by private interests and the history and recent changes in this control.
Therefore, as anticipated earlier, different configurations may emerge according to the considered context. In this regard, the heritage town of Venice and the mass tourism resort of Benidorm differ profoundly from many other coastal cities of the Mediterranean region. Their unique urban evolution and their relations with water flows characterize today these two cities as paradigmatic examples of coastal tourist models.

2.5.1.1. Venice

The historic city of Venice, in the Veneto Region of Northeast Italy, is considered one of the most important tourist destinations worldwide with an estimated flow of more 22 million tourists per year. Today the current urban model of the city is characterized by historical urban parts coexisting with other parts constructed and transformed more recently for tourist purposes. Venice spreads over 118 tiny islands that were consolidated and organized in a unique urban system characterized by canals, and a network of small streams that are the veritable arteries of this city. Venice is therefore the result of a dynamic process of interaction between people and water within a particular and complex natural ecosystem. The spectacular evolution of this city draws on secular people's struggle against a hostile nature and the continuous power and social control exerted over the management and the governance of land and water resources, including

the lagoon. Today, tourism represents the major challenge for the city in physical and social terms.
Although population growth is a phenomenon occurring in many cities today, over the last fifty years, Venice has experienced a continued population loss and now stands at less than 60 000 inhabitants. This process has been mainly attributed to tourism.

In the last decade the high tourism pressure on the city of Venice has resulted in a partial functional transformation. Therefore, the city has continued to grow in the mainland producing an uncontrolled process of urban sprawl in the nearby Veneto region. These current social and environmental processes of change are influencing the flows of water of this city of which the provision for tourists is the main component.
The model of water governance in Venice is semi-public and water supply coverage attains 100 percent of the city. However, wastewater treatment (sewage) coverage is very scarce due to the absence of a sewage network. Thus part of the sewage in the city remains untreated and flows directly into the Venice Lagoon, which receives contaminants especially during the high tourist season. The city is also affected by extreme flooding caused by climatic events.
Water is today a critical resource for Venice. It is fairly abundant but water quality (resources and drinking water) is an ongoing challenge. Additionally, more water resources will be needed to sustain this economic sector which is vital for the city.

2.5.1.2. Benidorm

Benidorm, located in the Eastern Spain, is a typical example of the mass tourism resorts that emerged along the Mediterranean coast in the 1960s and has become one of the most famous holiday destinations in Europe. Its urban form is characterized by concentrated tourist settlements with very high densities and vertical growth as a result of a profound process of urbanization influenced by the tourism sector.
Tourism is strategic for Benidorm which currently receives 6 million visitors annually well distributed throughout the year.

Characterized by very dry summers and long droughts, the city is based on a “sun and beach” tourist model currently expanding in order to attract other kinds of tourists (e.g. business conventions). Its urban model is considered environmentally efficient in regard to energy, water and land use, and less dependent on private transport. Most importantly, part of the wastewater from urban and tourism uses may be used by farmers through an interesting exchange of waters of different qualities.

However new urban forms and tourist amenities in the vicinity of Benidorm are emerging such as golf courses, aquatic parks, swimming pools etc and taking a much more sprawled form. Contrary to Venice, Benidorm may experience occasional problems of supply (although not in the last decade) but wastewater treatment services cover 100 percent of the flows. Moreover, the hydrosocial cycle of Benidorm shows an important presence of private interests, especially regarding supply.

2.6. Concluding remarks

This study has attempted to explore different approaches to the analysis of water in urban environments, particularly those in which tourism represents the main activity.
Co-evolutionary relations, complexity and new governance challenges related to water resources in these contemporary urban environments have been discussed in the first part of the study. Then, the paper has moved to present several categorizations of the flow of water in cycles, beginning with the hydrological cycle and continuing with the urban water cycle, urban water metabolism and finally the hydrosocial cycle. In each of these categorizations, the social and political components of water flows are increasingly made more evident. In this sense, the paper has emphasized the importance to explore hydrosocial cycles under the framework provided by the Urban Political Ecology, particularly in cities characterized by urbanization and tourism, extending therefore, the analysis to physical (hydrological) and social (human activities and economical and cultural conditions of power and control) flows of water. In light of the urban hydrosocial concept the cases of cities like Venice and Benidorm, may reveal how these physical and social flows are engaged in shaping and reproducing new urban and tourist hydro-social configurations (Swyngedouw, 2004, 2012). Moreover, these flows may disclose how are or have been influenced by different models (private and public) water governance. Its evaluation may also help to shed light on how water resources in these urban environments may be governed and managed in the present and future years.

Overall, this combined analysis can provide new insights for geographers, planners and those working in urban water studies and related disciplines interested in the interactions between water and governance both locally and globally.

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Chapter III

How Coastal Cities Change and Reconfigure Themselves: an Exploration From Urban Political Ecology Perspective

A preliminary version of this paper was presented at the International Conference "Changing Cities: Spatial, morphological, formal & socio-economic dimensions".

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3. How coastal cities change and reconfigure themselves: an exploration from urban political ecology perspective

Abstract

Cities located in coastal areas are changing rapidly. Much of this change is attributed to tourism, which is considered one of the most responsible for urban transformation, and one of the main drivers of global socio-environmental change.
There are extensive studies on urban coastal landscapes analysing how their change is facilitated by tourism. However theoretical and empirical understanding of new contemporary issues occurring in coastal cities, where tourism is a main activity, remain poorly addressed.
In the attempt of providing a critical examination of these emerging questions, the article adopts the Urban Political Ecology (UPE) discipline, as an emerging research field for socio-environmental change analysis in urban areas. First, it considers the concepts provided by the UPE, for analysing change processes in coastal cities from global to Mediterranean scale. Then, it investigates and describes the Mediterranean cases of Venice (Italy), Benidorm (Spain), and Mykonos (Greece) as paradigmatic examples of changing coastal cities.
Coastal cities evolve, change and reconfigure themselves through physical and social, internal and external processes and relations infused in their continuous urban metabolism. The Framework provided by UPE may help to understand how cities produce and reconfigure new urban landscapes.

Key words: Tourism development, Urban Political Ecology, Mediterranean, Venice, Benidorm, Mykonos.

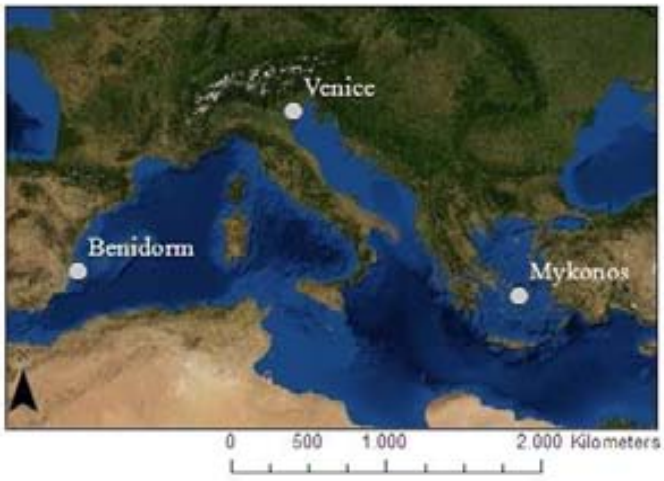
3.1. Introduction

Cities – whether large or small, including neighbourhoods, city-centers, suburban or peri-urban areas – are constantly changing (UN-Habitat, 2012). They are built, rebuilt, transformed and used by people for different functions, and grow in complex ways in terms of population, size, socioeconomic patterns, geopolitical settings (Hall, 1998; Batty and Marshall, 2012) and over-consumptive use of natural resources. Considered as the most complex, dynamic and never finished artifacts created by human activity (UN-Habitat, 2010; Zamenopoulos and Alexiou, 2012; Portugali *et al.*, 2012) they reproduce the interactions among biophysical, social, environmental and economic processes at the local, regional and global scales (Kötter, 2004; Swyngedouw and Heynen, 2003). Responding to increasing processes of globalization, urbanization and socio-economic change, the world has moved towards an urban dimension. In the last decades tourism has emerged within such dimension as an important economic sector influencing the urban environment at physical, social, economic, cultural and political level and interacting at local and global scale (Ashworth and Page, 2011). It is considered the fastest growing industry in the world today and has mainly developed in coastal cities, where processes of change are occurring very rapidly. Mediterranean coastal cities, in particular, are experiencing profound transformations due to tourism development which acts as the most important sector in the region, and influences new city's morphologies and urban forms.

Many studies dealing with urban tourism prove that this sector has gained more and more the attention of practitioners, researchers and policy makers. They have mainly focused on tourism as an instrument of economic development or as a sector affecting urban areas, landscapes and natural resources. However, these studies do not tend to provide a critical understanding of how cities are evolving through internal and external processes at a local and global scale in which tourism is embedded. This is partially because tourism has been defined demographically rather that sociologically, and lacks appropriate concepts for conducting empirical research (Mullins, 1991; Ashworth and Page, 2011). As a consequence, although tourism occurs in many cities world-wide, geographers, planners and scholars of urban phenomenon, whom theorize and engage in critical debates on cities and socio-environmental change, all too often ignore the patterns and processes of such change (Ashworth and Page, 2011). A more integrated approach based on a relational perspective is therefore needed to frame contemporary urban issues if we are attempting to explain how changing coastal cities are (re)configuring.

The objective of this study is to explore and discuss these issues in the light of the Urban Political Ecology (UPE) discipline. UPE is suggested in this paper as a suitable theoretical and empirical framework of analysis that may help to "disentangle the interconnected economic, political, social and ecological processes that shape urban landscapes" (Cook and Swyngedouw, 2012). Most importantly, it provides theoretical and empirical concepts for analyze how urban contexts become produced. To provide a critical analysis of the just mentioned issues, this paper adopts a case study approach. Benidorm (Spain), Venice (Italy) and Mykonos (Greece) (figure 3.1) have been selected, among many other coastal cities, as paradigmatic tourist destination of the Mediterranean basin, having dominant a mass tourist model and high visitor flows.

Figure 3.1. Cities localization map



Source: Own elaboration from Esri World Imagery Map

Specifically, Venice has been a global city in the past, and it is still now, as one of the world-class city and a representative cultural heritage. Benidorm has become one of the most well known mass tourism resorts in Spain and Europe. The Mykonos Island is currently experiencing an explosive tourism phenomenon which is peculiar among Greek tourist destinations. They are all cities characterized by increasing flow of tourists and rapid urban change processes, influencing their social and environmental context.

The paper has three main sections. The first section reviews the UPE approach and describes the key concepts and methods through which the currents processes of urban change may be analyzed, represented and understood. The second section provides a description of the processes of change and urbanization occurring in coastal cities from global to local scale. Specifically, it focuses on the Mediterranean context. The third section presents and analyzes the three cases studies mentioned above. Finally, the main arguments resulting from this study are discussed, and the conclusions are presented at the end of the paper.

3.2. Theoretical background

3.2.1. The Urban Political Ecology framework

Urban growth and its socio-environmental consequences have become one of the new domains of an important current of critical geographical thinking based on the premises of political ecology (Cook and Swyngedouw, 2012). Political ecology is an approach oriented towards the understanding of the complex interactions between society and environment mostly within the field of geography. As the urban phenomenon has gained remarkable prominence in recent years, receiving considerable attention, the interconnected linkage between human and natural processes has been appropriately extended to the foreground of "urban" through Urban Political Ecology discipline. The UPE is considered a school of critical urban political–environmental research (Heynen *et al.*, 2006b) that allows an investigation of the transformation of nature and the social relations retained inextricably connected to the processes of urbanization, and therefore, of how a particular urban environment is produced. More specifically, it provides a theoretical and a methodological/empirical platform for explore, untangle and expose how interconnected and contemporary internal and external processes of the city together form urban landscapes.

Starting from the assumption that nature and society do not exist independently as distinct entities, but that nature has become urbanized through the social interaction, and used in the process of making and remaking the cities (Cook and Swyngedouw, 2012), UPE scholars argue that "urban" is constituted through socio-ecological flows. Such flows (such as water, energy, CO_2, food, materials, etc.) are linked to the specific historical/geographical, social, cultural, political or economic conditions, practices and relations, the formal and informal institutions of governance that accompany them, the action of groups of actors, stakeholders and social power relations, the interaction among local, regional and global scales, and the relationship between capitalist urbanization processes and environmental injustices produced through exploitation, commodification and degradation of places. All these factors finally result in a continuous "urban metabolism" (a fundamental and central concept in the UPE theory (e.g. Gandy, 2004; Swyngedounw, 2004) configuring new and complex urban landscapes. From this perspective, 'urbanization' is retained a processes produced through particular forms of socio-physical metabolism, and "cities are conceptualized as metabolic vehicles constituted in and through metabolic circulatory socio-ecological flows" (Swyngedounw 2004, 2006). Therefore, according to urban political scholars, the socio-environmental changes result in the continuous production of new urban (social and physical) environmental conditions. On the basis of these theoretical premises the UPE has elaborated some central concepts such as: the relationship between society and nature, power, capitalism and circulation of capital, urbanization, networks, groups of actors, scale, environmental commodification and metabolism (Cook and Swyngedouw, 2012).

UPE scholars retain that to examine these concepts, shaping the formation of urban environments, is critical for conducting empirical research, and to understand and represent the continue changes and reconfigurations of contemporary urban landscapes. They have emerged in a growing number of UPE studies and continue to chart the terrain of the UPE (for a review of the main topics, see Cronon, 1991; Davis, 2002; Gandy, 2003; Swyngedouw, 2004; Desfor and Kail, 2004; Heynen *et al.*, 2006a).

Tourism has become one of the more recent political ecology themes, to explain how economic and political processes determine the way natural resources have been exploited. Existing research has been conducted in places such as Honduras (Stonich, 1998), China (Gössling, 2003) Mexico (Nim, 2006) and the Ecuadorian Amazon (Beahm, 2009). These studies have focused particularly on the interaction of international, national, regional and local actors, agencies, institutions, economics and politics at the interface of environmental change. Moreover, several research questions have emerged to understand "*who initiates and controls tourism development, for whom, for what purpose, at what cost, to what end*; *who has the power to create and control the narratives related to development issues; and, depending on the context, how are the resources affected by development processes"* (Beahm, 2009).

Through these researches, political ecology has introduced a new thinking to the ways in which tourism is studied, by broadening the scale under which tourism is conceptualized (Beahm, 2009; Swyngedouw and Kaika, 2000). However, studies focusing on tourism and urbanization from an Urban Political Ecology perspective are scarce, despite the increasing importance of the urban phenomenon. In sum, as Cook and Swingedown (2011) suggest the UPE framework "is an important step towards beginning to disentangle the interwoven knots of social process, material metabolism and spatial form that go into the formation of contemporary urban socio-natural landscapes". Its relevance for tourist studies should be, however, demonstrated with specific examples.

According to the theoretical and methodological framework adopted in this paper, the next chapters examine the increasing importance of the nexus between urban change and tourism phenomenon by focusing more specifically on selected case studies.

3.2.2. Changing cities: from global to local

Cities, especially those located along coastal areas, are considered among the major settlement hotspot globally (Sekovski *et al.*, 2012). In 2008, the world's urban population exceeded the world's rural population and approximately a quarter of population concentrated along or near coasts (Tibbetts, 2002). Although human population has been growing mainly in coastal megacities (Sekovski *et al.*, 2012), recent studies have showed that the concurrent movement of populations to coastal areas worldwide, also occur in medium and smaller cities (UN-Habitat, 2012). Coastline locations have offered advantages and opportunities for human settings. As strategic meeting points between land and sea, coasts have experienced long commodification processes of landscapes and natural resources such as water use, land-use change and other environmental resources suited to human activities. This has led to rapid urban and population growth and socio-economic development processes, as the result of a combination of geographical location, natural population growth, rural-to-urban migration, infrastructure development, national policies, corporate strategies and other major political, social and economic

forces, including globalization (UN-Habitat, 2012). These processes of change, associated with global capital, have proved to be major forces in the emerging landscapes of developed and less developed cities. Additionally, as the urban process has accelerated, the major economic, political, social, cultural end ecological processes of change and interaction have gained weight very quickly (Nijkamp and Kourtit, 2013).

Cities have always been labeled as an engine for economic growth. Through a diversity of processes they have become complex places of accumulation and concentration of economic and political power (Habitat, 2001), organizations, activity, infrastructure and resources, acting as magnets of development (Collet, 2010). Ultimately, cities have configured themselves as nodal points for business, competitiveness and creativity, consumption and leisure within the global network. Through these particular conditions, some economies have strengthened and urban developed, shaping new geographies of consumption and production.
This is particularly the case of the tourism sector which has been one of the most highly developed and dynamic industry of the world economy in recent years. It has grown at such a pace and scale that, in 2012 the total international arrivals were expected to reach one billion people for the first time (UNWTO, 2012). According the World Tourism Organization new destinations are emerging worldwide, new markets are expanding and international tourist arrivals in emerging economy destinations are expected to grow in double digits by 2030 (UNWTO, 2012: 9, 15). Influencing the movements of a relevant number of people and the urban development, tourism represents today a fundamental strategy of economic development for many coastal cities. This is attributable mainly to new socioeconomic processes producing substantial changes and transformations in traditional cities and landscapes (Ashworth and Page, 2011).

As Ashworth and Page have observed, new urban geographies are emerging from these processes and result in different patterns and complex forms with their own specific characteristics, practices and modes of consumption in time and space. They also noted that, while some urban forms influenced by tourism have developed over time, other forms do not pass through a series of phases of growth and development, and are emerging as new landscape for tourism (Ashworth and Page, 2011: 3). Additionally, these new tourist destinations require infrastructures, facilities and natural resources, adding further pressures on existing social and natural environments.
Indeed, as it has been observed, coastal cities, especially those characterized by tourism, are already under heavy pressures from human activities, and result as critical areas of global environmental change (Gössling and Hall, 2006; UN-Habitat, 2010); natural resource loss and urbanization phenomena are increasingly regarded as a global problem (Collet, 2010; EEA, 2006a,b; Small and Nicholls, 2003).

Occupying just 10 percent of the earth's land surface, coastal zones are heavily urbanized with 65 per cent of their inhabitants residing in urban areas (UN-Habitat, 2010). Despite the fact that the most urbanized coastal cities today tend to be situated in less developed countries, such as Asia and Africa, the process of rapid urbanization started first in today's more developed regions, gradually spreading from Southeast Europe across the whole European continent (Antrop, 2004: 9). In Europe 76 percent of the population lives in urban regions and 43 percent live in coastal regions (EEA, 2006a). Moreover between 1990 and 2000 urbanization in Europe grew 30 percent faster in coastal areas than in inland areas, and this difference continues to grow (UNEP/MAP-Plan Bleu, 2009). The Mediterranean coastal regions well illustrate processes of urbanization and socio-environmental change.

Considered by Hinrichsen (1999) the most celebrated and threatened in the world, the coasts of the Mediterranean region have always been attractive areas for development. Mediterranean cities are the result of the close interplay among these diverse natural characteristics and the equally diverse human activities, both past and present. This phenomenon refers to a great variety of situations, depending on the more or less strategic locations, natural features (climate, water, landscape, ecosystems, terrestrial and marine biodiversity) and cultural (historic and cultural heritage) resources, on the nature of the activities, as well as on the urban dynamics capable to face with all these issues. In the last decades, the interplay between processes of development and the human-environment relations have intensified and dense urban tissues of several Mediterranean cities has been exposed to socioeconomic changes and substantial landscape transformations (Trumbic, 2005). Out of a total 46,000 km of coastline, more than half are urbanized, and urbanization rate is expected to grow to 72 percent in 2025. According to recent studies, the western Mediterranean area presents the highest increase in artificial surfaces (UNEP/MAP, 2012). In Italy, France and Spain the coverage of built-up areas in the first kilometer coastal strip exceeds 45 per cent (EEA, 2006b). Most of these processes of urbanization have been attributed to the tourism sector. The Mediterranean is now considered the first destination in the world attracting 30 per cent of global international tourism arrivals; France, Spain and Italy, are among the ten strongest tourist destinations in the world (UNWTO, 2012).

Responding to waves of population increase, rapid urbanization and emerging economic sectors like tourism, the Mediterranean coastal cities have grown outward from small dense cores and acquired new forms, dimensions, functions and centralities. In this connection, it can be argued that by moving the analysis from the global scale to the regional scale, coastal cities are nowadays the places where processes of urban change appear more evident depending on several interconnected factors.

3.2.3. Urban change and tourism: new contemporary issues in the Mediterranean coastal cities

In southern European urban regions and especially in the Mediterranean, urban change processes and their social and environmental impacts have been observed and described by some authors (e.g. Antrop, 2004; EEA, 2002; Muñoz, 2001). Mediterranean cities have been historically characterized by compactness, urban complexity, social diversity and economic polarization in industrial and service areas. However, in the last two decades new urban forms have emerged. Urban sprawl can be considered as one of the most salient features of the recent urbanization process in the region (EEA, 2006b). According to Muñoz (2003) this pattern, generating a new type of city with important changes in the socioeconomic relationships between urban and surrounding rural areas, is characterized by disperse and low-density settlements. It shows simplified morphologies and design homogeneity in different cities (Muñoz, 2003). The loss in morphological and social diversity represents a significant change from the features that characterized the traditional Mediterranean compact city (Leontidou, 1990).
The dispersed city is considered an urban landscape designed and produced as a commodity, induced by mobility, including voluntary mobility such as that associated with leisure. The process of commodification produces wider environmental impacts compared to what generated by the compact cities, for instance, higher consumptions of land, energy and water as well as larger amounts of waste and pollution (Hoffman *et al.*, 2003; Rico-Amoros *et al.*, 2009; Mullins, 1991). Additionally, a proliferation of intermediate urban forms has emerged.

Tourism is considered the main driver of these new urban forms. Likewise, urban space morphology may influence and attract form of tourism (Gospodini, 2001). In many places of the Mediterranean regions activities have taken place, involving the development of tourist capacity (i.e., campsites, hotels, holiday resorts, second homes and villas, etc.) and support infrastructure (ports, marinas, and other new facilities, swimming pools, golf courses, etc.). These capacities can be identified in two main types of tourist patterns: landscapes and cities of mass tourism, associated with concentration of facilities, vertical growth of buildings, and high population density, and the new type of resort tourism characterized by settlement dispersion, horizontal growth, land consumption and low population density, detached residential homes with private gardens and swimming pools, together with additional factors of attraction such as golf courses, amusement or thematic parks, health centers (Hoffman *et al.*, 2003).

As outlined by Glossing (2006) tourism is embedded in the process of urbanization mainly in two ways. First, as the main driver behind urbanization in places oriented and suitable for tourism and leisure, that Mullins (1991) calls "tourism urbanization" and second, as an element of leisure production in urban place where a part of the city is oriented to satisfy tourism, even though the city's economy is not dominated by tourism and leisure production (Page and Hall, 2003).
As it has been observed recently, different forms and types of tourism produce diverging socio-environmental impacts. In particular, some studies show that the consumption of water, the most important resource for urban settlements, population and tourism amenities in the Mediterranean, may differ substantially according to the predominant type of tourist and second-home settlement, and the water requirements of future expansions of tourism will probably depend on the specific tourist land uses selected for development (Hoffman *et al.*, 2003; Mullins, 1991, 1994).

Several factors contribute to explain the changing urban patterns found in the Mediterranean. Besides biophysical and territorial conditions, the development of tourism along the Mediterranean coasts has reflected in specific socioeconomic and political characteristics. For example, economic restructuring has been a driver for infrastructure development mainly achieved through tourism and the burst construction phase mainly observed in Spain and Greece along the 2000s. Factors such as local community interests, health and security conditions, house speculation, and traditional models of tourism exploitation also have contributed to shape urban forms in tourism-specialized urban areas. Again, policies and programs initiated and implemented by the tourism industry have also contributed to new patterns, processes and directions of change in Mediterranean coastal cities (UNEP/MAP, 2012; Hoffman *et al.*, 2003; Mullins, 1991). Competitiveness and creativity appear as new contemporary elements of new economic urban strategy and action driven by globalization processes, in the specific dynamics of the Mediterranean. Finally, the recent economic crisis influencing the Mediterranean countries constitutes an important driver of urban change strongly interlinked to factors just mentioned.
As a result, all these factors are embedded in the configuration of the urban form and in its processes of change. Edwards *et al.* (2008: 1038) state that tourism is "one among many social and economic forces in the urban environment". Page and Hall (2003) argued that what characterizes these new urban configurations where tourism assume an important part, is the scale, complexity and diversify of consumption.

In this connection, Wall and Mathieson (2005) have addressed the issue how much urban change can be attributed to tourism. By considering the complex processes that are taking place in

contemporary cities, Ashworth and Page claim that the major urban changes should be sought in the phenomena of globalization of urban networks, complex interactions between the local and the global scales, rise of the city as the centre of cultural production and consumption, the commodification of cities as competitive marketable brands and other identifiable trends. According to these authors, they are the basis for the explanation of the current urban changes and transformations and to understand the direction of future urban configurations. Ashworth and Page also argue that what is happening to urban environments depend on the understanding of what is happening to cities, in which tourism is inextricably embedded.

3.3. Cases from Mediterranean cities

3.3.1. Venice

The historic city of Venice (Figure 3.2), located in a wide lagoon between mainland and the Adriatic sea, is an internationally renowned tourist destination. Although Venice is unique compared to other realities, it is considered a perfect case study of a large art city on which to base research into the long modification of land-use, the effects of tourism, and the contemporary processes of change (Zanetto and Calzavara, 1991; Zannini *et al.*, 2008).

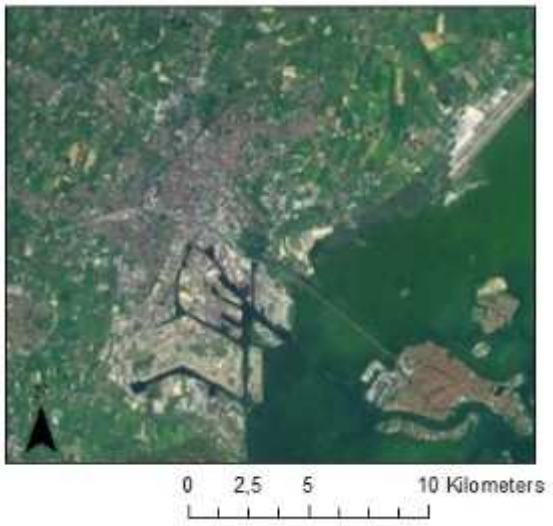
Originally it developed over a series of islands and was inhabited by few people. Over 15 centuries ago, refugees from the Italian mainland, fleeing from northern invaders, populated the coastal strip, while noble, owners and people settled on these islands to find protection. Its locality helped propel Venice to its place of wealth and political dominance. It grew in size and autonomy and, in the fifteenth century, became the center of world trade and the largest port city in Mediterranean and in the world. Although tourism seems a relatively new phenomenon in the city, it holds a long tradition since it was a destination for pilgrims during the preindustrial period, the grand tour and the European society of the 1700s for tourism elites during the industrial revolution and, finally, the transformations of the holiday in the era of mass consumption with the development of Lido and the global tourism and the Disneyfication of Venice (Costantini, 1997; Borg, 1992, Leonardi, 2003; Tissot, 1996; Zannini, 2002).
As Venice became a travel destination of many wealthy strangers, tourism influenced its conurbation. Certain parts of the city were chose to be built with a view to advertising its economic grandeur and to welcoming foreigners such as the waterfronts and the St. Mark's central square (Zannini *et al.*, 2008). After the deviation of the main rivers which flowed into the Lagoon between the fifteenth and seventeenth centuries and that avoided the risk of its silting, the city kept evolving through a complex combination of natural processes and human interventions.

In the early twentieth century urban transformations centered in the areas around the historic city: the new bourgeoisie chosen the Lido littoral in the lagoon as a seaside resort among the most interesting of the period, some communities of the mainland regrouped in Mestre, beginning its slow transformation from town to suburb. The process of urban sprawl began after the Second War World as a consequence of the replacement of industrial activities with tertiary activities. As industries needed to find new areas outside the city centre, Marghera developed as the most important industrial settlement, while tertiary activities were prevalently located in the centre generating higher revenues linked to real estate.

Higher real estate prices caused the population to migrate outside the city leading to the depopulation of the historical center. Since then, tourism has strongly influenced the evolution of Venice and its historical city centre in particular. According to Zannini *et al.* (2008) it has than gained strength with the advent of mass tourism, determined by better socioeconomic conditions and the new ways to travel. As a result, the significant modification of land-use regarded the housing but also the commerce. As it has been observed, two main transformation periods emerged over the last thirty years: the first refers to the upgrading of the area around St Mark's, triggered by the increase of second home acquisition (Lando and Zanetto, 1978; Costa *et al.*, 1980) and the second refers to the increased number of houses that have been refurbished and dedicated to extra-hotel services (Barbiani and Zanon, 2004). The process of growth and development refers in particular to the second largest building cycle (1993-2007) and the mechanisms that determined the formation of urban income. This was a decisive element in the uses and transformations of the city and the territory since the external economic and social phenomena took place on the territory for speculative purposes and profits.

These factors influenced the urban structure which today encompasses historical urban parts and other parts constructed and transformed for local and external interests and tourist purposes. It is characterized by both under-exploited and over-exploited cultural areas (Russo, 2002) and new areas (or the refurbishment of abandoned production areas) created to improve its image; the transformation of the commercial structure also adapted to satisfy the tourist demand. After the stagnation in 2008 because of the international economic crisis, the positive trend of tourism arrivals in 2010 seems to be continuous in the subsequent years. In 1951, around 1.1 million tourists per year visited the city and in 2011 there were 22,080,717 of which 6.221.821 stayed overnight in the historical city centre. In 2012 the 80 percent were foreigners, especially from the US, followed by the traditional European markets of France, UK and Germany. While emerging markets such as Russian, Brazil and China also increased substantially (Annual Tourism Report 2012).

Figure 3.2. Urban expansion along the Venice's coastline



Source: photo: from web
Map 2011, 0.3m resolution

Figure 3.3. Urban dispersion and sprawl on the Venice's mainland

Source: Own elaboration from Esri World Imagery

Art, culture, the lagoon environment and the current 14 business exhibitions per year and international events that the city is constantly improving, are the main events in the historic city which attracts more than 60 per cent of its visitors in peaks during spring and fall months. The major transport infrastructure, the port and airport, are expanding both in term of size and tourist arrival. Today, the city concentrates around 418 hotels and 2.314 other accommodations which include bed and breakfast activities. Moreover, the visible increase in the number of restaurants and clothing stores is a direct result of the need to address the demand of both tourists and work-commuters. Demand for housing in historic Venice is consequently very high, it refers in particular to second homes, and it has become the most expensive urban real estate market in Italy. For this reason, the population has decreased from 102,269 residents in 1976 to 59,080 in 2011. This process of depopulation of the historic city is generating conflict between tourists and resident population over the use of urban functions (Van der Borg and Russo 2001: 167) and the consequent phenomena of urban dispersion in the surrounding territory that local policy and planning are enable to contrast (Figure 3.3).

3.3.2. Benidorm

Benidorm (Figure 3.4) and the Costa Blanca are the most important seaside resorts in Europe and Mediterranean coast. In the mid 20th century it was a small fishing village inhabited by 2,000 people. In the early 1950s the fishing industry went into decline, and the village was regenerated through the action of the General Franco regime that used tourism as a tool of power and a short-cut to economic prosperity. In 1956 a plan was approved for the use of beaches for pleasure, and Benidorm became one of the first Spanish fishing villages converted in tourist destination experiencing significant urban growth. Since the late 1960 population has increased tenfold and now stands at 80,000 inhabitants, 40 percent of whom approximately are foreigners (Benidorm en cifras 2012). Since the first tourist hostel built in the Playa de Levante in 1925, which was the beginning of the holiday industry for this town, Benidorm completely changed. Today, it represents a concentrated form of tourist settlements (Figure 3.5) characterized by 142 hotels with 30,000 swimming pools, 330 skyscrapers including the 52 floor Gran hotel Bali, 6.266 apartments, 10 campsites with some 11.275 places, providing more than 68,000 beds, and 18,000 second homes, as well as resorts, villas and extensive recreational facilities (Benidorm en cifras 2012).

Several factors may explain these changes. The coastal environment, characterized by white sand, palm trees, crystal-clear waters and a favourable microclimate all year, has contributed to its attractiveness. As said, this sun and sand destination emerged along the Mediterranean coast in the 1960s.as a high-density urban development and high-rise buildings, which conform Benidorm's distinctive vertical skyline. By no means this was an uncontrolled process. Rather, Benidorm is the result of a long and profound process of land-use transformation and local planning model based on the public initiative and approved in 1956. Since then local authorities planned the categories of land-use, buildings and infrastructures, and defined growth areas.
The Alicante airport, opened in 1967, was the perhaps the biggest contributing factor to Benidorm success as a holiday resort. In 1977 passenger numbers reached 12 million. After periods of international crisis and recessions, in 2011 the flow of visitors was 1.748.564 people and hotels alone annually registered approximately 10 million overnight stays (Benidorm en cifras 2012). Foreign tourists, primarily British, followed by French and northern European countries, account

for half of these visits. Current projections suggest increasing numbers in hotel occupancy in Benidorm for the summer 2013 (Vicente, 2013).

As it has been recently observed by Ivars i Baidal *et al.* (2013), the interaction of local factors and global forces substantially influenced the development model of Benidorm, and the relationships between the urban configuration model and the tourism dynamics during four critical phases: (i) the international recession and supply-demand imbalances (1988-1993); (ii) the expansive phase (1994-2001); (iii) the stabilisation stage (2002-2007) and (iv) the effects of the international economic crisis (2007-2010). Among economic factors, the crisis of the traditional sun and sand Spanish model was identified, as well as the national and local tourism crisis in adapting to changes in the tourism market (Phase i), the local tourism recovery of Benidorm that contemporary caused the reduction of attractiveness of other tourist destinations such as Greece and Turkey (Phase i); the fluctuation of the local money; the favourable economic national situation and consolidation of the tourism industry (Phase iii) the world economy recession and the repercussions on the local tourism demand (Phase iv), and the dependence on the British market (Phase iv). Planning and policy factors contributed on urban planning and environmental quality improvement, with a strategic marketing plan (1991) for the town; the creation of a water park; an extensive public park (Phase i) the beach seafront promenades renovation (Phase i and iv) and the new terminal of the Alicante airport, associated to growth of low-cost airlines and the increase of internet purchases (Phase iv). Regional tourism policies also supported the major theme park (2000) located outside the town and associated with beaches and urban spaces that contributed to urban growth process with new activities, such as golf courses, the construction of hotel and residential accommodation, a new leisure area and residential homes (Phase ii). While the real estate market boom produced many non-hotel beds due to the growth of residential tourism, a considerable renovation of existing establishments was carried out (Phase iii). Moreover, new strategic infrastructures of tourism linked to culture and business were promoted (Phase iv).
Competitiveness factors related to rival sun and sand destinations (Phase i), or growing rival destinations (phase iv) offering alternative tourism models to the Spanish traditional model were also observed. This has led Benidorm to promote creation of the *Tourism Training*, first in a network of regional centres (Phase i), urban, recreational and leisure facilities, including the hotel growth with high-range categories, as a product brand from the Benidorm and the Tourism Marketing Plan (phase iii and iv), and currently the promotion of a new model of tourism for more sophisticated and independent travelers, continuing to maintain the traditional offer for families, young people and elderly. This indicates that new urban forms and facilities will change according this new model of tourism, since tourist settlement patterns influence and are in turn influenced by the profiles of tourists (Rico-Amoros *et al.*, 2009).

Moreover, local and international interest groups or stakeholders played a critical role in the decision making for the town development and the renovation of urban public spaces (Phase iv). Exogenous factors such as international wars and conflicts (Phase i and iii) also contributed significantly to the tourist movement reductions and local development. Moreover, social factors such as new consumption habits or property speculations were the responses to the ongoing situations. All these factors result intrinsically linked to the environmental and sustainability factors, as the processes of urban configuration of Benidorm have occurred through a long commodification of its coastal environment, hinterland and natural resources. A remarkable example is the water issue in Benidorm, which in part describe such commodification process.

After the drought crisis emergency of the summer of 1978, which coincided with the sharp increase period of tourist arrivals and that severely affected the German market by the prospects of insufficient water, the water supply system of the city was renovated and enhanced in order to ensure water supply for the new urban and tourist facilities, tourists and local people. Since then, sustainable measures such as obtaining water from farmers in exchange of electricity also were activated (Rico and Olcina, 2004). Although its vertical urban form changed the traditional one, Benidorm such as Manhattan are both considered sustainable "intelligent terrains" and a future model for holiday hubs which is expected to expand globally by 2030 (Thomson Holidays, 2010; Webster, 2011).

This model is retained more environmentally efficient, in regard to energy, water and land-use, and less dependent on private mobility (Iribas, 2000; Ivars i Baidal *et al.*, 2013; Rico-Amoros *et al.*, 2009), than many other tourism models based on urban sprawl located in Mediterranean coastal areas (EEA, 2006b). However different land management strategies have recently been retained responsible to have affected the environment of the surrounding municipalities that have used Benidorm as an anchor for urban sprawl (Bellot *et al.*, 2007). As a result, the proliferation of new urban forms, such as housing development with green gardens and private swimming pools, and recreational sites such as water parks and golf courses are generating new processes of landscape change.

Figure 3.4. High density along the Benidorm's coastline

Source: Own elaboration from Esri World Imagery Map 2011, 0.3m resolution

Figure 3.5. The unique vertical and touristic skyline of Benidorm

Source: photo: from web

3.3.3. Mykonos

The island of Mykonos, Greece, (Figure 3.6) is a well-known international tourist resort and famed as the most important gay holiday destination in Europe. Traditionally it was a very poor fishing village characterized by local activities based on fishing, farming, and breeding on harsh lands, and ship construction which represented the major industry. Tourism has turned the

economy over since it started in the 1950s by opening new opportunities for local people to gain income. Despite the natural environment of the island, typical of the archipelago of Kyklades, characterized by low vegetation due to the dry climate, lack of fresh water and poor soil conditions, the "sun and beach" tourism model has been favored by its coasts, long sunshine duration and little rainfall. As it is mostly visited during the summer months, it has a seasonal character.

Tourist numbers have increased substantially from around 5150 arrivals (at hotels) in 1965 to 60.000 in 1995 and currently are experiencing an explosive rise, unknown in the other Greek islands. In 2013 1 million visitors were expected and more than 4000 1-day transfer visitors per day use the island as an intermediate stops on ferry routes or as a day trip destinations. Tourists visiting Mykonos come from Germany and UK, and from other emerging markets such as China, Turkey and Russia (SETE, 2012). The island has thus become more cosmopolitan and expensive than other Greek islands sustaining the country which compete internationally with other tourist markets (SETE, 2012).

From the mini-resort built back in the 1960s, new tourism developments have grown up on a quarter of a third of the island between 1971 and 1991. Afterwards, the accommodation stock has risen considerably. The island's population has also increased in size, in contrast to other Greek islands that have lost population over the last decades. It doubled between 1961 and 1991 from 3718 to around 8500, and now stands above 10,134 people. This growth was followed by the expansion of the infrastructures and investments that have further boosted the island's capacity to accommodate tourists.

The case of Mykonos is a paradigmatic example of the process of urban sprawl occurring spatially far away from (and functionally outside the direct influence of) an urban region and mainly linked to tourism and second-home development sometimes linked to informal housing and real estate speculation (Salvati, 2013) (Figure 3.7) . Until the 1970s, the island of Mykonos was characterized by a dense spatial organization with adjacent settlements concentrated within the area of the main city and the harbor. Such a settlement model is similar to that observed in several other Greek islands and reflects the traditional compactness observed in several Mediterranean coastal towns. In the following years, however, an impressive growth of dispersed settlements (especially one-floor houses with small gardens or two-floor residential housing estates) was observed, also due to the urban planning directives that permitted the construction of multi-floor buildings only in the main settlements of the island. Thus, rapid urbanization has altered the socioeconomic structure and local culture (Coccossis and Parpairis, 1995). During the first phase the rapid and uncontrolled tourism development has transformed in scale, volume of built-up areas, character and environmental quality (Özgen, 2003).

The island experienced impressive changes in land-use and in the urban landscape of the main center (Chora) due to urban expansion. Moreover, tourism and second-home development in suburban areas surrounding Chora have caused concentration of people and buildings especially along the coastal rim forming a fragmented, entropic and diffused peri-urban landscape with poor aesthetic quality and important implications for environmental degradation. Water and soil pollution occur especially during the peak summer season.

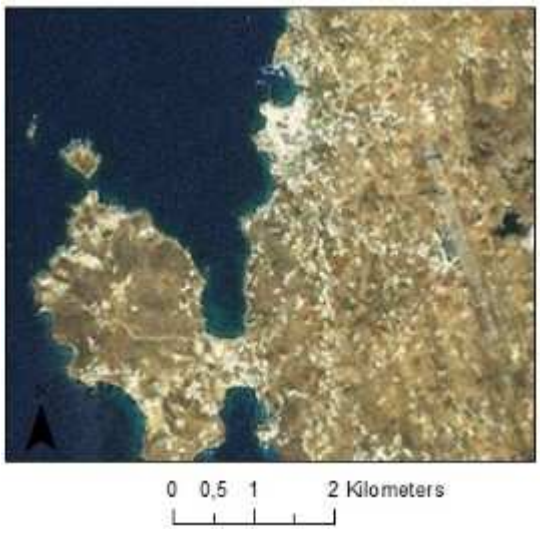
Despite water resources on the island of Mykonos are limited it is a critical resource for local people and for sustain tourism, which highly depends on its presence. Thus, two dams have been built to collect surface water, while a central wastewater treatment plant, a desalination plant and

the network projects made for water and sanitation are currently under construction, according to the information provided by the local municipality of Mykonos.

The conversion of agricultural and pasture land located in the suburbs of the main city and observed since the 1980s was primarily driven by socioeconomic changes due to tourism development and house speculation (Leontidou and Marmaras, 2001). The limited effectiveness of urban planning as well as a poor control against land appropriation and illegal buildings were the main causes of landscape changes in the 1980s and 1990s in Mykonos, with a pattern similar to other Greek islands that act as primary tourism poles. As discussed by Andriotis (2004) "the planning process of tourism development is controlled by external actors, mainly the central government". On the contrary, these dynamics are now diverging, at least partially, from those observed in Kyklades prefecture due to the quite different settlement patterns, landscape composition and tourism pressure found in the neighboring islands (Salvati, 2013).

Other relevant factors have affected the processes of environmental change. The crisis has played a big role on tourist sector of Mykonos, due to the last three years marked by riots, strikes, social upheaval and political unrest in Greece (Smith, 2013).

Figure 3.6. Low-density, discontinuous and fragmented urban expansion in Mykonos Island



Map 2011, 0.3m resolution

Figure 3.7. Peri-urban landscape in Mykonos with residential settlements and detached villas scattered along the coast

Source: Own elaboration from Esri World Imagery
Source: photo: from web

However, in the last year Mikonos and other Greek island have been re-launched in tourist exhibitions around the world in other to compete internationally as tourist destinations and moving away from the old "sun and beach" tourism based-model.

Despite the Municipality of Mykonos is currently developing a "quality tourism" model, the attempt to break with the old stereotype has frequently been thwarted by corruption and social power interests. Moreover, new public investments focusing on the creation of new strategic infrastructures are currently under construction such as: the enlargement of the port and airport, the Cultural Center, the water infrastructures mentioned above. They are contributing to change this landscape to respond to new interests linked to tourism demand. However, the weak role of

the State and the lack of autonomy in the decision-making of the island' future impedes the accomplishment of an integrated policy (Smith, 2013)

3.4. Discussion and conclusions

Cities and landscapes are on the international and local political agenda today. They receive increasing attention from researchers, geographers, planners and policy makers (UN-Habitat, 2010, 2012). The main reason is the general observation of the speed of the changes, urbanization effects, environment impacts and transformations, globalization and networks considered important driving forces of these changes and the emergence of new landscapes. New elements like tourism add complexity and new challenges to the highly dynamic urban picture. Despite the number of approaches to understand such change, little is known about ongoing urban processes and their relations.

In this study, three rapidly changing coastal cities were analyzed using the emerging framework provided by the Urban Political Ecology. The analysis was aimed at identify and discuss how contemporary processes of urban change produce new urban landscapes. The three selected cases in southern Europe (Benidorm, Venice and Mykonos) have illustrated how tourism-driven urbanization affects urban form and peri-urban landscapes in different ways. Even though studies dealing with tourism in these cities exists, they mainly focus on the economic influence and environmental impact of tourism, and do not consider the complexity of processes that are taking place in these contexts in which tourism is profoundly and intimately embedded to urban form, and how such processes will continue to produce changes in the urban and peri-urban landscapes. Three types of urban/peri-urban landscapes are identified as mainly linked to the different interplay between urban forms (compact, dispersed, discontinuous, fragmented), socioeconomic structures (polarized, scattered, poly-centric) and political-institutional regimes (e.g. centralized or decentralized). While Venice can be regarded as an example of urban expansion directly or indirectly linked with tourism development, the Benidorm and Mykonos cases represent landscapes mainly driven by tourism expansion. The picture is obviously complicated by the interrelationships of a number of anthropogenic drivers influencing the environment through non-linear paths and by the unpredictability of territorial actors' behaviour.

The paper argued that landscape changes resulting from the complex political, economical, social, cultural and ecological processes that form certain types of urban contexts in coastal tourism-specialized cities are permeating the intimate relationship between tourism and urban form. More than other approaches, Urban Political Ecology allowed to understand how these processes are interconnected and produce a particular socio-environment metabolism that materialize through new urban form. From this perspective, as it has been shown in the paper, the construction of the skyscrapers (in the Benidorm case), or the water infrastructures (in the case of Mykonos) testify the particular social, power, cultural relations through which socio-natural metabolisms are organized. Tourism therefore, results as an important component within this urban metabolism, but not the only one responsible of the changing urban form.

The approach based on comparative analysis of relevant coastal cities' case-studies represents a tool for the in-depth understanding of the intimate relationship among tourism, contemporary processes of urbanization and urban landscape changes in the light of the Urban Political Ecology approach. Future research on urban change phenomenon should take into account more

effectively the processes that constitute urban metabolism since it is crucial to understand the forms and socio-environmental dynamics of cities. Moreover, such type of analysis, revealing the socio-natural metabolism of the urban scale, constitutes the basis to explore those flows, like water, that constitute an important part of the city metabolism.

3.5. References

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Chapter VI

The Governance of the Hydrosocial Cycle in Tourist Coastal Cities: the Case of Venice

A preliminary version of this paper has been presented in the 2014 Annual Meeting of the Association of American Geographers (AAG), in the session Critical Approaches to Urban Water Governance III.

Ridolfi, E., 2014. Governing the Hydrosocial Cycle in Tourist Coastal Cities: The Paradigmatic Case of the Heritage Town of Venice, Italy. Tampa, Florida, USA. April 8-12, 2014.

Valuable comments and suggestions from the Meeting attendees helped me to improve this chapter.

“Le storie si raccontano da quando esiste la parola,
e priva di storie la razza umana sarebbe perita,
come sarebbe perita priva d’acqua.”

Karen Blixen Ultimi racconti, Adelphi, 1998

4. The governance of the hydrosocial cycle in tourist coastal cities: the case of Venice

Abstract

This paper explores the increasing relations between water cycles in Mediterranean coastal cities dominated by tourism, to develop more adaptable and sustainable urban water policies and governance systems. Water cycle largely sustains the socio-environmental system of these cities, as well as economic activities like tourism. However, these issues remain less investigated in conceptual and methodological terms.

This study attempts to explore these aspects through an empirical analysis of the hydro-social cycle in the historical center of Venice, in response to concerns over water resources arising from a massive tourism model, and excessive urban and social carrying capacity. I employ the "hydro-social cycle" concept which incorporates the water's social nature. It has been defined in literature as an analytical tool for investigating hydrosocial relations. To do this, I first focus on the geo-historical aspects to understand how hydro-social relations have co-evolved, shaping the historical center of Venice. Secondly, I reconstruct the current hydro-social cycle by combining the urban ecology discipline by identifying and quantifying the water flows, and that of Urban Political Ecology by describing the discursive composition of water cycle, the powerful actors' interests, the governance and control of these flows in the city of Venice looking to the role of tourism.

In conclusion, the framework provided by this study is suggested for further representation and critical understanding of governance systems related to hydro-social cycles in coastal cities characterized by dominant forms of tourism.

Keywords: Hydrosocial cycle; Water Governance; Coastal Cities; Mediterranean; Venice

4.1. Introduction

Many of the Mediterranean's coastal cities are shifting towards tourism, raising special concerns regarding water governance-issues (UNWTO, 2013; Gössling *et al.*, 2012).

Water largely sustains the socio-environmental systems of these cities, as well as economic activities such as tourism, which already represents one of the most important economic sectors in the region. Tourism in Mediterranean cities is an instrument of urban development, attracting 30 percent of global international arrivals and affecting local and foreign capitals. At the same time tourism is also recognized as one of the major drivers of global environmental change in water because of its potential impacts and effects on water demand and the generation of wastewater (Gössling *et al.*, 2006). Historic and heritage cities in particular, benefiting from this tourism receive (and, often suffer as well) a high number of tourists all year round (Jan van der Borg *et al.*, 1996; Williams, 2010; Ruoss and Alfarè, 2013). In these cities, as elsewhere, the relationships between water and tourism are intensifying the complexity of urban space (Gössling *et al.*, 2012).

However the study of the way by which water flows, circulate, interact and interweave in urban systems dominated by tourism represents a relatively new field of inquiry, and has been investigated little in conceptual and methodological terms.

The aim of this study is, therefore, to advance our knowledge about these emerging issues moving away from the conventional and dualistic analyses that separate social processes from material water flows and drawing instead on the "hydrosocial cycle" concept in order to incorporate the social and political nature of water considering at the same time, how water and social relations co-evolve and co-produce new hydrosocial configurations over space and time (Linton and Budds, 2013: 2). Through the empirical case of Venice's historical center[2] (Figure 4.1) in this paper I will investigate past and present hydro-social relations and its coevolution, with a special attention on the role of tourism in the modern era.

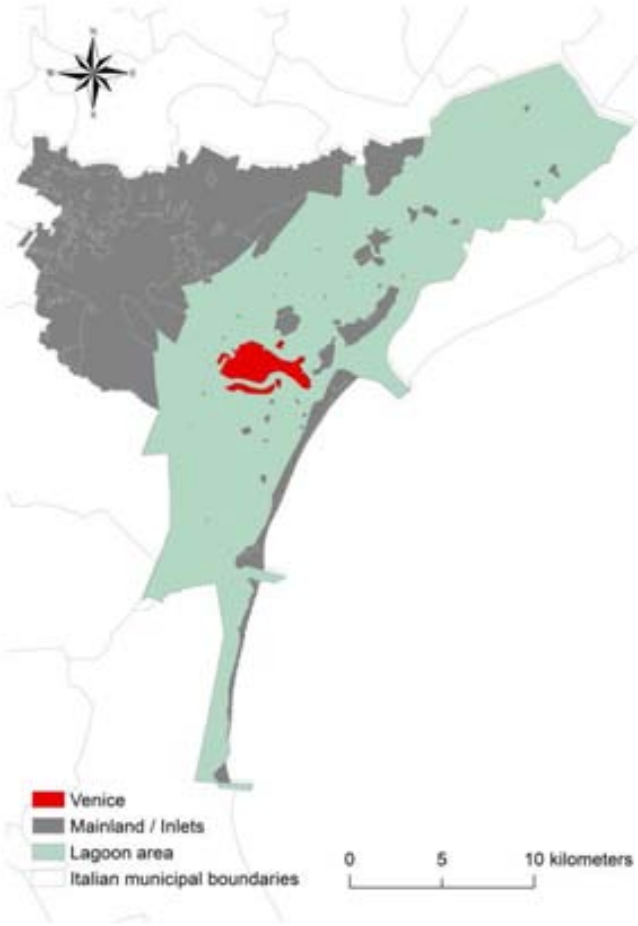
In the light of this framework, I first focus on the geo-historical analysis necessary to understand Venice's complex history of water governance, management, and in particular the network of powerful actors and interests that have led to the current hydro-social configuration. In this respect, I follow Swatuk (2010: 522) who has recently pointed out that ''present day water policy, practice and management are the results of historical dynamics". Second, after shedding light on how water flows, urban space and tourism have coevolved in Venice, I analyse and illustrate the current hydrosocial cycle of the city. To do this, I combine the urban ecology perspective to identify and quantify the water flows and Urban Political Ecology to describe the physical and social discursive composition of the water cycle itself dependent on powerful actors' agendas and interests, the govern and control of these flows and their relations with tourism. By combining Urban Ecology and Urban Political Ecology perspectives I attempt to integrate both social and physical analyses.

By exploring the Venice case, I also attempt to extend the hydrosocial cycle analysis to tourist coastal cities which have so far received little attention. This will allow a better understanding of current water governance structure.
Although Venice is, of course, the world's most unique city and a real tourist magnet, as a Unesco world heritage site, the way in which water cycles affect and are affected by tourism in urban areas are representative of larger issues of power and control and have worldwide applications (Amos, 2012).

Moreover, Venice (figure 4.1) represents a paradigmatic case to show how, since ancient times, hydrosocial relations take shape in dynamic ways. Today, the water cycle that flows in this urban fabric dominated by tourists, and its governance pose a unique set of challenges for the present and future of the city and its lagoon.
This research draws on quantitative and qualitative methods such as literature reviews (historical documents, reports, scientific, national and international papers, news papers) as well as collections of data and other assorted information. I also conducted in-person and key informant interviews with tourists, local people, employees and stakeholders involved in the water and tourism sector, and with scientists from the local universities.

[2] The term Venice's historic center refers, throughout the study, to Venice's insular urban core which encompasses Cannaregio, Castello, Dorsoduro, Giudecca, S. Croce, S. Elena, S. Marco, S. Polo and Sacca Fisola neighborhoods. They are the the neighborhoods 1 and 2 of the Municipality of Venice. Terms such as "city center" or "lagoon city" are used as synonyms.

Figure 4.1. Venice location map



Source: own elaboration

The paper is organized as follows. The section below presents the theoretical and methodological background of this study. Section 4.3 documents and analyzes the historical geography of Venice's hydro-social flows. In section 4.4 the coevolution among water and tourism in the city is investigated and Venice's current tourism model characterized. This is followed by section 4.5 that traces Venice's current hydro-social cycle revealing new relations between these flows and tourism, then illustrated and discussed in section 4.6.
The paper concludes by outlining the potential of this study suggesting further representation and critical understanding of urban hydrosocial cycle governance in coastal cities characterized by mass tourism.

4.2. Theoretical background

Water and how it is conveyed and metabolized in urban settlements is not often thought of as a fundamental component in creating and sustaining urban areas. If at all considered, water is usually understood as a necessary resource to supply cities, rather than a driver that critically interacts, flows and circulates into the urban environment. Therefore, water is closely linked to society and urban space permitting the reproduction and functioning of the latter.

In the last decade, this view of water incorporating social relations, besides physical and material dimensions, has been conceptualized with the term "hydrosocial cycle", by geographers working within the field of political ecology of water and social science (Budds, 2008, 2009; Kaika, 2005; Linton, 2008, 2010; Swyngedouw, 2004).
The concept has opened new perspectives of research to explore how flows of water influence the development of urban systems, characterizing elements and governance structures, and vice versa. In this cycle, flows of water circulate through a complex, stirred and often entangled network of streams, underground and surface canals, rainfall outlets, as well as pipes, water treatment plants, reservoirs, dams, leaking taps, gardens, swimming pools, and also water policies and legislations, quality and quantity standards, institutional arrangements and water companies (see e.g. Bakker, 2003). The natural substance of water (H_2O) becomes therefore transformed into a socio-natural "hybrid" that captures and embodies the relations through which it is produced, urbanized, metabolized, commodified and domesticated (Kaika, 2005; Swyngedouw, 2004, 2005) and also the processes that are simultaneously material, discursive and symbolic (Swyngedouw, 2004: 28). Water moves thus away from the hydrological cycle, understood and represented since ancient times as the natural circulation of flows in the hydrosphere, towards the hydrosocial cycle, which reflects human and no-human relations and the water's social and political nature (Linton and Budds, 2013).

Over the last decade, this concept has been employed in several empirical studies. However, as Bardati (2009); Linton and Budds (2013) argue, it has not been fully defined in a coherent way possibly because, as the studies show, hydrosocial cycles and relations analyzed assume very different configurations according to given context, revealing specific characteristics and thus making the concept fleeting. Boelens (2013) for instance, has demonstrated the usefulness and flexibility in employing the hydrosocial cycle approach extending it towards further domains such as hydro-cosmological cycles in the Andean highlands.
Linton and Budds (2013) have recently re-conceptualized the hydrosocial cycle, to reveal its potential in theoretical and methodological terms. They suggest its use as a framework for exploring hydrosocial relations, thus undertaking critical political ecologies of water. They define the hydrosocial cycle "as a socio-natural process by which water and society make and remake each other over space and time" (Linton and Budds, 2013: 1) in a sort of continue co-evolution and co-constitution. They also argue that exploring historical and geographical processes internalized in water flows "offers analytical insights into the social construction and production of water, the ways by which it is made known, and the power relations that are embedded in hydrosocial change". According to them "theorizing and investigating water-society relations is compatible with emerging forms of governance, and might be useful in promoting more equitable hydrosocial relations" (Linton and Budds, 2013: 2).

In this respect, Liverman (2004) and Swyngedouw (2009) agree and contend that the reworking of environmental governance is urgent to explore the existing and intricate relationships among political systems, scales, new actors such as consumers as well as other stakeholders in formulating objectives and policies, as well as the use, management, and distribution of water. It is critical particularly "to respond to processes of globalization and global environmental change" (Liverman, 2004: 734).
In practical terms, governing hydro-social configurations implies to address the question of "who is entitled to what quality, kind and what volumes of water and who should control, manage and/or decide how the hydro-social cycle will be organized" (Swyngedouw, 2009: 58). It also

requires the analysis of the discourses about how water is mobilized for different uses in different places, is defended or legitimated for particular strategies, who has the access or control over, and who will be excluded from this resource (Swyngedouw, 2009). According to some authors, tracing the flow of water and examining the physical and socio-political discourses surrounding the resource may help to reveal the functioning of urban metabolism conceptualized as a "number of dynamic, interconnected, and mutually transformative physical and social processes" (Castán Broto *et al.*, 2012: 858) and to "show how social power is distributed in a given society" (Swyngedouw, 1999) and thus in the hydrosocial cycle.

From a methodological point of view, recent studies have moved in exploring the political ecology on water focusing the power relationships that configures different hydrosocial cycles (Budds, 2009).
Moreover, limited studies exist that have explored the relationships between tourism and water resources using a political ecology perspective (Stonich, 1998). Additional, little attention has been paid to physical aspects of water and its knowledge. As yet, given the increasing presence of private interests about water management and control, this literature has focused particularly on governing practices involved in privatization processes (Fernandez, 2013). However, public, private or hybrid urban water governance systems characterizing the hydrosocial cycles exists and produce several relations between water (as flow resource) and society.
This paper addresses this gap by exploring these issues employing the urban ecology and urban political ecology perspectives of research looking to both the physical and social aspects that characterizes the water governance systems.

Urban ecology and urban political ecology are two fields that have emerged from the disciplines of ecology and human geography respectively, identifying ways in which water and urban form influence each other. While urban ecology uses the concept of the water-cycle looking to more physical aspects related to input, consumption and output, as well quantity, quality, location and processes (Alberti, 2008; Vitousek et al., 2008), urban political ecology looks at the process in which humans harness and mobilize water for urban areas. This includes setting up new or altering old institutions of politics, governance, and water practices, and changing relations between society and nature (Heynen, Kaika, and Swyngedouw, 2006).
Together, these perspectives suggest the need to adopt a more critical approach to analyse the governance of the hydrosocial cycle especially in areas where tourism as a global economic process appears as a major factor and may significantly influence this governance.

"Veniexia è in aqua et non ha aqua"
"Venice is in water and has no water"

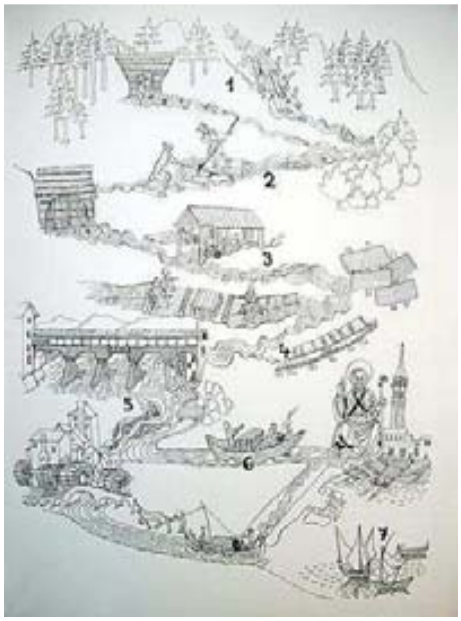
Marin Sanudo, 1880.

4.3. Reconstructing the historical hydro-social flows of Venice

Venice, located in a wide lagoon in the north-eastern part of Italy, between the continent and the Adriatic Sea, is the result of centuries of natural and anthropogenic interactions and dynamic transformations.

Originally the Venice‘s islands were shaped by the freshwater inflow and sediments of two branches of the Brenta River (now the Canal Grande and Canale della Giudecca) running through the river mouth from the mainland into the lagoon and the sea.
The settlement process on these emerged lands, almost completely covered by brackish water, often muddy and unstable, occurred mainly by means of water and implied the use of other resources from long distant places. For centuries, millions of wooden poles were made to flow down through the Cismon-Brenta River[3] into Venice’s islands, where they were driven into the mud, allowing the city to be founded. This River, also called “wood river” (Asche *et al.*, 2010) was domesticated, exploited and triggered as an intense hydrosocial flow of interests, business, technology and water knowledge summing up intense natural and social relations. Even if not made explicit by Asche and colleagues (2010), the “wood river” (figure 4.2) represents the complex and long hydro-*social* flow which permitted the rapid urban development of Venice’s islands which, although muddy and unstable, without local freshwater sources[4] and arable lands, attracted wealthy, noble and religious people from the mainland, who created the urban, cultural and historical richness of the city.

Figure 4.2. The “Wood River”



Source: Asche, 2010

The city has always depended on external supplies for almost everything, including freshwater; an essential precondition to every settlement. After the first urban nucleus of Rivo Alto (now Rialto) on the Grand Canal was founded, the Ducal Government, the political and administrative center which detained the power and control on the city and all waters, emerged soon. Ever since the ‘city of wood’ became urbanized, each of their elements was unconditionally influenced by the presence and absence of waters.

[3] The River flowed from the Trentino, Tyrol and Veneto mountains into the Venice’s plain and lagoon

[4] "Veniexia is not in aqua et aqua" with these words Marin Sanudo, historian and chronicler Venetian of 16th, contested the lack of potable water in the Venice’s islands. (Sanudo, M. 1880, *Cronachetta*, ed. Fullin, Venezia, p. 63.)

Initially, lagoon dwellers (mainly fishermen and extractors of salt), obtained fresh water from rainwater filtered in cisterns.
Since the 14th century the Venetian Government recognized that all the waters of Venice ensured business, wealth and power to the city. Therefore, the Magistrate of Waters (or Water Authority) was established imposing rational water use and behaviors in order to avoid waste. The Magistrate integrated political, legal, administrative and scientific competences for the management, regulation, protection and control of waters and the territory of Venice Republic. The city was the first in the world to introduce the concept of "public use of water" as a resource for the community, into the legal framework on waters (Cacciavillani and Drago, 2006). This concept still constitutes the cornerstone of the regulatory environment for water.
The Venice Government mandated the construction of wells called "Venetian wells", and encouraged affluent families to build and donate these wells to the city's population (Cacciavillani, 2010: 118). Cisterns were replaced with sophisticated rainwater collection wells that filtered rainwater flowing from the roofs, into underground protected tanks, ensuring the maximum amount of water possible, with the maximum hygiene guaranteed.

Water demand increased due to growing population and activities. Nonetheless, water flows continued in accordance with Venice social conditions and events. Later, in the early 15th century (an era of scientific social and governmental innovation in Italy), about 126 fountains were built in the courtyards and squares or next to wells, becoming important focal points for Venetians to socialize.
In the 16th century the supply of potable water was secured by about 2.700 private and public wells, plus another 1,300 used for industrial purposes. In percentage, the filtered water contained in the Venetian wells[5] was about 20 percent of the total, compared with the 80 percent of raw rainwater. The amount of potable water per capita was about 5-5.5 liters per day increasing to 6.8 liters two centuries later. In the mid-19th century, about 6,046 private cisterns and 180 public cisterns existed in the city (Costantini, 1984).
The Venetian wells thus shaped not only the evolution of the urban water supply of Venice but also that of the Eastern Mediterranean civilizations who adopted the same water system (Angelakis *et al.*, 2012: 471).

Between the 15th and the 16th century great attention also was given to public sanitation. This was performed by the state and was "invented" in Venice through a complex and articulated governance structure (Cacciavillani, 2010). However, it became rigid and bureaucratic through many social figures such as Savi (water experts), Acquaroli (water vendors[6]) and monks, among others, who verified the quality, quantity and salubrity of all waters. Therefore, local hydrosocial practices fused together people, behaviours, places, territories, and labour which were subject to specific and very strict water politics.
In times of increasing demand and droughts wells were used as reservoirs for purchased water, brought by professional employees 'Acquaroli' on 'burchi' (boats) from Fusina in the mainland. Unlike Venice, the Veneto plain has always been characterized by a particularly rich and articulated hydrographic network. For this reason water was collected and transported into the lagoon city to be sold in washtubs for public and private use.
Given the lack of local freshwater sources the city continually improved its water systems in order to battle scarcity. However, there never was physical scarcity per se; rather, scarcity was always

[5] The capacity of the Venetian wells was proportional to the space from which water was collected.
[6] The local name for these water vendors. (Cacciavillani, 2010).

"socially produced" since increasing water demand resulted from the changing needs and interests of the Venetian upper classes. For this reason, water supply and demand coevolved in the city, new supplies generated higher demands, and in turn, higher demands favored supply expansion over other alternatives. This coevolution required urban water interventions (i.e. the construction of new wells) that had implications for the form of the city (Gianighian, 1989: 557). Thus, for instance, the urban structures[7] were built around the Venice wells, and not vice versa (Costantini, 1984: 14). In the 15th century, Venetian wells were integrated by the Seriola[8] (small canal) which diverted the water of the Brenta River from Dolo to Moranzani (in the mainland). Here the Acquaroli loaded the water for the city. Some Seriola's branches also provided water for industrial activities in Venice (Cacciavillani and Drago, 2006) and sale of ice during the summer months. The complex Moranzani's hydraulic system was strategic to the water supply of Venice.
Due to siltation of large areas of the Venice lagoon by rivers and the subsequent transformation of the lagoon, observed by experts of waters, the city became a laboratory for experimentation in water engineering.

The first maps representing the diversion and control of the rivers were the hydro-social tool through which water flows became the product of interests, social conflicts, uncertainty, numerous failures as well as decisions and policies linked to waters and territories (figure 4.3).

Figure 4.3. Detail from a map of the river diversion interventions, by Christopher Sabbadino (1557) one of the most famous and influential oldest hydraulics of the Republic of Venice.

Source: D'Alpaos, 2010

Between the mid-16th and the mid-17th century, and after a series of attempts, several hydraulic regulation works were built starting with the diversion of the Brenta, Dese, Sile and Piave rivers out of the lagoon to avoid silting.
The river diversion policy, thought to preserve economic interests and for defense purposes (Guerzoni and Tagliapietra, 2006) allowed Venice to become the center of maritime world trade

[7] Such as houses, churches, canals, bridges, *calli* (streets), buildings, dwellings and ancient industries.
[8] At this point Venetian Government decreed the greater purity of Brenta's waters.

with the largest harbor in the Mediterranean and in the world, as well as one of the most populous cities in Europe with more than 200,000 inhabitants. Consequently, urban space became more reduced and water increasingly valuable. The Venetian wells were complemented by the "renaissance double house"; a dwelling equipped with a cistern fed by a system of pipes within the walls, carrying rainwater from the roof.

With the first technical facilities for the storage and transport of water, duties and tariffs were introduced. Since then, water was not only domesticated but also transformed from a free resource into an economic good. Water vending became a very lucrative business and highlighted the bipolar structure of Venetian society (Moryson, 1908). The considerable returns of the water businesses also changed the social composition of Venice, as the water economy became increasingly controlled by the Venetian Government. In time, access to water depended increasingly on the ability of people to pay. Poorer people used the (few) public cisterns available, those of the convents and often those of the patrician families of which they were clients, while the wealthiest households owned wells in their own private courts or fetched their water by boat. Forms of power and control on waters were exerted by local authorities from very early times who subtracted citizens the water reserves, mainly located within the walls of the Ducal Palace, especially in case of popular riots.
Other flows of water tell about of the environmental and social conditions surrounding use and the governance of waters in Venice. For instance salt water being abundant in the lagoon was exploited and transformed by mills (e.g. Molino Stucky on the Giudecca island) and salt flats in the city for the buying and selling of economic products and foodstuffs, in what became "the key to a policy that made Venice the dominant commercial force of southern Europe" (Kurlansky, 2003).

The tidal flow[9] of the Adriatic Sea entering and leaving from the inlets of the Lagoon of Venice twice a day held the important function of naturally removing raw sewage and wastes thrown by Venetians in the streets and canals. In 16th century, and given the high number of people living in the city, Venice developed one of the first sewer systems in the world, consisting of an intricate network of underground conduits called "gatoli" built to transfer wastewater from homes into the canals (WPI project, 2013). In this rudimentary sewage system anaerobic process took place inside the gatoli (as pipes lacked an outlet) which therefore act as a septic tank until the next high tide flushed its contents. The aerobic process proceeded in the canals and in the Venetian Lagoon and disinfection occurred naturally by the action of seawater. When, during the 17th century, European cities were growing rapidly without any sanitary facilities, Venice had already one of the more efficient systems in this respect.

By the mid-19th century, when the water supply system put in place in the 16th century became inadequate, poorly hygienic and wasteful, new waterworks projects and studies, to provide the city with a circulating running water network, were undertaken. Between 1882 and 1884, in the wake of fervent economic and entrepreneurial initiatives mainly linked to the infrastructural policies of ports and rails, Venice was to be granted an aqueduct from the mainland (Cataloghi Marsilio, 1984). After twenty years of negotiations, the aqueduct was finally built. A hydrophore[10] was located in the Moranzani area, 11 km away from the city. This facility housed

[9] In 14th century the Venice's inlets were eight and allowed greater exchange of water between the Sea and the Lagoon.
[10] An instrument for obtaining water (as in a river) from any desired depth

the pumping system of the Seriola, intended to supply the aqueduct (800 mm diameter) which carried potable water into the great reservoir of St. Andrea (10.000 m^3) which in turn distributed flows throughout the city, to public wells and private users through a dense network of underground pipes. This water project was executed by the "Società Veneta" (or Veneta Company) and, was managed by the French Societé Generale des Eaux[11] until 1973. The Venice aqueduct was the first commercial success abroad of the French company (Album degli ingegneri ed architetti, 1886) followed by projects in other Italian cities such as Padua and Naples, but also Constantinople (1882) and Porto (1883).
Since 1847 additional water was supplied to Venice city through artesian wells scattered across the mainland and managed by a private water company.

By 1884 both the city and Venetians could celebrate the domestication of water flows all sanitized; water practices and circulation moved from the public space of cisterns and wells (which became unused) toward a private sphere of the houses. Social practices, positions and relations of power became more marketed and consolidated. While rich people's houses had private and decorated toilets, common people had their bathroom with sink and toilet in the kitchen which was the most spacious and hottest place of the house. Poor families used public showers spread throughout the city and the canals as public toilets for essential bodily hygiene. Water canals continued to be used for sewage disposal in absence of a municipal sewer system, a situation that continues to this day.

The construction of the aqueduct together with the railway bridge that linked Venice with the mainland, mobilized potable water, gas, energy, materials as well as people and travelers into Venice, and became a great technical conquest for Venice. These flows stimulated Venetian and foreign capital investments mainly oriented toward tourism. The promotion of Venice as a tourist destination materialized in a radical renewal of the city. Its urban structure expanded becoming more and more dense, equipped with better services, and with expanding commercial and industrial activities. Water, in particular, assumed new functions and played a fundamental role in its society and environment.
In the next section, I explore more in depth the relations, very often ignored, between water and tourism which largely have shaped Venice's identity, culture and heritage, as well as its hydro-social cycle.

4.4. The role of tourism in the coevolution of the urban hydro-social cycle

4.4.1. An historical overview

The bond between Venice and tourism has a centuries-old history (see e.g. Cosgrove, 1982, 2003). According to Fontini Brown (1997: 9), Venice was an attraction long before the term "tourism" was ever invented. The lagoon city had always received visitors and between the 13th and the 17th century, it consolidated this practice welcoming foreign tourists and its international reputation as a majesties heritage city. In 18th century, the city became a strategic destination of the Grand Tour for the European aristocracy (Redford, 1996; Verhoeven, 2013) which, according

[11] The French company 'Societé Generale des Eaux' born in Paris in 1853 and distributed potable water to Paris and Lyon.

to Davis and Marvin (2004), would be the first form of tourism, and one fundamental for the Venetian culture and society (Zanetto, 1986). By the mid-19th century, Venice turned into a "pattern" of tourism destination for wider social segments (Towner, 1985: 318; Cosgrove, 1982: 146; Querini Stampalia, 1856).

With the important infrastructural operations, productive investments, and the improvement of the city image between the mid-19th and the mid-20th century, numerous palaces were converted in sophisticated and modern tourist accommodations, by many decaying noble families. One of the reasons of the tourism revival of Venice was based on the culture of the body and swimming, together with new rituals and practices of holidays, that was spreading across Europe (Bernardello, 2002: 83; Vanzan Marchini, 1999).

At first, canal and lagoon waters were converted in natural swimming pools, at least until the 1980s. Given that bathing in the lagoon waters was considered an innovating medical therapy (Barzilai, 1853), in 1833 an establishment, called "Floating baths of Venice" was built and docked at San Samuele (Farina, 2001). It included a decorated bath of 1060 m^2 equipped with "simple and medicated, fresh and salty waters, steam and showers" for healing and hygienic purposes. Later, these floating baths were complemented by floating gondolas for ladies. Swimming and bathing practices became very popular among the aristocracy to enjoy pleasure, status, leisure and health, and were transformed into a prestigious social habit that progressively excluded the lower classes.

Consequently, water assumed new functions and values (Vanzan Marchini, 1997, 1999) shifting from an indispensable public good to a commodity. Waters now abundant in supplying the city facilitated the expansion of luxury through the construction of hotels (eight hotel-spa facilities), mainly located on the Grand Canal, and two floating baths for health and body care as well as for leisure and pleasure. This form of tourism, limited to summer months, allowed Venice to become the leading holiday destination for noble and rich people from all over Europe. Later, urban-planning policies, economic interests and private investments were addressed to launch Venice as a leader of the thermal-cultural tourism sector, attracting an increasing number of tourists. However, thermal bath practices, born in the luxury city lagoon, were relocated to the sea side island of Lido, due to military and security reasons concerning the lagoon and to the direction of new economic investments (Bernardello, 2002). Nonetheless, Venice's historic center continued to be a focal point in the evolution of Europe's cultural and heritage tourism for rich and leisured classes who visited Venice in the eighteenth and nineteenth centuries. As Venice became increasingly more competitive in the world of Mediterranean destinations, in the 1950s flows of tourism expanded intensively. Around the mid 20th century, the historic center accounted for 184,000 residents and recorded approximately 1,200,000 overnight stays. By then, the number of overnights was being far outstripped by the presence of day-trippers and tourism reached unprecedented proportions year by year. By the mid 1990s, the historical centre hosted 7–8 million arrivals (Montanari and Muscara, 1995), and by 2002 arrivals reached 12 million people. It was estimated that, of this total, some 80 percent were day-trippers (Van der Borg, 2002).

Among the many factors that can explain this growth in demand, we must cite new favorable local and external social and economic conditions, and the desire to experience this unusual city's cultural heritage (Van der Borg *et al.*, 1996). According to many authors (see e.g. Quinn, 2007) this type of tourism has taken over the historical center and has expanded its social composition.

Since the second half of the nineteen century, the massive influx of tourists has given rise to what is called the phenomena of "mass tourism".
As a result, the city has experienced a profound "metamorphosis" until today (Verbeker, 2010). As I will show later, new water and tourism relations have again configured the city. The next section provides a tourism characterization which attempts to describe and represent the key features and specificity of tourism in Venice's historical center.

4.4.2. Characterizing current tourism in Venice

Historical Venice ranks today in 45th place among the world's leading cities in terms of international tourist arrivals (Euromonitor International, 2012). And it is the third Italian city, after Rome and Milan, with the highest tourist flows largely coming from abroad (ONT, 2013).
In the last years, tourism has contributed to the Veneto's regional economy with some 15 billion euro annually (8,2 percent of regional GNP). This revenue is 3.5 times that of agriculture, 3.5 times that of the food processing sector, and 54 percent of the entire regional trade revenue, while offering almost 500.000 direct and indirect jobs. The attractiveness of its built environment, with an extra increase of foreigners of 22.4 percent since 2005 has resulted in the replication of Venice's image around the world, for instance in cities from Las Vegas to Macao. The waters of the lagoon, sea and rivers are a key element attracting tourists to Venice since they allow the practice of various forms of tourism (e.g. naturalistic, coastal, cruise, fluvial, and thermal tourism (Regione Veneto, 2007). Drinking water sources, available in the historic center, allow one to enjoy the city, and to sustain all economic activities surrounding tourism.
The influx of visitors is challenging the identity of the lagoon city but numbers prove difficult to calculate. This is because official tourism studies, elaborated according to different methods, provide information that may vary considerably. The "Tourism Report 2012" of the Venice Municipality, for instance, indicates a total influx of visitors over 20 million people per year, or 60.000 on average every day. Other estimates range from 24 million (Costa, 2012) to 30,38 million (Italia Nostra[12]) per year or 83.000 per day (Lanapoppi, 2012).
Even though tourism is more marked during the summer months, particularly in July, it is not limited to single season. It runs all year round following local and international events. Peaks of 200,000 day visitors are not an exception during special occasions, such as carnival.
According to official sources Venice's tourism flows are mainly composed by tourists (or overnights[13]) and "excursionists"[14] (generally distinguished into day-trippers[15] and false excursionists[16]) (table 4.1). However, in table 1 I identify other two categories: "Vacationers" and "Resident tourists" and summarize their differences regarding several variables such as influx of visitors, length of stay, tourism expenditure and accommodation, among others. By doing so, I seek to characterize the wider picture that tourism assumes in the historical center.
From the table we can see that the figures of tourists and excursionists vary substantially. For example, the "Visiting Survey 2012[17]", based on multilingual questionnaires, attempts to dispel the myth of "hit and run" Venice tourism pointing out that the lowest number of excursionists does not spoil the city but brings wealth as well.

[12] Italian Association for the Protection of cultural heritage and Environment.
[13] An overnight stay is every night that a tourist actually spends in a tourist accommodation (by sleeping or being there) or that s/he is registered in a tourist accommodation (his/her physical presence there is thus not necessary).
[14] People (domestic, inbound or outbound) visiting the city and the trip does not include the overnight stay.
[15] People visiting the city in one day.
[16] People who stay in the mainland or around the lagoon city, but have as only purpose visiting the historic city.
[17] Source unpublished: Courtesy of Servizio Statistica e Ricerca - Comune di Venezia Dipartimento Turismo

Table 4.1. Different forms of tourism and their characteristics.

Variable	Tourists	Excursionists		Vacationers	Permanent tourists
		Day trippers	False Excursionists		
Influx of visitors	64% (VS, 2012)	15% (VS, 2012)	21% (VS, 2012)	Low/moderate	Moderate
	5.507.459 forages; 714.362 domestics (TR, 2012).	6.400.000 - 31% (CESDOC, 2013)	8.100.000 - 39% (CESDOC, 2013)		
	Tot. Tourists 6.221.821 - 30% (TR, 2012 and CESDOC, 2013)	tot. excursionists 14.500.000- 70% (CESDOC, 2013)			
Length of stay	4,3 nights Hotels 2,5 nights Exta-hotels (VS, 2012)		2 nights (TR, 2012) in the mainland	2 weeks to 2 months	During periods
	2,34 nights Hotels 3,05 nights Exta-hotels (TR, 2012)				
Tourist origin in hotels and extra-hotels	Europeans mainly (VS, 2012)	Italians mainly (VS, 2012)	Europeans mainly (VS, 2012)		
Tourist origin in informally private houses	UK, Western Europe and United States (NV, 2014)				Foreign investors
Land use pattern	Hotels 279 (from 1 to five-stars and 5 luxury stars; presence of three-stars hotels mainly); Beds 16.516; 4.451.996 overnight stays in 2012 (TR, 2012)				
	Extra-hotels 2.040 (1.442 housing units "classified, unclassified or managed by estate agencies", 274 B&B, 278 rented rooms, 25 youth hostels and 15 residences (TR, 2012); beds 11.247; 1.769.825 overnight stays in 2012 (TR, 2012)				
Average age	39 years-olds (VS, 2012)	36 years-olds (VS, 2012)	38 years-olds (VS, 2012)	ND	ND
Group size	About 3 people; in couple and with friends, mainly (VS, 2012)			ND	ND
Lodging type	Hotels 64% (mostly 3 stars-hotels and pensions); 16% Extra-hotels (12% B&B; 4% youth hostels); 14% Private houses (VS, 2012)		Hotels and pensions in the mainland		Apartments; Mansion houses and palaces in the historical center
	Informally Private houses 55% increased between 2012-2013 (NV, 2014)				
Tourism Activity	Cultural and urban tourism, mainly				Cultural and urban tourism, businnes; International events
Level of education	Bachelor's degree/high school degree (VS, 2012)				Wealthy clients

Tourism expenditure	169 euro/person/day - 220 euro/person/stay (Accommodation and other exp.) (VS, 2012)	25 euro/person/day (VS, 2012)	Moderate		Moderate/High
Tourism accommodation expenditure	Room in hotel: High/very high 192 – 1124 euro/person/day (CV, 2012)		Moderate: 54 - 139 euro/person/day for a room in hotel in the mainland (CV, 2012)	1.400 euro/month - 65m^2 in apartment	4.000 - 9.000 euro/m^2 apartaments for sale to very hight prices for 300mq for wealthy clients
	Informally Private houses: 1250 - 1860 euro/week (or week end) (NV, 2014).				
Transport	plane, train, cruise (VS and TR, 2012)	train, car, bus (VS and TR 2012)			
Seasonality	Very high June/July Moderate: May/Fall Low December/January (CV, 2012)				All year, and during cultural events

Source: Own elaboration from various sources synthesised (Visitor Survey 2012 (VS, 2012); Rapporto Turismo 2012 (RT, 2012); NuovaVenezia, 2014 (NV, 2014); City of Venice (CV, 2012)

According the Visiting Survey, excursionists are younger and more educated, and consume fewer resources (e.g., foodstuffs in restaurants) in the city.
By contrast the "Cesdoc, 2013" analysis, based on Veneto tourist indicators, confirms the high presence of excursionists (70 percent) and their impact on the city and residents. The tourist/resident ratio for 2012, calculated by Cesdoc, was 87:1, up to 247:1 if considered excursionists, for a total of 334:1 visitor/resident ratio. Since its advent, the phenomenon of excursionism has been widely recognized as the main responsible of mass tourism and its intense pressures, as well as a threat for the city and its population (see e.g. Kay, 2008; Tantucci, 2013; VeneziaToday, 2013; Reski, 2012). Moreover, the numerous policies proposed so far have failed to counter the invasion of tourism and services such as fast food and similar processes of standardization initiatives (Vitucci, 2011).
During two-thirds of the year the number of visitors far surpasses the optimum flow of 20.750 visitors per day (the carrying capacity of the city calculated by Costa and Van der Borg in 1988), producing negative socio-economic and environment impacts (see e.g. Graduatoria EBNT 2012; Ferri and Guarnaroli, 2012). A large part of day trippers are also represented by millions of cruise passengers that visit Venice center during one day. They were 1.8 million in 2012, a figure projected to grow since that one third of all cruise ships worldwide come to Venice each year (Tattara, 2013).

In term of accommodation, 64 percent of tourists seem to prefer hotels than private apartment or houses (table 4.1) (Visiting Survey, 2012).
Excusive hotels offer a variety of facilities and water amenities such as spas and swimming pools. However, three-star hotels represent the most important segment of the hotel sector in Venice (Annuario turismo 2012). In any case, recent studies and websites surveys (see e.g. NuovaVenezia, 2014) show that, between 2012 and 2013, the number of hotels has increased from 209 in 2001 to 267 in 2010 (+58), while that of extra-hotels increased from 294 in 2001 to as

many as 1645 in 2010 (+1351), or in relative terms, 28 percent and 460 percent[18] respectively (figure 4.4).

Figure 4.4. Accommodation facilities in Venice's historic center

Source: OECD, 2010

Most significant, is that Venetian houses rented informally to tourists have increased by 55 percent indicating thus the opposite trend. In this respect, some studies (e.g. Ferri and Guarnaroli, 2012) explain that the increase of extra-hotels has occurred due to the lack of market regulation, changing thus the urban residential fabric. Many historical palaces and residences continue to be converted in tourist facilities and reclaimed from the residential real estate market, making the "house problem" increasingly crucial for the resident population (Coses, 2009).
Vacationers represent a smaller flow of visitors in the city, staying proximally from two weeks to two months in owned or rented apartments and usually spending much less than tourists. As shown before, prices related to sales or rents vary significantly in the historical city, especially if compared with the mainland.

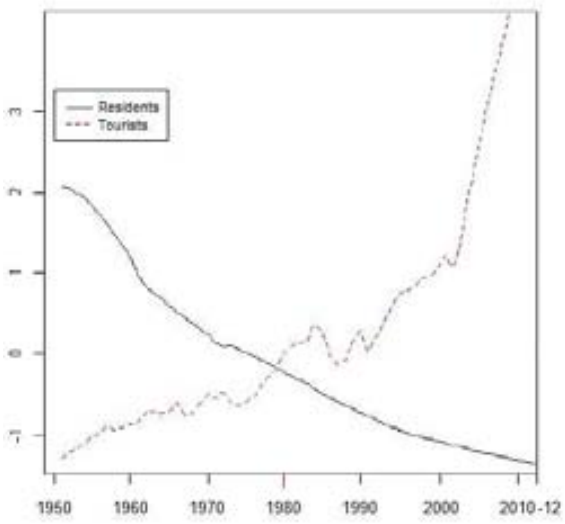
Increasingly, private houses rented informally may attain very high prices of up to 10.000 euro per week (Personal survey with American tourists).
In the last decade, many foreign tourist investors have turned into resident tourists purchasing valuable apartments, mansion houses and palaces in the historical center. This segment is willing to pay from 4,769 €/m² to 8000-9000 €/m² (the average price in Venice Municipality is 2878 €/m² and 1.892 €/m² in the mainland) and much more. In 2002, the "Fondazione Venezia 2000" advanced the proposal to convert fluent tourists, such as second-homes owners and holders of businesses who operate and bring wealth to the city, into stakeholders and honorary citizens with specific legal status, and the same rights of Venetian residents. The idea to promote the so called "special tourist", also defined as "first class tourist" (Fumagalli, 2002), for a "special city" was conceived to counter the "hit and run" of excursionism, revitalize Venice and protect its cultural and environmental heritage.
To a certain extent, tourism in Venice is still perceived as a luxury item; an elite destination linked to international events and activities. In this respect, Reski (2012) and Montanari (2013)

[18] City of Venice - Department of Tourism, Statistic data Service

state that “Venice lives on a permanent sale”, as in the last six years a hundred historic buildings have turned into luxury hotels or tourist attractions, even at the cost of modifying the city master plan to accomplish economic interests. Venice’s historical centre, business and public establishments have thus become heavily depending on a very heterogeneous tourism. Jan van der Borg *et al.* (1996) pointed out that Venice is the city that “most clearly represents what the term “touristification” means for an urban area”, turning rapidly into a theme park (Guimaraes Pereira and Funtowicz, 2013; Bianchin, 2006); “a city virtually without residents within 2030” (Hooper, 2006; Vitucci, 2011).

Figure 4.5. shows how since the 1950s, tourism numbers have continued to increase, while those of urban population have declined at a rate ranging from 1000 to 2000 people per year. In 2012, the population of Venice dropped to less than 58.000 inhabitants, of which about 3500 foreign (City of Venice, 2014).

Figure 4.5. Residents and tourist’s dynamics.



Source: Adapted from COSES, 2009

Residents have moved into the mainland triggering a sprawling urbanized coast model and dispersion already in place, as well as tourism growth to supply the high demand coming from the city lagoon. Although the accommodation capacity responds to the tourist market many hotels have been constructed in Mestre, which offers advantages in terms of space and price and other three hotels having 500 new beds and water amenities are planned near the Airport area. As observed (Coses, 2009), the exodus of residents that dramatically this small city continue to experience has not been just attributed to high tourism impacts and pressures and the real estate market out of control, but also to the overall quality of life, service, housing, urban mobility, architectural limits, depletion of environmental resources over the last decades, as well as the lack of effective urban and public policies (Coses, 2009: 5).

These reasons have been confirmed by some of my interviews from local actors. As a result, the structure of residents in the lagoon city presents a high number of relatively young people (average age of 45 and living single-person households) with higher education qualifications, and employed in the most important positions; university students of two major universities, and retirees (Coses, 2009) as well as higher-income residents and an increasing number of foreigners. The frequent question: “Who must be included among Venetians'?” remains open and difficult to

define (Coses, 2009: 3). According recent surveys about 150.000 would be approximately the total number of *city users* (table 4.2) daily living the historic center. Current projections suggest these figures could rise significantly by 2020 (Veneto Region, 2014).

Table 4.2. Daily population equivalent in the Venice's historic center.

Population group	**Population equivalent**
Residents	67 693
Second home owners	4 731
Undergraduate students	3 416
Tourists (overnight visitors)	14 761
Tourists (day-trippers)	32 195
Commuters (study)	6 359
Commuters (work)	14 295
Total population equivalent	**143 450**

OECD (2010: 75)

As I will attempt to show in the next section, it is in the historical urban system dominated by tourism and tourists, more than by residents, where water flows, circulates, and is being used, mobilized and governed establishing new physical and social relations and new urban water governance challenges.

4.5. Tracing the hydro-social cycle in Venice's historical center

After secular socio-environment processes of evolution and transformation, Venice's historical center depends on, and interacts with, several flows of water.

The surrounding lagoon[19] (550 square kilometers, 1.2 m deep) is today a transitional environment, by definition of Water Framework Directive 2000/60/EC, and a highly complex hydrological system (Bonardi *et al.*, 2003). It is divided from the sea by a barrier island (60 km) which is interrupted by three inlets Lido, Malamocco and Chioggia. Through these inlets, an average of 400 million m^3/day of water is exchanged (10,000 m^3/s peak value; Gačić *et al.*, 2002) and circulates inside the lagoon through a 1500 km long network of channels. It is governed by a semidiurnal tidal regime[20] (Gacic *et al.*, 2004) ranging from 35 cm to 100 cm during neap and spring tides respectively.

The Venice Lagoon's watershed (about 2000 km^2), once flooded by the sea then emerged, was reclaimed for centuries. Large areas of land were recovered from marshes and lagoons; today they are used for agricultural, industrial, and urban settlements purposes. In this strongly anthropised context, a complex hydrogeological network takes place. It is characterized by 3.780 km of surface waterways, natural and controlled[21], flowing into the lagoon. 525 km^2 of this territory is

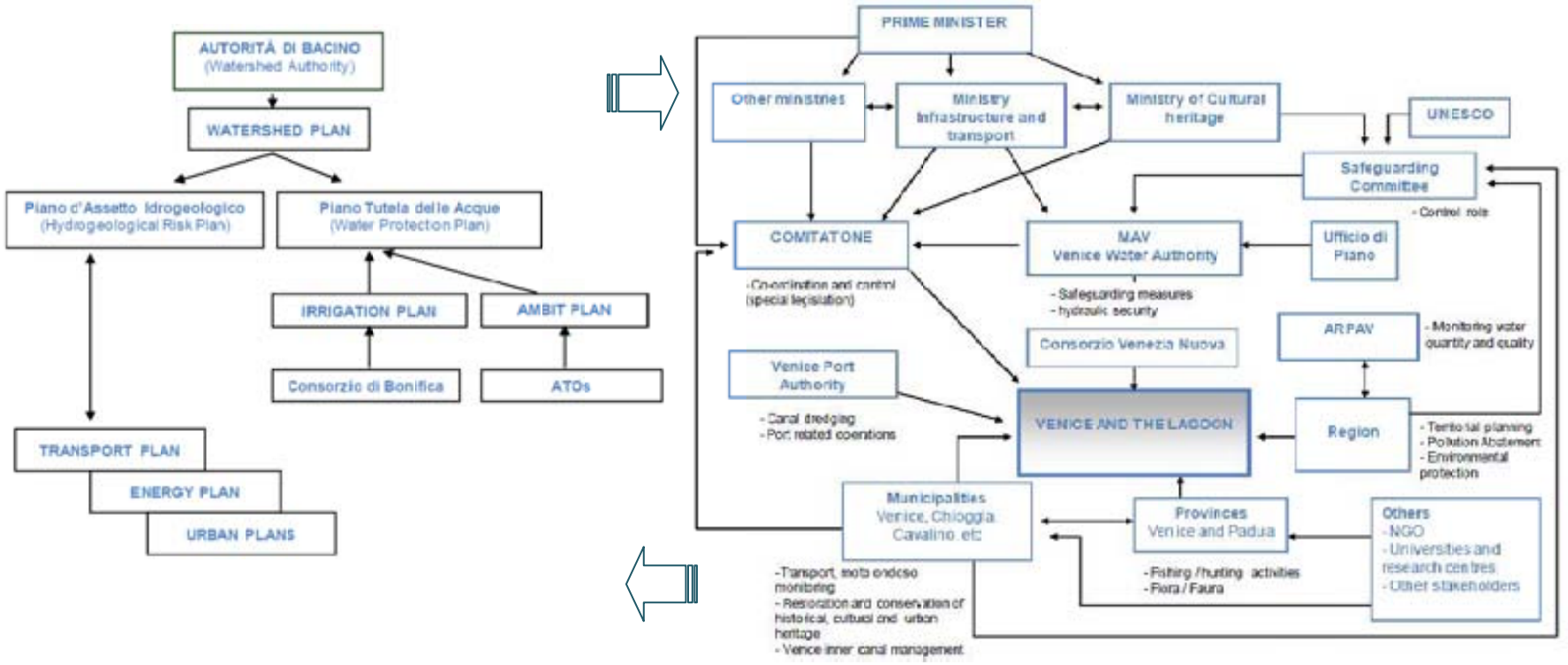
[19] It is the largest wetland in the Mediterranean Basin and in the Adriatic Sea.
[20] Tides vary particularly in relation to astronomical and meteorological factors.
[21] the most significant rivers are: Dese, Zero, Marzenego-Osellino, Lusore, Muson Vecchio, Tergola, Scolo Soresina, Scolo Fiumazzo, Canale Montalbano (natural flows) and Naviglio Brenta, Canale di Mirano, Taglio Nuovissimo, Canale dei Cuori (controlled artificial flows).

artificially drained by pumping plants, sluices and other hydraulic infrastructures, as a considerable fraction of the basin surface is below mean sea level (up to - 4m in some areas). Freshwater runoff, about 2.8 million m³/day, is conveyed into the lagoon through 27 outlets distributed along its border, 11 are main effluents. The average flow rate of fresh water from the rivers is about 34.5 m^3/s, 5 m^3/s from the pumping stations and 11 m^3/s from precipitations (MAV, 2011). This drainage basin with its complex hydrographic network is one of Europe's largest aquifers. The mountain springs are important reservoirs of good water quality which feed the Veneto plain. The latter is divided into high, medium and low plain leading down to the coast. In the high plain a paramount groundwater aquifer recharges the entire hydrogeological Veneto system. The surface groundwater aquifer emerges in the southern part of the plain giving rise to the resurgences and thus to some of the most important rivers of the region and in Europe, such as the Sile. Due to the major rivers diverted out the lagoon over the last 500 years, fresh water inflow is currently less than 1 percent (Micheletti, *et al.*, 2011).

Venice and its lagoon also receive an average annual rainfall of 800 mm. The water balance between precipitation and evapotranspiration is generally negative since the quantity of rainfall is not sufficient to recover the corresponding loss of water due to evapotranspiration. Nonetheless, the rainfall deficit is compensated by the Regional area which receives about 19.5 billion m^3 of water (Arpav, 2012).
Over the last decades rainwater quality has declined due to contaminants emitted into the air, that return on the ground through washout and runoff into the lagoon through the drainage basin network. Moreover, water also circulates throughout the lagoon through fog and the high percentage of humidity (75 percent) due to the presence of water lagoon and poor ventilation.
The coastal area bordering the lagoon has experienced rapid economic development and urban growth since the 1970s. Here, emissions circulate in the air and in the water bodies through the Marco Polo's Airport, the urbanized area of Mestre, the Marghera industrial zone, located from north to south, as well as from organic pollution in run-off from mainland agriculture and livestock production discharging in the drainage basin and then into the lagoon.

The quality and quantity of the water bodies pertaining to the lagoon and its drainage basin, are controlled, managed and protected by a complex and articulated governance structure, gradually set up from the nineteenth century onwards. This structure, recently analyzed by the "OECD territorial review Venice, Italy (2010) and schematized in figure 4.6, is characterized by a "multi-level governance framework" (OECD, 2010: 160).

Figure 4.6. Venice's water governance framework



Source: Adaped from OECD (2010)

Each flow of water, has attached one or more government entities, agencies, laws, plans (see table 4.3)

Table 4.3. Water flows, their management and control

ID	Responsibility
Special Laws (171/73, 798/84, and 139/92)	Safeguarding the environment (landscape, historical, archaeological and artistic features), protect the hydraulic and hydro-geological equilibrium, regulate the watercourses (natural and artificial) feeding into the Lagoon, reduce and regulate tide levels, coastal defense works, and pollution protection.
Commissione di Salvaguardia – the Commission to Safeguard Venice	Instituted by the First Special Law, has the power to block proposed interventions and must approve projects on all construction sites as well as land use transformations and modifications planned by private and public bodies anywhere within the Venice Lagoon boundary.
Venice Water Authority (Magistrato alle Acque, or MAV) delegates its operational functions to the Consorzio Venezia Nuova	Technical agency of the Ministry for Infrastructure and Transport with direct and primary responsibility for the safeguarding, security and hydraulic protection of waters of the drainage basin and lagoon.
Consorzio Venezia Nuova (CVN)	Safeguarding the Lagoon and is comprised of a group of Italian construction and engineering firms, all from the private sector.
Comitatone	The second Special Law (1984) instituted a mixed committee of government ministers and local authorities known as the Comitatone (Large Committee). It oversee the implementation of protection measures and budgetary allocations among the various strata of public administration and other institutions
ARPAV (Agenzia Regionale per la Prevenzione e Protezione Ambientale del Veneto)	A public utility with the aims to prevent and control the environmental quality of water bodies (quality and quantity) according to 152/06 and to verify the achievement of water quality defined by Ministerial Decree Ronchi-Costa - 1998. Together with the Venice Water Authority ARPAV controls these flows, also estimating loads of pollutants discharged into the lagoon. Rain water also are monitored by Arpav.
Administrative layers (Regional, Provincial and Municipal)	
The Veneto Region	Pollution control, with regard to inputs from the drainage basin, establishing the Master Plan 2000, a framework programme of measures to monitor and reduce pollution
Provincia di Venezia – Provincial administration	Land use management and environmental protection responsibilities, notably regulating fishing activities in the Lagoon. It controls effluents and emissions and noise pollution.
Comune di Venezia – Venice Municipality	The Comune set up Insula SpA for the integrated management of canal dredging, and revision of utility pipelines, etc. The tide forecasting office is also part of the Comune.
Watershed authorities	
Autorità di Bacino (Watershed Authority)	Central to water resource management and protection on the watershed scale.
Optimal Territorial Areas (ATOs)	Management of water supply in each territory (ambito) and for setting tariffs at the municipal level. In particular, the ATOs oversee the merger of several water supply operators and implement the functional integration of the various parts of the water cycle into each ambito.
The Consortia for Land Reclamation and Irrigation (Consorzi di Bonifica)	Improve and manage the hydraulic functions of rivers, canals and ditches of their respective territories, reducing flood risks where relevant. They also co-ordinate infrastructural works and monitor land reclamation activities carried out by landowners, and deal with soil conservation, erosion control, irrigation water supply and tariffs.

Veritas	Veneziana Energia Risorse Idriche Territorio Ambiente Servizi, or VERITAS, is owned by 25 municipalities and acts as a bulk water supplier to 18 municipal water providers, including Venice historic center.

Source: Own elaboration, synthetised and updated from OECD territorial review, 2010

From the table above and in accordance with the OECD territorial review (2010), it can be said that the Venice governance and legislative framework for water presents a notable institutional fragmentation. Water management is controlled and governed at three scales of government – municipal, provincial and regional, with various national ministries and agencies, watershed authorities on the mainland, and several agencies in and around the Lagoon. The legislative framework is also complex because Venice and its Lagoon are covered by the Special Laws (171/73, 798/84, and 139/92) which operate directly under national government control, as it considers the city and its surroundings as a matter of national interest.
Given its multi-scalar water governance character "problematic gaps and overlaps in the jurisdiction of the multiple public and private agencies involved" (OECD, 2010: 160) also producing uncertainty in management, and conflict and competition between agencies rather than co-operation (OECD, 2010: 167).
As stressed below, in fact, the flows of water of the lagoon continue to suffer from urban and industrial contamination from the mainland and the historic lagoon center, despite being controlled and governed through this articulated governance framework, unable to solve public and private conflicts, competitions and interests.

On the other hand, the more coordinated water supply for the historic Venice seems to be less affected by this fragmented structure of governance. After the construction of the aqueduct managed until 1973 by the Municipality of Venice and the French water private company Suez, the public water supply utility ASPIV (Azienda Speciale per la Gestione dei Servizi Idraulici e Vari di Venezia) was founded in 1977 to provide water to Venice and Mestre. In 1995, ASPIV started to manage also sewage and wastewater treatments. In 1999 this company was converted into the joint stock company ASPIV S.p.A., then was followed from other four water suppliers (ACM, ASP, SPIM e VESTA).
However, to overcome the fragmentation of responsibilities in the management of water resources and reorganize the water sector the law n. 36/1994, known as "Legge Galli", was launched in Italy. This law established the Ambit Authority (Ambito Territoriale Ottimale, ATO) to coordinate water supply.
In 2007 the Ambit Authority (ATO) consolidated the four previous water suppliers into a single corporation VERITAS S.p.A. (Energia Risorse Idriche Territorio Ambiente Servizi). As an inter-communal, publicly owned company, VERITAS[22] is currently responsible for the integrated urban water cycle management and for delivering potable water to the Venetian population and the millions of tourists. The consolidation process and rationalisation of the water supply sector, that in many countries has occurred "top-down", in Venice was "bottom-up"; driven by municipalities, motivated by concerns about new water-sector requirements imposed at the national level and addressed from new EU legislation (Directive 2000/60/EC) concerning water quality (OECD, 2010). Concurrently, the regulatory framework has evolved further. Water supply

[22] At Regional level Veritas is the first public multi-service company in the Veneto offering integrated water and solid waste collection and disposal services at the metropolitan scale (25 municipalities); it sells and distributes energy and offers integrated management of urban and industrial services (Veritas, 2014).

continues to be governed by national laws and associated regional laws and policies; in particular, the region, province, and public health authorities continue to monitor water quality, and managed by ATO and Veritas. Today, Veritas delivers about 300-350 l/person/day to the historic center, approximately 300 liters of water per second, through the aqueduct and the secondary distribution network of 300 kilometers (Bilancio Veritas, 2012), serving 100 percent of the population. 87 percent of this water comes from aquifers and the rest from the Sile River. Groundwater is pumped from five artesian aquifers (44 wells in total) located in the provinces of Venice, Padua and Treviso. The water quantity abstracted amounts to over 4,000 liters per second. The resource is purified in the Ca Solaro water treatment plant (in Favaro, Veneto) where a system of active carbon filters improves the taste and characteristics of water. This reserve also covers consumption peaks.
Water provided by Veritas for the center and its municipality, has one of the highest price of usage in Europe. Between 2007 and 2012 the price of water doubled and now is about (250 euro/year) (Associazione difesa consumatori – Adico 2011). Water consumption in the lagoon city is mainly for urban and tourist purposes and attains about 179 l/person/day. Peaks of urban water consumption can reach even 500 l/person/day during high season and are primarily influenced by the large number of tourists, and considerably higher than the rest of the region (Qualità dell'ambiente urbano 2013).

Although substantial increases in water consumption are detected, information about this consumption in the tourist sector does not exist because it has not been separately identified. According to the people I interviewed in the water management authority, information about water consumption from tourism is difficult to obtain and assess therefore it is not collected for statistical purposes. Attention towards this issue has moved only recently from the Venice Municipality through a pilot project called "Venezia sostenibile"[23] (Sustainable Venice). It investigates, trough questionnaires submitted to different Hotels, Restaurants and Museums, among other profit and nonprofit businesses, actions adopted by these activities to reduce environmental impacts, including those on water resources. Even if with just 4/5 questions water issue has been considered, and refers to the type of water provided (whether bottled water or tap water), water-saving measures (double flush toilets for instance) and rainwater reuse systems. As this project is running for the year 2013-2014 no data is available yet. However, they will only identify which activities result to be the most virtuous about the actions undertaken with respect to water resources (City of Venice, 2014) without mention useful actions to reduce impacts on water resources for example, by tourism.

In Venice's historic center a high flow of bottled water enters into the lagoon city every year, and produces high amounts of plastic waste (260 tons were dropped in 2008), as well as carbon emissions. Given the quantity of solid waste produced, about 2.4 kg/person/day or twice as much the average amount in the region due to the huge influx of visitors, plastic waste collection is performed separately. Bottled water has even a high cost of transport into the lagoon city, and its collection as waste is very difficult and expensive in the exclusively pedestrian historic center of Venice (about 411 euro per ton compared with 68 euro per ton on the mainland).
For these reasons, in 2008 during the UN World Environment Day, the City of Venice, in cooperation with Veritas and under the auspices of the Venice's Roman Catholic diocese, launched a wide campaign against rampant consumerism of bottled water by tourists. Tap water was promoted through the free distribution of 120,000 glass carafes to households, and thousands

[23] http://www.comune.venezia.it/flex/cm/pages/ServeBLOB.php/L/IT/IDPagina/62159

of reusable plastic containers for tourists with a map showing the location of 37/157 operative fountains accessible across Venice (figure 4.7). Fountains today provide Venetians and tourists with some 135.867,600 l/year of potable water, from aquifer in the high Val Padana area, where flows are extracted from a depth of about 300 meters The Municipality of Venice owns 60 percent of Venetian fountains, which are functional at 60 percent. The remaining 40 percent belong to Veritas and are functional at 70 percent.

Thanks to a cartography of fountains elaborated by Coop, a local cooperative of consumers that develops environmental policies and strategies, in relation to the campaign for the public good water against the Italian water privatization referendum of 2011, and local public participation by citizens which have formed the "Gruppo delle fontane" (group of fountains), many other fountains providing clean drinking water are being opened.

However, these fountains managed by the municipality are difficult to maintain due to the management costs hold by Veritas (about 200 thousand euro).

Fig. 4.7. Venice's fountains map

Souce: http://www.venipedia.org

The Venice tap water project has allowed a reduction of plastic wastes dropped to 237 tons in 2009 (Barry, 2010). The example of Venice has influenced other cities such as Florence and London ("London on Tap" campaign) to reduce the consumption of bottled water (Rosenthal, 2009).

According a study conducted by Coop in cooperation with Federutility for the 2010 campaign "Acqua di casa mia" (or my house's water), Venice's potable water and that of San Benedetto one of Italy's most popular bottled mineral water brand, which mainly supplies the city of Venice's historic center, have the same characteristics as they come s from the same region. Most importantly the study highlights that tap water does not require the production process used for plastic bottles; a plastic bottle of 1 liter and a half needs indeed 35 grams of plastic, almost 90 grams of oil, over 2 liters of water and 160 grams of CO_2 (Life Cycle Analysis data from Plastics

Europe[24]). The study also informed that the bottled water business has undergone significant development in recent years. San Benedetto together with other three big Italian private companies (Nestlé, Rocchetta/Uliveto e Ferrarelle) controls about 55 percent of the export market of mineral water flow, about a billion liters, generating annual revenue of 400 million euro.
For these reasons, the Venetian campaign has, to a certain extent, caused the (positive) action of the bottled water lobby which, in turn, has recently promoted a project "Nuova vita al Pet" (New Life to Pet) with the aim of implementing new habits of consumption, with the recovery of plastic bottles directly in the stores. Early estimates show a 30 percent reduction of CO_2 emission from 2008 to 2011.

In the historic center losses of potable water, however, continue to be widespread. In fact, only 3 fountains have a water-saving button and all the other remain open 24 hours a day even if at reduced pressure. Another consistent flow of potable water directed to the historic center is lost due to the network leakage and equivalent to about 150 l/person/day (Rapporto UrBes 2013). The state of old pipes and the difficulty to repair them in Venice's historic center is the main cause of this.

Today, rainwater is not collected and treated in the historic center for drinking or alternatives uses as it was in the past. However, 32 Venetian wells of the many abandoned in the 19th century have been currently revaluated by the Venice Municipality under the Special Laws for Venice (171/73, 798/84, and 139/92) through a pilot project, to recover them and provide water for non-potable uses. This study, presented in 2003 to the World Water Forum in Kyoto, has aroused international interest as an ancient but still interesting alternative water source (Gianighian, 2004).

The flow of water supplied, once consumed from the historic center become wastewater that in the Venice case, as in other Italian cities, returns untreated into the environment flowing directly into the 182 canals and to the lagoon basin, to become exchanged with sea waters. Although the Merli Law 319/1976 orders sewage treatment and disposal throughout Italy and the Legislative Decree n. 152/2006 establishes mandatory wastwater treatment for Italian urban centers, Venice did not comply with these regulations due to its particular historical urban configuration, as outlined in the Special Law for Venice[25].
The sewage system described in section 4.3 and consisting of a complex network of underground conduits has been efficient during centuries. It works still today for wastewater and rainwater collection which then flow out into the canals and the lagoon. Only in more recent urban edification parts, such as Sant'Elena, Giudecca, Santa Marta, Sacca Fisola, more modern networks exist. This historical sewage network is managed and controlled by Insula; a wholly public company, working with the City of Venice in the construction of public works and infrastructure of urban maintenance and construction. However, due to the industrial and economic development in the late nineteenth century and the boom in tourist activity in the 1970s, the quality of water in canals and lagoon has worsened considerably and the sewage system has become no longer viable. The introduction of treatment plants was largely ignored until the law 206/95 when individual wastewater treatment became compulsory. No discharge was allowed until permission by the Magistro alle Acqua, the authority that still today supervise the safety of the Venetian Lagoon and the entire related infrastructure.

[24] http://www.plasticseurope.org/plasticssustainability/eco-profiles.aspx
[25] Venice Municipality "Fee Pursuant to Law 206/95" (2013)

The law 71/90, also established that until the realization of a sewage network and a centralized treatment plant, wastewaters in the historic center have to be collected, transferred and treated in individual plants. The choice of a decentralised system for wastewater treatment with advanced and non-invasive technologies was considered the most appropriate for the delicate environment of the Venetian Lagoon. According to MAV's estimates, these decentralized systems treat more of 50 percent of effluents.

Currently, historic Venice has proximally 6,400 septic tanks serving a variety of functions: private citizens, public activities, tourist facilities, artisans and hospitals (figure 4.7). As fig. 6 shows, septic tanks serving tourist facilities and public activities (e.g. hotels and restaurants) are mainly located in the areas more affected by tourism influx and pressures: the Santa Lucia's train station and the area surrounding San Mark's square. The figure also makes evident that, being the area from the train station bordering the Gran Canal until San Marco square the most frequented by tourists, the septic tanks are the result of the tourist influence.

Figure 4.8. Venice's septic tank locations map

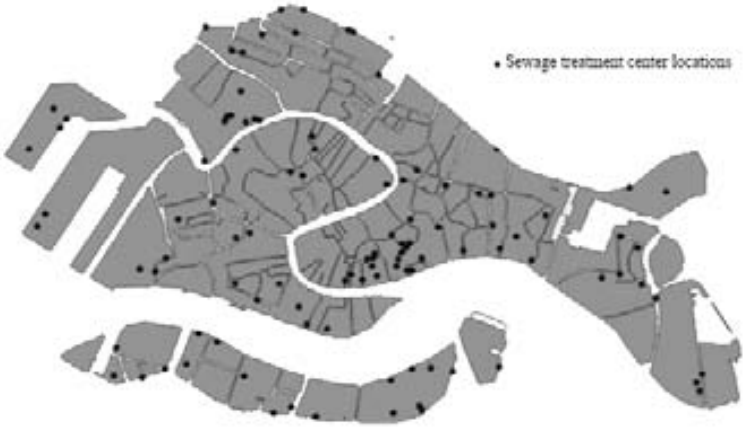
Source: adapted from Insula's Map in WPI Report 2013

Other 150 sewage treatment center locations serve 53 tourists facilities, 27 public services, 18 private households, 6 other locations, and 4 serve hospitals and health centers. Even in this case, sewage treatment centers are mainly located near the area surrounding San Marco's square (WPI Report, 2013), a number are located within hotels (figure 4.9). Some of these treatment plants are owned by the Municipality of Venice and managed by VERITAS, and operate separately as there is no centralised system.

However, the Venice Water Authority uses a tele-control system to manage the effective operation of each wastewater treatment plant. That system allows maintaining a high level of dependability and control over the treated wastewater that is discharged into the Venetian Lagoon. Each plant operates within the parameters required to produce the high quality treated wastewater discharged.

In particular, the Hotel Danieli and the Hilton Molino Stucky in historical Venice use this system and the MBR treatment plant which removes pollutants from the wastewater to enable its reuse. This technology coupled with the remote control and monitoring of the treatment plant allows savings of water.

Figure 4.9. Venice's sewage treatment center locations map



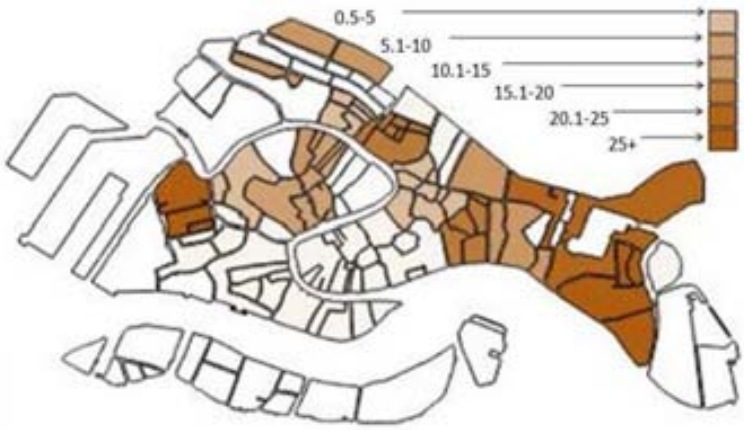
Source: WPI Report (2013)

The installation of a MBR treatment plant into the Hotel Danieli, one of Venice's most famous hotels, already allows an estimated saving of 40 percent of treated water as a reserve for the flushing of toilets. While, the historical mill Hilton Molino Stucky Venice has been recently renovated and converted into a luxury 5 stars superior hotel and is a popular tourist destination. Through its MBR plant the amount of water treated is approximately 670 cm/d and is equipped with an innovative vacuum wastewater piping system (Gray, 2011).

Although these innovative MBR decentralised wastewater treatment plants are object of international attention for possible applications in other countries (e.g. in Australian cities as new opportunities of water supply for government) they remain very expensive and difficult to implement in the lagoon city (Gray, 2011). However, even if they are expanding in historical Venice, the Lagoon continues to receive an organic and pathogen loading equivalent to more than 400 000 persons during the tourist season and the presence of significant levels of hepatitis A and enteroviruses (OECD, 2010). Indeed, bacterial contamination of the waters of the rivers is considerably higher. The average value of Escherichia coli (related to direct untreated discharges or treated only with primary systems) is 1800 cfu/100 ml and higher than the limit of 500 cfu/100 ml established by the Legislative Decree 30 May 2008 n. 116 for the suitability of coastal waters and transition for the purpose of bathing (MAV, 2010). Today, swimming[26] in the canals is therefore forbidden due to the pollution of water. As figure 4.10 shows, suspended solids produced in cubic meters per year present a large range of output values; especially in the eastern part of Venice they may reach more than 55 cubic meters per year (WPI Report, 2013).
According to the MAV report (2010) waters of Venice canals and those of rivers from the drainage basin are particularly contaminated by phosphorus and nitrogen. Water quality, particularly near the city, is extremely poor. The average value of phosphorus concentration into the canals (caused by urban discharges) is 41μg/l, which is 3-4 times higher than that detected in the peripheral areas and in the open lagoon.
The concentration of nitrogen, (caused by urban untreated discharges receiving only primary treatment, such as septic tanks) is 858μg/l. Both the phosphorus and nitrogen exceed the quality standard requirements set by the DM 23.4.1998, confirming that the historic center is a significant source of nutrients.

[26] Since the 1960 two public swimming pools were built in the historic center and on the Giudecca's island.

Figure 4.10. Venice's sewage output by islands map



Source: WPI Report (2013)

Indeed, despite the fact that the Special Law for Venice had fixed the target of a maximum discharge in the lagoon of 3 000 tons of nitrogen and 300 of phosphorus, nitrogen has reached 5000 tons per year while the amount of phosphorus has remained within limits. This high concentration of nitrogen comes from waterways and agricultural canals which drain into the lagoon.

According to recent studies, nowhere is the water quality "sufficient" or "good": 70 percent of monitoring points in the Lagoon are classified as "bad"; 27 per cent as "poor" and the remaining 3 per cent "unattributed" (Rusconi, 2007). Pollutant loads (direct and indirect) are attributed to inputs from rivers (64 percent due to agricultural run-off) of the drainage basin; from Marghera's industrial area (13 percent), from the historic centre (6 percent due to untreated sewage and wastewater), from Campalto water treatment plant (4 percent) and from atmospheric deposition of chemical substances (e.g. mercury, dioxins, and hydrocarburants) arising from the petrochemical processing in Marghera Port (13 percent).

The industrial area of Porto Marghera (5.146.541 m^2), is characterized by large concentrations of pollutants (including heavy metals, nutrients and hydrocarbons).

For this reason rainwater here are generally collected and managed by private local utilities operating under the supervision of the Technical Office of the Venice Water Anti-pollution Authority. Flowing in the greywater systems, these waters are collected in tanks and conveyed to a treatment plant located to Fusina (MAV, 2010). Many of these treatment plants also collect bilge water, greywater and tank wash water. In particular, one of these plants, which is the largest plant in Europe, collects rainwater from at the Passenger maritime station, which is treated up to 95 percent through the innovative "Stormfilter" technology. Once treated (about 19'080 m^3/year) the waters of the entire port are conveyed into the lagoon attempting to respect the legal parameters, but nonetheless continue to affect waters of the lagoon.

In strong connection with the Port, another important form of water contamination into the lagoon is caused by large cruise ships. According to international studies (e.g., Klein, 2012: 15; U.S. EPA, 2008; Commoy *et al.*, 2005), high quantities of organic nitrates and phosphates, are released by cruise ships and their passengers; each passenger produces about 30 liters of wastewater per day and 380 liters of gray water per day. Moreover, cruise ships produce three types of wastewater: black water (from toilets), gray water (from sinks, showers, bathtubs, washing

machines, cookers, deck washing, swimming pools, saunas, etc.) and bilge water (part of the hull where convey fuels, lubricants, condensations from air conditioners, etc.). On the basis of these data, a recent study from the Economic department of the Ca´ Foscari University of Venice (Tattara, 2013) has analysed the environmental impacts of cruise ships on the city of Venice and the related costs and revenues, as showed in table 4.4.

Tab. 4.4. Analysis of the costs of the lagoon and sea pollution related to Venice's cruise ships in 2011

ID	**Prod/Passenger/ day**	**Cost**	**Total cost €**
solid waste	5 kg	€ 0,15 per Kg	1.033.026
Black water	30 liters	€ 0.05 per liter	2066052
Gray water	380 liters	€ 0.01 per liter	5233998
Bilge water	10 liters	0,30 € per liter	4132104
Hazardous waste	0.16 kg €	3.36 per liter	740 473
Total marine pollution			**13,205,653**

Source: Tattara, (2013, 30)

As Tattara explains, the contamination from Venice cruise ships is just one of the many pollution drivers into the lagoon, but its impact is significant. If, on the one hand this activity generates revenues around € 290 million annually, on the other hand the social and environmental costs of cruises must be evaluated in similar figures (Tattara, 2013: 30).
This economic activity represents high revenue for the cruise lobby and the Venice Municipality. However, it does not benefit the historic Venice and its inhabitants but rather the private company VTA which is benefitting from the rapid growth in cruise ship traffic, and the Venice Port Authority which attempt to convert to Venice into 'the European gateway for trade flows to and from Asia'[27].
But, while cruise ships are a delight for tourists who admire the whole city lagoon from the Giudecca Canal, passing next to the historical and fragile palaces of Venice may produce substantial impacts on these historic resources. The citizen action group "No alle grandi navi" and the Italia Nostra[28] association, for many years, are struggling to protect the water lagoon and the city from potential accidents asking to exclude cruise ships from the lagoon (Lanapoppi, 2012). Despite the Port Authority replies with studies stating that cruise activity is not a peril for Venice, the Tattara's study (2013, 34) highlights how polluted flows of water may influence tourism and in turn being influenced from them, as once waters are degraded Venice may lost its attractiveness as tourist destination, and the cruise sector, as important part of Venice's tourism industry, becoming irreversibly damaged.

But multiple exposures to contaminants present in the lagoon also exist through flooding (OECD, 2010, 80). The city of Venice is rather often exposed to flooding events. When the tide rises above 110 centimetres, greater volumes of water enter through the inlets, causing the

[27] https://www.port.venice.it/en/the-port.html
[28] http://www.italianostra-venezia.org/

phenomenon known as “acqua alta” (or high water) (figure 4.11). While resident and worker Venetians struggle against high waters, tourists are more and more attract from these events[29]. Flooding has thus turned into an alternative and bizarre attraction for many tourists whom experience high waters in San Marco’s square, enjoying a swim in the city's flooded streets and squares despite the ban from water contamination (Brown, 2012). However, flooding also may influence the reduction of tourism-related income (OECD, 2010).

Figure 4.11. Venice flooding map

Source: City of Venice (date unknown) It shows the area of the city covered by water at 100 cm (red), 120 cm (dark blue), and 140 cm (light blue); these areas represent 3.56%, 35.18%, and 90.19% of the city respectively.

Since the late nineteenth century, the frequency of these events has increased tenfold with numerous implications (OECD, 2010). According to several studies high water results from many factors including hydrology (e.g. combined action of the astronomical tide and winds), and climate change (e.g. increase in air temperature, reduction in rainfall, and an increase in sea surface temperature) also induced by the ‘urban heat island effect’ of Venice and its urbanized hinterland (Amos, 2012). Events are also a “symptom of poor water governance, related largely to human action at local and global scales” (OECD, 2010: 148). Insufficient management of the drainage basin is also considered a cause exposing mainland areas and Venice historical center to flooding. According Rusconi (2007), water pushed into the Lagoon by storms also travel up into the mainland via the river mouths and breached the banks. The growing coastal area with its urban infrastructures also can be critically affected (Cipriani, 2013).
In response to this problem, in 2003 and after years of assessments and preliminary projects, the Italian government together with the so-called “Super Committee for the Safeguard of Venice”, the Magistrato alle Acque, and its concessionary Consorzio Venezia Nuova (with the network of many other italian private companies and construction cooperatives), decided to undertake the Italy’s largest infrastructure project, “MOSE (standing for Modulo Sperimentale Elettromeccanico, or experimental electromechanic module). This project, expected to be finished

[29] http://www.dailymail.co.uk/news/article-2231342/Tourists-swim-Venices-iconic-St-Marks-Square-Floating-City-flooded-high-tides.html

in 2016 and currently built at 80 percent, has been located at the three inlets of the lagoon. It consists of a set of 79 mobile floodgates to block the entry of seawater in case of high water and defend Venice's historic center and its natural environment.

In the last year, the MOSE have been an attractive for Italian and foreign tourists paying a ticket for visiting the flood barriers (Corriere Del Veneto, 2013). However, this enormous economic operation (the final cost calculated is 5494 billion euro, the estimated cost in 2001 was about 1.8 billion, then doubled in 2003) has been contested since its inception. Environmentalists and scientists have demonstrated that it is irreversibly damaging the lagoon natural ecosystem, because the sea barrier will increasingly close the lagoon which will no longer be renewed by the tides, producing thus cumulative environmental impacts. Italian and international experts have scientifically proved that it will not effectively in protect the city due its design features (see e.g. Carbognin, 2010: 1046). Moreover, Italia Nostra, an Italian heritage and conservation body, has promoted a social struggle against this project in order to ensure the socio-environmental justice. According to them flooding, as the most perceived flow of dangerous water for Venice, has been engaged as pretext to protect the heritage city and its lagoon, but in fact it has protected and sustained a entangled network of political and private economic interests (Vannucci, 2013). Such social pretest and network of interests linked to the flows of floods was recently revealed with the Mose's corruption scandal. The Venice's mayor and more than 30 Italian politicians were arrested, accused of financing election campaigns in bribes from the consortium building, ultimately paid for by taxpayers (citizens) who are funding the construction of the project (Barry, 2014). This hybrid made of water and political interests, flowed through places, territories, people, institutions, money, drawing geometries of power masked by the social and environmental hydraulic mission against high waters.

After trying to trace all these flows of water, and to examine the physical and socio-political discourses surrounding them, the next section provides their integrated representation.

4.6. Integrated Urban Hydro-Social Cycle Governance

The sum of water flows identified and described in the above section is illustrated in figure 4.12, where physical and social aspects configuring the hydrosocial cycle are put together in a relationship acting on the Venice urban tourist system. The figure attempts to show a big picture of Venice's water flows able to illuminate the functioning of its urban space and the structure of its urban water governance in all its complexity.

Specifically, the characteristics of the water cycle (input, consumption, output) and the physical aspects of water flows are illustrated in the figure, and the entities that monitor, control and manage these flows are identified. As it can be noted, this representation differs substantially from the classical urban water cycle representations. Rather, in our example, water flows, water governance structures and the urban dimension highly influenced by tourism are integrated into a unique system, configuring the complex governance of the urban hydrosocial cycle of Venice. Additionally, this complex integrated system and its functioning not only operates at the local scale but also exerts a particular influence at the global scale. Indeed, water flows (physical and socially governed) are responsible for triggering global phenomena such as environmental change, and climate change (figure 4.12). Therefore, their impacts are not locally limited but may have multiple global effects.

Figure 4.12 also shows the status of governance for each water flow (good; scarce; being improved; bad). This helps us to understand which of these flows of water are more affected in terms of quantity and quality, as well as how governance is responsible for this.

As previously noted, the flows of water sustaining Venice's historic center and its lagoon depend on the whole system including the drainage basin and the entire mainland as well as seawaters. The lagoon waters and the increasing flood flows represent the water bodies having a bad quality status linked to a bad governance status. These flows are the most controlled and managed by different entities. Despite this, the overlap of functions and interests has compromised co-ordination of water quality management within the lagoon watershed because of the separation between "upstream" and "downstream" functions.

Flooding is the other flow controlled and governed by public and private entities, pertaining to different administrative layers (national, regional, provincial and municipal). But even in this case action and co-ordination tend to be negative in the face of the pressing flooding problems that continue to affect the historical city.

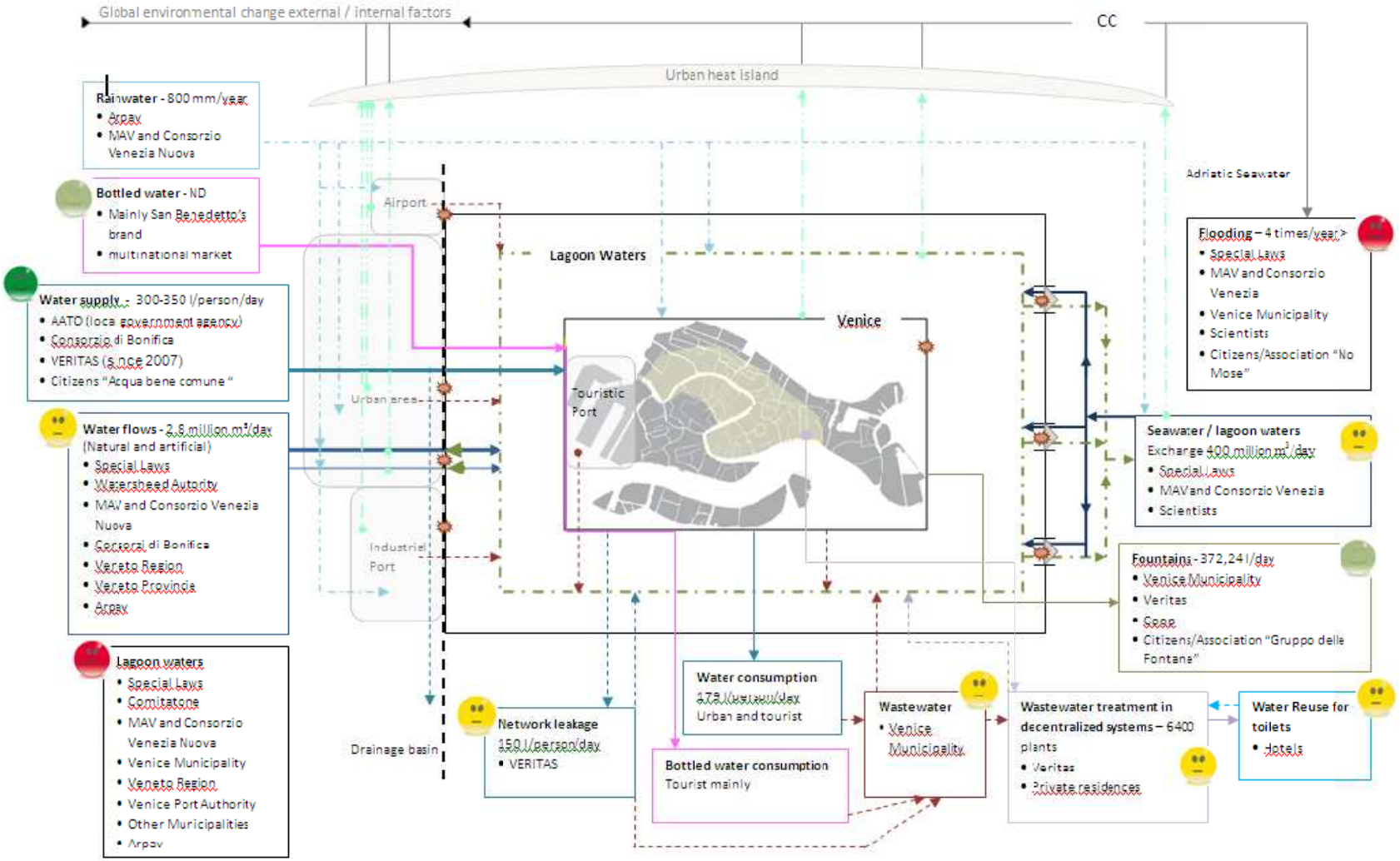
The lagoon is therefore the most affected water body of Venice as it is the receiver of water contamination from multiple flows of water conveying towards it. Moreover, the various entities responsible for the management do not systematically address the issue due to political and economical interests mainly linked to tourism sector and also private interests as described in the previous section.

On the other hand, water supply managed by Veritas, which operates at the Regional scale, presents a good governance structure. While other water supply models are increasingly characterized by a private or semi-private management in the Mediterranean countries, the Venetian publicly owned water corporation is a good example of co-ordination capacity (horizontal and vertical) in the water supply sector.

However, a referendum on water was held in Italy on June 2011, concerning privatisation of water services. It asked for the cancellation of two legislative articles; one on the privatisation of public services with an economic value, and the other on the Environment code that forces water tariffs to be calculated according to capital costs (full cost recovery). The law under referendum wanted water supply to be managed exclusively by private companies or by public-private enterprises. The referendum provoked criticism even among water experts (see e.g. Boitani, Massarutto, 2011). Finally, Italian citizens voted against water privatization. As Wenonah Hauter, Executive Director of Food & Water Europe, declared "The success of the referendum in Italy is a true display of the power and potential of grassroots activism. The Italian Forum of Water Movements (Acqua bene comune) and Italian citizens managed to mobilize an entire nation and raise awareness around the human right to water and defending water as a common good".

However, water supply not only depends on the model of management but especially on the integrity of the territory through which it circulates. In this respect, the Veneto mainland is becoming more and more urbanized and contaminated from the agricultural sector. Even if water is an abundant resource able to reach the historic center of Venice, its quality and quantity might soon worsen, due to lack of effective urban water governance on the mainland. For this reason the tourist sector might also be affected. Here, water consumption by tourists is not easy to assess, because of, as noted in section 4, the flow of tourists remains undefined. However notable differences among tourists and excursionists may influence water consumption in different ways. To a certain extent, the high presence of tourists in the city might also generate exclusion of residents from this resource, and further competition and conflicts as residents are currently leaving the city. Moreover, wastewater is a flow that is increasingly being affected by tourists.

Fig. 4.12. Representation of hydro-Social flows, their relations and governance system



Source: Own elaboration

The issue of wastewater treatment, which is indeed improving in the city, needs to be more co-ordinated and managed.
However, water supply not only depends on the model of management but especially on the integrity of the territory through which it circulates. In this respect, the Veneto mainland is becoming more and more urbanized and contaminated from the agricultural sector. Even if water is an abundant resource able to reach the historic center of Venice, its quality and quantity might soon worsen, due to lack of effective urban water governance on the mainland. For this reason the tourist sector might also be affected. Here, water consumption by tourists is not easy to assess, because of, as noted in section 4.1, the flow of tourists remains undefined. However notable differences among tourists and excursionists may influence water consumption in different ways. To a certain extent, the high presence of tourists in the city might also generate exclusion of residents from this resource, and further competition and conflicts as residents are currently leaving the city. Moreover, wastewater is a flow that is increasingly being affected by tourists. The issue of wastewater treatment, which is indeed improving in the city, needs to be more co-ordinated and managed.
Partially as a result from this analysis we can also argue that the management of urban water resources in Venice is characterized by significant governance gaps.
These gaps are a result of a fragmented institutional, legislative and planning framework, and in particular to an insufficient intergovernmental co-ordination; a short-term focus on water management and related issues, lack of insufficient integration of the dominant water and tourism sectors into policy making.
As these two sectors are dominant in the city of Venice, the urban water governance framework and policy-makers should consider these issues under a more long-term and co-cordinated manner.

4.7. Concluding remarks

The objective of this paper has been to demonstrate how in the configuration of water cycles the increasing relations between water resources and tourism are critical and may influence and be influenced by governance systems, especially in Mediterranean urban coastal areas dominated by mass tourism.
By depicting the past and present hydro-social cycle of Venice I have attempted to highlight the physical and social aspects linked to this cycle.
Considering the Venice hydro-social cycle in a historical perspective, the paper has shown how the historic center was shaped by different water flows and by the network of powerful actors and interests that have led to the current hydro-social configuration. It has also attempted to shed light on how water resources, urban space and the tourism sector have co-evolved over time. It also has demonstrated that tourism is not a recent phenomenon in Venice, rather, it has always been supported by water resources, policies and strategies. What is relatively recent is the dimension of tourism in the city.
The characterization of the current model of mass tourism has also allowed an understanding of the relevance of this sector for the city, how water flows are linked to tourism, and how they influence each other.
Through the concept of the hydrosocial cycle, I have also analysed and graphically illustrated the current water governance system of Venice by employing Urban ecology and the Urban political ecology frameworks to show not only the physical aspects of water flows, but also the political and economic interests and power relations attached to these flows reflecting to a certain extent

the gaps of water governance issues. The identification of these gaps is useful to address new strategies and policies to govern the resource that continually influences and is influenced by the tourism sector.
In the same way as Venice, many other Mediterranean coastal cities are facing governance problems linked to water and tourism sectors, which are increasingly dominant at a local and global scale.
For this reason, our study suggests that further characterizations and critical understanding of the governance of urban hydrosocial cycles in coastal cities affected by mass tourism are needed to improve governance systems and effective urban water policies.

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5. Conclusions

5.1. Main results

This Doctoral thesis has explored new directions to investigate the governance of water cycle taking place in urban tourist environments.

Increasing urbanization, population growth and new economic sectors as tourism are all expected to impose significant strains on urban water resources and governance in the Mediterranean as elsewhere over the coming decades. Coastal cities facing the Mediterranean basin are already experimenting strong urban expansion, change, transformation and the emergence of tourism as the dominant economic activity. These cities in transition require more and more demand and supply of water, particularly during periods characterized by the waves of tourist flows.

In order to cope with these challenges a deeper understanding the relationships among water, urbanization and tourism has been investigated.

In the past, but still today, studies tend to analyze the characteristics of the urban water cycle (UWC) (inputs, outputs and consumption) and to identify and quantify urban water flows and their origin to provide the resource to city, in different ways and for different purpose. However, beyond accounting studies, as water has become increasingly influenced by social dimension and change, particularly in urban areas, the relationship between water and society has come to the forefront of critical inquiry in the last decade, attracting significant scholarly and popular interest.

However, more integrated analysis about the physical and social aspects of water in cities need more consideration. For this reason, this thesis has extended the analysis of the "hydrosocial cycle" considering the both perspectives.

Main results from this research were showed in the main body of this thesis.

Specifically, chapter 2 has provided an integrated framework of research in order to analysis and to assess hydrosocial cycles in urban environments characterized by mass tourism models.

The framework elaborated considers physical and social aspects to quantify water flows and their consumption but also to identify the social political flows of water and networks and actors involved in the control of these flows. As showed, such flows of water can influence the formation of different models of water governance and the latter may also affect the characteristics of such flows accordingly. Therefore, reconstructing empirically the hydro-social cycle becomes a key issue to explain different models of urban governance based on the water and the management of the resource.

Results from chapter 3 have showed the importance to analyse first an urban system to understand the environmental, socio-economic and political transformation processes and then the water cycle which acts by circulating on this system. The cases investigated have provided relevant evidences of how and to what extent these processes occur.

Results from chapter 4 have showed past and present hydrosocial relations for the case study of Venice. This case has been valuable to shed light on issues linked to water governance in a complex heritage urban system dominated by mass tourism.

5.2. Implications of the findings and limitation from the research

Even though, according some researchers, case studies carried out through the hydro-social cycle concept seems to be "case dependent", this thesis stresses the relevance of this approach. It in fact allows to disclose many aspects of each hydrosocial cycle analyzed pertaining to a given context and to consider strategy and opportunities that derive from the analysis.

Therefore, this thesis points on the idea that more case studies need to be developed in tourism cities of the Mediterranean to analysis and assess more hydrosocial cycles, to then identify strengths and weaknesses to improve the concept.

5.3. Contribution of the dissertation

The ambition of this work was to deliver new knowledge about hydro-social cycles, their metabolism and their governance models in different tourist coastal cities, and especially an integrated framework of analysis to develop this study.
The scientific approach used by this doctoral research will be useful to be applicable to other cities for future investigations.

5.4. Opportunities for future research and policy

In this Doctoral thesis many flows of water such as, for instance, rainwater, network of streams, underground and surface water, water treatment plants, reservoirs, dams, leaking taps, etc. were identified and analysed, then illustrated to provide a big picture of urban water governance.
The "Hydro-social cycle" concept, as innovative approach helped to explore both the physical and social aspects linked to the flows of water. The framework of research provided here may address further work of research and especially compare different cases studies. More hydrosocial cycles may therefore be assessed to discuss and think about different water governance models.

However, from the research results referring to chapter 4, where the case study of Venice was investigates, emerge that another important flow exist and it calls for particular attention.
It because, as it has been described in the first part of the chapter, the Venice's historical center depends on about everything, including food. Tourists, as it has emerged from the Visitor Survey report 2012, of the City of Venice, are used to consume much food in the city, especially in restaurants and more recently in fast-foods. The hidden flow of water contained within the food, the so called "virtual water" assumes, therefore, another important flow to be investigated.
Future research may thus incorporate the analysis of such flow which is increasingly linked with consumptions by Venice visitors. Additionally it may open another innovative research line, less investigated so far, but useful to assess how the hydrosocial configuration change according the virtual water.

From the other side, chapter 4 has also provided a schematic illustration of the resulting urban hydrosocial cycle governance. This representation may help water planners, policy-makers, and who is involved in urban water management to take decisions for improving that flows of water resulting more affected. The representation also provides information where water and tourism aspects are in

relation. Tourism, as dominant sector in this city would be considered within the complex management of water resources, and not separately.