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The fragile/resilience city represents a topic that collects itself all the issues related to the urban risks and referred to the different impacts that an urban system has to face with. Studies useful to improve the urban conditions of resilience are particularly welcome. Main topics to consider could be issues of water, soil, energy, etc..

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Journal of
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In these last ten years, TeMA Journal has published several international studies and researches supporting the scientific debate on the urban complexity and the future challenges of urban areas. Thus, the three issues of the 12th volume will think again the debate on the definition and implementation of methods, tools and best practices connected to the evolution of the main scientific topics examined in depth in previous TeMA Journal volumes.
In detail, the Journal welcomes papers on topics about the interdisciplinary interaction among Land Use, Mobility and Environment, and also urban studies from the domains of engineering, planning, modelling, behaviour, regional economics, geography, regional science, architecture and design, network science, complex systems, energy efficiency, urban accessibility, resilience and adaptation.
Publishing frequency is quadrimestral. For this reason, authors interested in submitting manuscripts addressing the aforementioned issues may consider the following deadlines:

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WATER FOOTPRINT INDICATORS FOR URBAN PLANNING

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ABSTRACT

Compared with the great number of studies carried out on virtual water, the Urban Water Footprint - UWF, has been object of less attention from researchers, probably because only in the last decade city water shortage has presented itself as global problem.
The study analyses the issue of the water value as a non-renewable resource, subjected to pressures that influence its quality and quantity. The "value" of water therefore indicates the measure of a resource used as an indispensable element of urban complexity, subtracted from its ecosystem and transformed from a natural resource to an anthropic resource.
Two indicators of the Water Footprint Network-WFN are proposed to analyze the water footprints of urban areas. The blue water indicator, generally used by the WFN to assess the stress of water bodies, where in this study is calculated as urban water consumption. The green water indicator used by the WFN to assess the rainfall uses of an regional area is analyzed here as an ecosystem element of the urban territory.

KEYWORDS:
Urban Water Footprint; Planetary Boundaries; Urban Water Planning

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水足迹，城市规划指标

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摘要

与对虚拟水资源进行的大量研究相比，城市水足迹(UWF)一直是研究人员关注较少的主题，这可能是因为在过去的十年中，城市水资源短缺已经成为全球性的问题。
本研究分析了作为一种不可再生资源，水资源价值所面临的影响其质量和数量的压力问题。因此，水的“价值”指的是一种资源的衡量，被用作城市复杂性的一个不可或缺的因素，从其生态系统中消减，并从一种自然资源转换为一种人为资源。
提出了水足迹网站(WFN)的两个指标用以分析城市地区的水足迹。蓝色水指标，通常被WFN用来评估水域的应力，在本研究中是作为城市用水量计算。绿色水指标被WFN用来评估本文分析的某一区域的降水利用，将其作为城市地域的生态系统要素。

关键词:
城市水足迹，地球界限，城市水规划

1 INTRODUCTION

The international community considers the urban systems as the physical form where it will be possible to reach the objective to share the benefits resulting from the actual level of development of the technological systems and from the use of the natural resources. The document New Urban Agenda - NUA, approved after the United Nations conference "Housing and Sustainable Urban Development" in October 20/10/2016, underlines that cities could be the source of resolution rather than the cause of the challenges that our world is facing (Habitat III, 2016). The NUA aims to be a tool for decision making and the stakeholders for urban planning and design, based on the needs of a civil society; it has to be able to imagine and realize the great structural transformations determined by footprint of human systems in each city. The NUA outlined new skills for urban planning, to support the role and enhanced capacity of national and local governments in data collection, mapping, analysis and dissemination and in promoting evidence-based governance. The objective is to promote a shared knowledge about the "geographic" data also through censuses, household surveys, population registers, and to develop economical - environmental indicators to urban plans. This study aims to evaluate how water shortage can constitute a drivers in the targets of urban re-planning. The World Economic Forum (2017) shows that in consideration of the fact that more than 3,5 billion of people lives currently in urban areas, water shortage will constitute in a brief period, one of the greatest risks that the national and local governments must face. This study aims to evaluate how water shortage can constitute a drivers in the targets of urban re-planning. The World Economic Forum (2017) shows that, due to the fact that more than 3,5 billion people currently live in urban areas, water shortage will soon constitute one of the greatest challenges that national and local governments must face. Water shortage is the subject of several studies carried out by Water Footprint Network, which has implemented a method to measurement anthropic uses of the water, substantially based on three indicators: *green water* determined by the rainfall; *blue water* which is water's employment from rivers and groundwater bodies, *grey water* is calculated as the volume of water that is required to dilute pollutants to such an extent that the quality of the water remains above agreed water quality standards. The WF indicators are largely used by the scientific community in particular in the studies directed to measure the *virtual water* that "travels" with products. The virtual water conceived by Allan in 1998, it refers to the volume of water consumed or polluted for producing the product, measured over its full production chain (Allan, 1998). When nation exports/imports such a product, it exports/imports water in virtual form. The virtual water isn't submitted to the regulation that concern the right to "to use the water" (unlike the Emissions Trading - Prohibition Act that regulating the emission in the atmosphere in according to Protocol of Kyoto). This permits to the economic operators "to transfer" the flows of water throughout the continents without any logic, except economic. These flows of products released in the great urban areas to satisfy billion people, are out of control of the local governments and can result in a biological impoverishment of their areas, and in shortage of their aquifer. This is one of main worries of the international organizations, first the Fao (FAO, 2011). According to Hoekstra and Mekonnen (2012) the main focus of the water planning is to satisfy the increasing water need, both local and regional level without over questioning whether consumptions was actually necessary. There isn't a complete vision of the national, of the domestic and of the industrial consumptions. The authors show that the WF of the average water consumer is of 1.385 m3 /y, the average consumer in the United States has a WF of 2.842 m3 /y, while China and India have a WF of 1.071 and 1.089 m3 / y respectively. Compared with the great number of studies carried out on virtual water, the Urban Water Footprint - UWF, has been object of less attention from researchers, probably because only in the last decade city water shortage has presented itself as global problem. It clearly a very different phenomenon, because water shortage in urban areas, doesn't mean a total lack of water as occur in the regions afflicted by intensive irrigation. What worries researchers of the UWF, is the relationship between the great quantity of water used in the cities and the effects that this can have on the hydrological local environment in terms of quality/quantity of water and extreme weather. This study investigates the possibility of using the water footprint indicators in order to have common values on the uses of water in urban areas, where "value" means a measurement of water used and subtracted from the natural environment for anthropic uses. First of all, a general framework will be made of the studies that have dealt with "value" to water flows in the urban and non-urban context. In paragraphs 3 and 4, footprint indicators have been proposed to assess the variability of water consumption within urban territories. Then, the Blue Water Footprint and the Green Water Footprint were calculated only for the water flows consumed in the Italian cities, like drinking water and domestic water. In paragraph 5, it was argued on the links between UWF values and urban planning instruments and how the UWF indicators can address urban transformations towards sustainable approaches.

2 THE URBAN ENVIRONMENT AS FLOW OF RESOURCES IN/OUT

The footprint that the human systems leaves on natural ecosystems is conditioned by the process of mutual adaptation between vegetable and animals species. These biochemical dynamics modify the ecosystems, and at the same time have create a state of dynamic equilibrium in which every element belongs to a whole. This scientific knowledge has developed over the last decades starting from Lovelock's Gaia Theory (Lovelock & Margulis, 1974) and has accompanied the scientific optimism which have led to the growing use of natural resources. The studies of the ecological footprint (Wackernagel & Rees, 1998; Wackernagel et al., 1999), have supported the necessity to introduce suitable indicators to measure the anthropic pressure on natural systems. These Indicators must be defined not on the basis of environmental characteristics affected by human systems, but calculated on the basis of the consumptions of natural resources used in anthropic processes. According to researchers the purpose of these indicators, is contributed to determinate the coefficient of biocapacity with which the natural systems succeed in restarting the states of equilibrium compromised by human footprint. In fact the biological times of resilience required by natural ecosystems, are not compatible with the aggressive nature of the anthropic footprint, (Tiezzi et al., 1992). The resources consumed by the cities has been object of studies on the urban metabolism, in which the urban environment is described as a hybrid system, where the cycles ecosystemics "intertwine" with the technological system create by the man (Baccini et al., 2012; Gisotti, 2006; Kennedy et al., 2007). In particular the in / out water flows that cross the city, develop dynamics that upset the pre-existing ecological characteristics, determining in the majority of cases, new cycles of ecosystem (Varriale, 2017). As shows the Fig.1, in the anthropic cycle of water there are many alterations in the environmental process and the consequent risks for the urban environment, among which:

- extraction from underground water with the risk of stress of reservoirs, and the aquifers lowering;
- collecting rainwater in mixed systems grids for disposal, with risks of urban flooding;
- unauthorized water withdrawals by private, and the risk of illegal disposal of industrial waste in the sewer system;
- risk of increased leaks from the distribution networks due to the obsolete state of the net.

In the cycle anthropic water is occurs the breakup of natural cycles of elements of ecosystem, where particularly in urban environments, vast volumes of water are lost. Many researchers are questioned on those broken cycles and on the way to recompose it beginning with a detailed analysis in the city. The metabolic flow of the water crosses the city for "to feed it" in all the natural and anthropic elements and when it flows out of the city it is then returned to its natural environment in different qualitative and quantitative states. In the first studies of the Water Footprint, it was made clear that to measure the total volumes of these flows, there was the difficulty to measure a dynamic flow prone to continuous variations. The section of a riverbed in fact could give different readings of its flow according to the season. Furthermore in the Footprint approach the water measure doesn't show exactly the existing volume but the "employed volume", in other words that part of the flow used for anthropic purposes. That volume in the anthropic usage is a different from that the natural level. In Seyam et al. (2003), the value water flow is defined as the missing link between the measurement of the water and the hydrology.

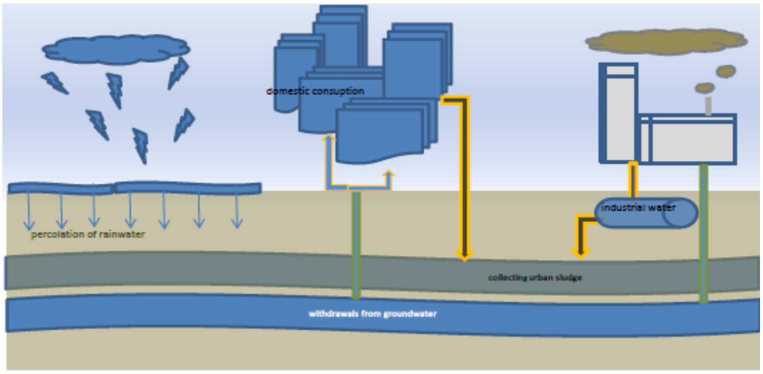

Fig. 1 Cycle of anthropic water

The hypothesis of the researchers is that the value of a molecule of water depends on the path that it follows inside the hydrologic cycle and from the values produced along this path. As a result, the resiliency of the water resource is based on quantity of rainfall of area refill. As a consequence, the emptying of the river basins for hydrologic services of urban distribution, without consider the rainfall, it cause a loss of the value of flow of the water. In the studies conducted by Costanza et al. (2014), the attribution of the value of an ecosystem resource is necessary when it needs to make some objective choices on the consequential benefits from its use. Generally the evaluation of the costs and benefits of environmental resource is poorly quantified because it is necessary to evaluate a wide range of benefits that include ecological sustainability, efficiency, social equity. But it is only the latter, according to researcher, that promote the definition of the value of the resource, through a governance that aims to share the resource for the public good. The demand to share globally the value of the water, is sustained also by Vörösmarty et al. (2015), who indicate the necessity of taking actions to deal with the dangers of the water shortage and pollution with laws which promote universally the sustainable use of water. Terms of sustainable consumption (Chapagain et al., 2012). In the study conducted in the Basin of the Zambesi, the researchers calculated the whole value of water use, included the "geographical transfer" of the water in the global commerce. Clearly, hydrological value of the water varies: the WF of regions or hydrographic basins has a different meaning from that in urban areas. In fact the scale to which the urban water footprint refers to, is that of the hydrographic basin that develops itself in the limits or inside the semi-urban borders. The studies that underline the problem of the scale o appraise the water footprint are different. Ma et al. (2015), for instance, in the analysis of WF in Bejing, shows that water consumptions of the mega-cities is ten times more elevated in comparison with the volume of available resources in the semi-urban area, which is inevitably translated in a meaningful external water reliance. Rushforth and Ruddell (2015), in the city of Phoenix in Arizona, estimate as WF is wider than regional track, going towards other nations, with consequence to have to face the right to the water, with different groups of political interest. Other studies focus new indicators for measuring WF in urban area. Fialkiewicz et al. (2014) suggests to analyze all structures that produce water consumptions in urban area using an approach bottom up that to gives evidence of the behavior of the human systems in the water use. The study of Wolfgang et al. (2016), proposes a methodology to estimate water use an urban scale, quantifying the consumptions of the drinkable water for different urban districts. The indicators are developed for the blue, green and grey footprint, in terms both the volumes of domestic - sewer nets line, and of rainfall flux. According to Agudelo-Vera et al. (2011), only starting detailed analysis of the consumptions is possible to develop a planning for domestic use of water. Monstadt (2009) furnishes an interesting contribution on new perspectives of WF analyses in urban planning. The author underlines the crucial importance of urban infrastructures grid for ecological sustainability of the cities. The technological nets manage the resources flows and model in essential way the environmental practices in the cities. The author thinks that the complex interdependences among cities and urban infrastructures widen our understanding of the ways in which we can develop, to govern and to renew the cities in sustainable way. In this approach, technological networks are not the keys of the "smart cities", instead represent an instrument towards urban sustainability. According to Papa et al. (2013), the technologies are one of the fundamental drivers for the construction of a sustainable city based on: technologies, people and governance. The footprint analysis have rarely been reproduced in urban planning analysis, while analysis of the urban people behaviors has been object of a broad seam of studies. The study Gargiulo and Russo (2017) investigate on the energetic consumption and the issues of CO2. The study shows that many studies have been developed on the relationship between the physical characteristics of the urban form and the energy consumption, while the focus of the search rarely compares the issues of CO2 with other urban characteristic as the functional, geographical and socioeconomic aspects. The city in many studies continues to be a bidimensional physical form, the search hardly faces the urban territories as process of the social behaviors. In the next paragraphs we bring some evaluation of water footprint conducted with new indicators implemented for measure the urban water consumptions beginning from some behaviors of the users.

3 THE CONSUMPTIONS OF DRINKABLE WATER

The first challenge that planning of water consumptions must face is due to the uncertainties of the data on the people behaviors. The behavior of the consumers in Italy it has been analyzed with data from Istituto Italiano di Statistica that referred only to domestic and industrial water use. From the Istat data of period 2000 -2011, on 116 cities of Italy we observed a period of substantial reduction of the domestic consumptions procapita, with an average reduction of -6.9%, with two level extremes: -30.54 % and +8.19 %. The distribution of the rate reduction of the consumptions between 2001/2011, shows that the reductions higher than 20% are very frequent. In the Fig. 2 the trend of the reduction in water consumption 2004/2011, is compared to the average values. In the same period the average increase of people is +4.5%. This trend has been compared with the demographic evolution each municipality. So we have that the rate of reduction of water use is enough distributed both in the Provinces with an increase of the population and in those with a decrease. In some cases (Tab.1), where the population is decreased in meaningful way, there are meaningful increases of the water consumptions.

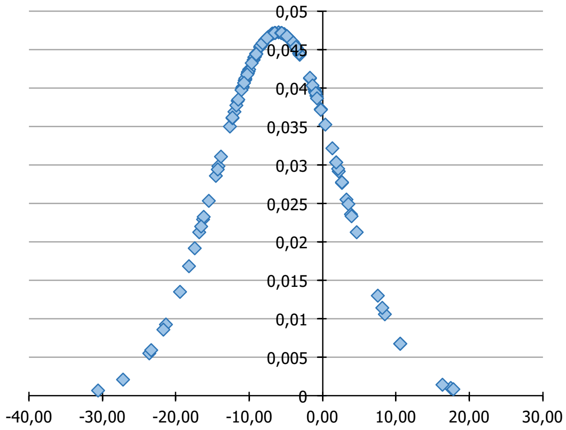

Fig.2 Trend of reduction value of the water consumptions 2004/2011 estimated with mean values

The demographic data doesn't seem meaningful for definition of tendencies of water consumptions, as is already shown in a study on the negative correlation between the energetic consumptions and density of population (Gargiulo & Russo, 2017). The estimates on water requirements are based on water supplies that quantify the population according to some categories, such as:

- uses from private residences, about the consumptions of the private sphere of the families, of which: personal cleaning, feeding, washing laundry, cleaning of the house, care of the private gardens and spaces condo etc.;
- uses from public buildings or collective institutes what: hospitals / clinics private, schools / university, markets, penitentiary, public and private offices, religious institutes, etc.;
- uses from public services what: management of the urban green, of the urban spaces, washing of the roads, fireproof service, etc;
- commercial and tourist uses: hotels, restaurants, business generally, etc.

Cities	Consumption reduction rate	Demographic balance
Trieste	0.99	-10,061
Treviso	5.89	3,382
Cremona	2.65	-1,298
Isernia	5.4	873
Caserta	0.71	552
Benevento	4.51	-337
Nuoro	11.87	-204
Sassari	5.31	3,053
Oristano	1.73	488
Catanzaro	2.99	-5,887
Crotone	2.46	-1,129
Reggio Calabria	6.14	464
Catania	1.66	-19,208
Caltanissetta	11.39	300
Messina	11.56	-8,764

Tab.1 Variations population and water consumptions 2001/2011

Obviously many of these consumptions depend on processes that could be overestimated or underestimated, and vary in the time according to the choices of the socio-economic players. The water endowment should be based on the behaviors of the consumers rather than on the numerousness of the various samples. Actually some regions are already developed Regional Waters Plans where underlined to deepen the data on the socioeconomic characteristics that form the demand of water in a specific area. For instance, the seasonality is considered as a fundamental parameter for the evaluation of the water supply, because there could be different habits referred to water use between seasons. In a study conducted on the Water Footprint of Sant Antonio Abate (south Italy) in 2017, the variations in the seasonality of the water consumptions are exclusively been imputed to the behaviors of the economic players that are represented by the industries of the canning sector of the tomato, that is active only in the summer months in that areas (Varriale, 2017). The seasonality and the demographic dynamics are fundamental parameters to value water endowment pro capita by planner, but according to an analysis more deepened, seem to be less determinants as thought. Among the water consumptions of the Italian families, there is for instance, the distrust of the consumers on the quality of the waters of the public nets. In the survey have not been advanced questions on the possible risks on the water quality due to the bottling in plastics or to the industrial risks of the bottling process, but it is evident that the 75.3% of the interviewed ones have motivations that overcome every risks because in the period 1995/2016 the consumptions of bottle of water are increased of around 9%. Obviously, the water consumed has a different value "social" from the natural right to the water, and in Italy the total of the footprint of the water in bottle included the exports, corresponds to 11.570.000 L / year (Tab.2). We have quantify the consumption of drinkable water-taking into account the data that we have examined, the water that the Italian consume in domestic use and for personal uses is given by the following (express values m^3/y):

$$W_{ci} = W_p + W_b = 5.411.580 + 11.570 = 5.423.150 \times 1000 = 5.42 \times 10^9\ m^3/y \qquad (1)$$

Where:

Wci Drinkable water Consumption is given from:

Wp = volumes accounted by the Utility (Istat, 2012) and Wb = consumptions bottled water.

Consumption type	2016
Consumers bottled water	54,721,800
Consumption in l/year/p.c.	206
Water bottles in mgl *	12,700
Export l in mg	1,130
Consumption Italy l/mg	11,570

Tab. 2 Statistics of plastic bottles on Censis data (Censis, 2018) (*) Thousands of liters

The families that declare not to trust to drink the water of the faucet still represent a considerable percentage despite the progressive improvement of the last fifteen years: from 40,1% in 2002 to 29.1% in the 2017. The families that declare not to trust drinking the tap water represent a considerable percentage, (despite the improvement of water supply of last fifteen years): from 40,1% in 2002 to 29,1% in the 2017. There are 7,4 million families that consume water bottle, with a marked territorial variability. The fact that people doesn't have a clear awareness of its own water footprint is confirmed by a survey in USA in 2017, with a sample of 1020 people. The results of the survey shown that majority of the questioned, indicated the water saving as a solution to the excessive consumption (for instance choosing showers briefer, alternate water when it washes us the teeth, etc.), rather than suggest improvements of the efficiency (i.e. technologies soft to guide dosing or recovery plants). Water is perceived therefore as a good that belongs to private sphere of individual, submitted to personal choices in which founds the inalienable right to the water.

4 BLUE WATER FOOTPRINT

The consumptions of drinkable water calculated in the previous paragraph, constitutes only a part of the volume of the blue Waters in urban environment. Indeed, the supplied volumes to consumers are always below the water's volumes introduced in the water nets that in the Italian municipalities they are average of around 145 m^3 /y for inhabitant, in comparison to the provided volume of 89.3 m^3/year. Therefore part of volume introduced in the water work then is loss, during the activities of disbursement and distribution. The leakage of drinkable water caused for, piping losses, mistakes of measurement, and not-authorized consumptions, they are equal to 38,3%, for a volume of 3,4 billion/m3, Istat (2017). The leakage volume has a strong impact on the volumes of water withdraw from the water basins in the cities (Fig. 3). The leakage have an obvious territorial variability that depends on the efficiency of the local water supply network. The accounts of urban water supply is conceived as an incomplete accounting in how much what enters the flow in terms of volumes, it doesn't correspond to what it goes out. The actual leakage are defined as a volumes that remain after all the components of consumption (measured and not measured) have been taken away by the volume of drinkable water that enters into the net. The volume not measured, it corresponds to consumptions not invoiced and authorized (i.e., consumption for urban parks) and the apparent losses (water's theft, measurement failures) represent the water consumed but not paid by the clients. The water management service often complain that is accounted in the consumptions represents only a part of the water flow managed in urban area, and that the principle "who pollutes pay", confirmed by the Dir UE 60/2000, is not honoured. Therefore, calculations on the losses in the water budgets are indirect evaluations with limits of uncertainty, rather than direct measurements (European Union, 2015). The global water volumes entered in the supply system to provide all urban distribution water grid are crucial to understand the type of pressure on peri urban area. For this reason we have analyzed the water volumes introduced in the distribution water grid of 20 Italian regions.

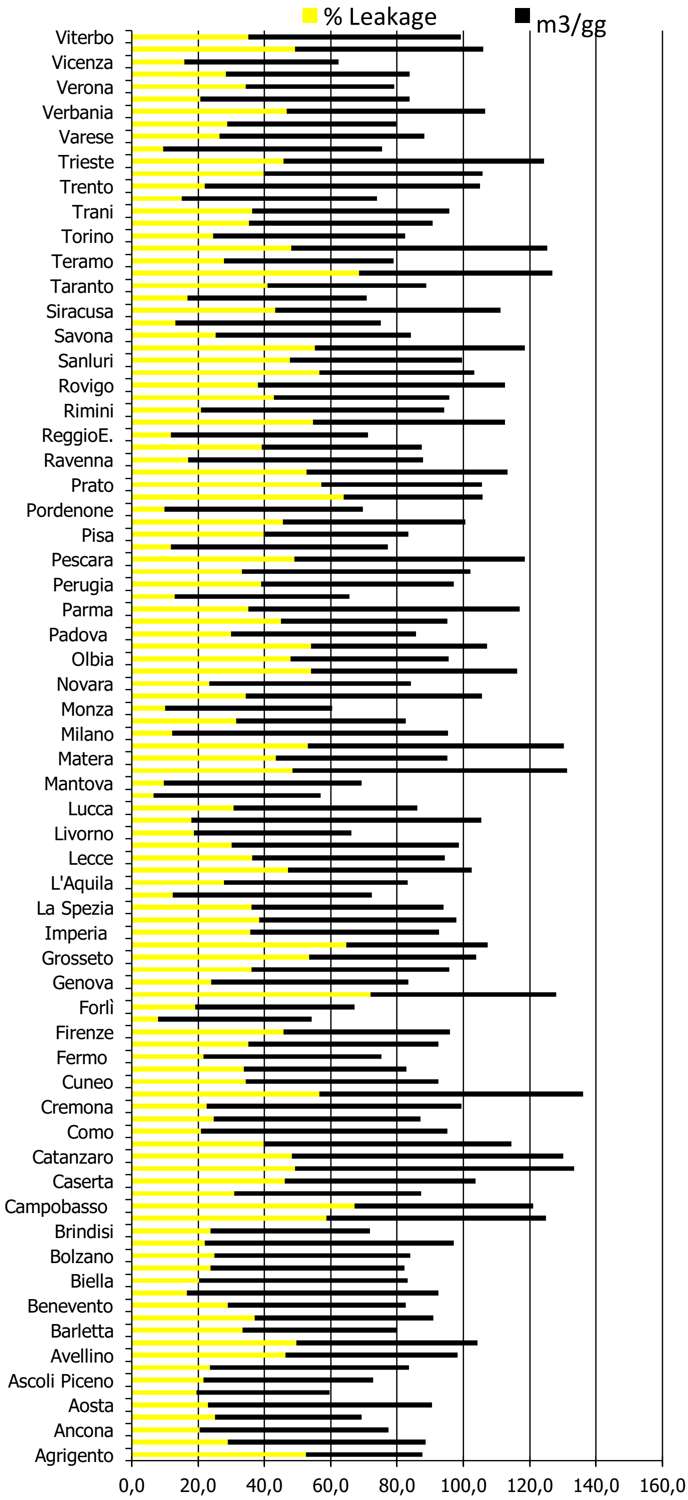

Fig. 3 Volumes disbursed and volumes lost in the water networks of the Italian provinces, Istat 2017

We have divided the period 1999-2012 (Istat data) in three principal spans 1999-2005; 2005-2008, 2008-2012 to consider the regional variations in the entered volume of water by utilities. The objective isto verify growth or reduction trend of the water volumes for region. As shown in Fig. 4, it is possible to observe that the volumes entered in water net vary in the incoherent way in all the regions, for all three periods. For instance in Marche the introduced volumes are in growth in the third period from 1999 to 2012, while in Campania the volumes introduced into the net decrease in the second period for then to increase in the third one 2008/2012.

In Calabria instead in the third period there is a reduction of the volumes introduced in comparison to the previous periods. These variations can be explained in terms of processes out of control such as:

- the consume not measurable because made for public activities of the municipalities (cleaning roads, construction sites, etc.);
- unauthorized consumption that occur in urban suburbs in illegal supply for domestic, industrial or agricultural;
- visible losses of the water distribution, that employ time in the phases of identification and reparation.

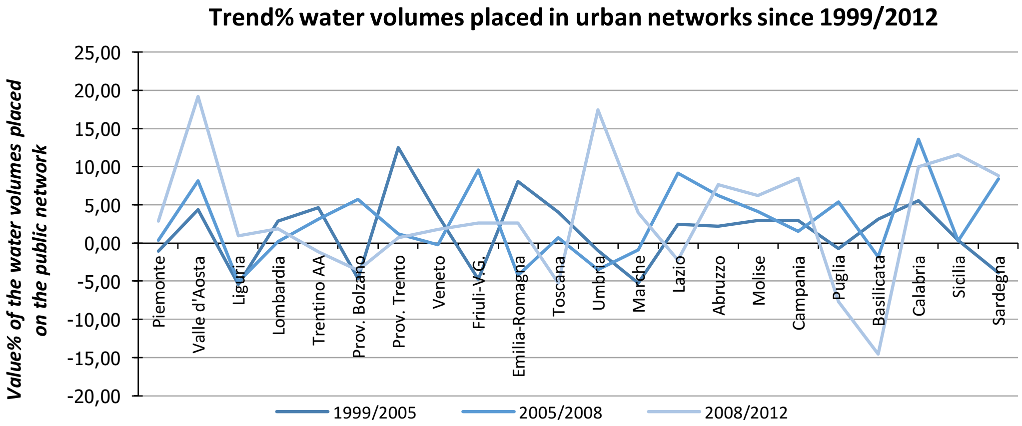

Fig.4 Volumes entered in the network for each Region expressed as difference % in between periods

These "chaotic" trends of the volumes introduced into the water nets during the period 1999/2012 show how much is difficult to effect precise forecasts of the urban water consumptions, and how much these uncertainties could increase in reason for the obsolescence of the urban water infrastructures, with an WF that could begin to take shape as a "water sprawl" on the territory. The analysis of the water footprint in urban areas should in fact take into account the fact that the sources of water do not always insist within the peri-urban boundary, so often it's necessary draw water from other neighboring basins. Therefore the urban water footprint spills over other urban areas, and the catchment networks sometimes stretch for thousands of km in and out of the river district with a sprawl difficult to contain. Furthermore, the volume supplied to urban distribution network, could also be lower than the actually volume provided by catchment area with losses also on that network. But unfortunately there are no certain data about this, despite these activities in Italy are managed exclusively by the regional authorities. In order to have an accurate impression of water consumption in urban areas, it would be necessary to include volumes of water imported and exported into the regional networks whit the relative losses of these. It would be necessary develop accounting for volumes transferred between subsystems also defining acceptance limits for loss level of each system (European Union, 2015). A factor to be considered in the analysis of the urban water monitoring concerns the sources from which the volumes of water are withdrawn. The principal sources of extraction in Italy are: sources, underground aquifers, basin artificial, lake and superficial waters. The wells pumping averagely represents the withdrawn more used in the Italian regions (Tab. 3). The wells containing waters of high quality and have times of resilience undefined because they are determined by the depth of groundwater, by the characteristics of the ground and by the precipitations. Therefore, this represent a critical step from the point of view of the ecosystem. Collecting water from wells is practice the most widespread in Italy, and as points out the Tab.3. In the majority of the regions both of high consumption and low - satisfies more than the 50% of its requirement, with the Basilicata exclusion that mainly collect from superficial waters. Water's collecting directly from sources are distributed in this way: from wells 48.6% (with an evident water stress from underground waters), 36% from source, 5% from superficial waters, 10.5%, from artificial basins or lakes and 0.2% from brackish waters. Regarding the import / export of water, it should be noted that Basilicata and the Marche collection around 90% more of what they consumed, and that export almost 50% of the volumes of water in other regions. So, from analysis of the local hydrographic districts, it is possible to highlight the value of the transported volumes through the regional areas and obtain an account of ecosystem water flow.

Italian Region	Water Source	Water well	Surface waters	Lakes	Brackish waters	Total
V. d'Aosta	47,063	5,640				52,703
	89.3	*10.7*				
Liguria	29,760	132,764	34,155	47,386		244,065
	12.19	*54.4*	*13.99*	*19.42*		
Lombardia	264,711	1,200,996	1,577	46,186		1,513,470
	17.49	*79.35*	*0.1*	*3.05*		
Piemonte	293,108	337,726	20,741	2,746		654,321
	44,8	*51,61*	*3,17*	*0.42*		
Veneto	230,330	418,943	63,142	2,385		714,800
	32.22	*58.61*	*8.83*	*0.33*		
Friuli V.G.	59,613	163,863	9,614	1.010		234,100
	25.46	*70*	*4.11*	*0.43*		
Emilia	41,461	310,655	108,318	46,117		506,551
	8.18	*61.33*	*21,38*	*9,1*		
Marche	110,698	36,930	6,208	21,745		175,581
	63.05	*21.03*	*3.54*	*12.38*		
Umbria	43,738	71,212				114,950
	38.05	*61.95*				
Toscana	89,509	236,792	130,225	4,219	1,094	461,839
	19.38	*51.27*	*28.2*	*0.91*	*0.24*	
Lazio	858,371	300,014	3.592	24,126		1,186,103
	72.37	*25.29*	*0.3*	*2.03*		
Abruzzo	232,150	59,716	11.288			303,154
	76.58	*19.7*	*3,031.54*			
Molise	114,489	42,671	13,854			171,014
	66.95	*24.95*	*8.1*			
Campania	470,269	457,594	58	25,002		952,923
	49.35	*48.02*	*0.01*	*2.62*		
Basilicata	40,145			286,632		326,777
	12.29			*87.71*		
Puglia	560	88.481		89,827		178,868
	0.31	*49.47*		*50.22*		
Calabria	194,311	170,930	46,723		10,027	421,991
	46.05	*0.41*	*11.07*		*2.38*	
Sicilia	169,735	419,456	4,631	113,350	6.853	714,025
	23.77	*58.75*	*0.65*	*15.87*		
Sardegna	39,655	40,818	3,521	246,026		330,020
	12.02	*12.37*	*1.07*	*74.55*		
Totale	3,330,374	4,495,948	460,782	956,962	17,977	9,257,255

Tab.3 Received volumes (thousand m^3/y) by type withdrawl, our elaboration, ISTAT, 2012

5 GREEN FOOTPRINT

The green water is calculated with the volume of the meteoric waters used in the activities of irrigation, particularly is calculated as virtual water contained in the zootechnical and agricultural products and traded at global level. This flow of water in the WF account is defined renewable, given that, under natural conditions of the meteorological events, the rain flow is distributed in the ground for percolation and subsequently in the atmosphere by evapotranspiration, in according to a natural cycle of the water. Instead in this study, the calculation of the Urban Green Footprint - UGW has been considered that the waterproofed of the urban territories is the cause of the "consumption" of the meteoric waters, that are subtracted to the natural cycle of the water. Indeed it deals with waters that falling on the waterproofed grounds of the urban territories, that are conveyed toward the nets of collection of water, and sometime they are mixed with wastewater.

Therefore, the anthropic activity of waterproofing of the urban ground is considered as the cause of the loss of water volumes of rainfall. Obviously, widest is the asphalted surface, greatest is the water that is subtracted by the natural environment. According to these considerations we have calculated therefore the Urban Green Water following (expressed in m^3/y):

$$UGW = A_p - A_V * I_{rf} = 8{,}424{,}924 \times 1{,}000 = 8.42 \times 10^9 \qquad (2)$$

Where: UGW = urban green water; Ap = Area Province (County), Av = green area; Irf = Index of rainfall. The green area has been calculated as the value % of green areas on the total provincial area, ISTAT 2016.
The calculation of the index of rainfallsis based on the so called pluviometric height, where a millimeter of accumulation is equal to 1 liter water fallen on a surface of 1 square meter. For every province there has been so identified the relative UGW, given from the areas constructed and the green areas, for the rainfall index of the province.

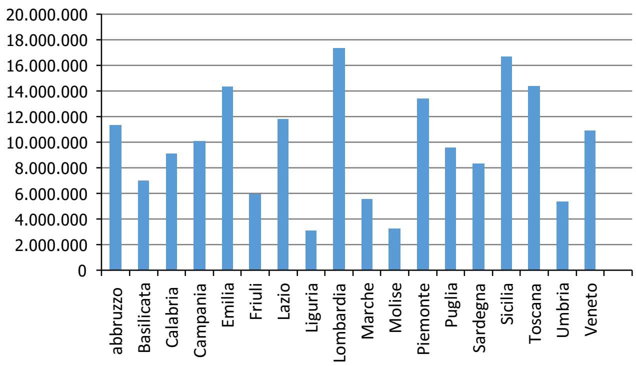

Fig.5 Green footprint for Italian Regions, our elaboration, Istat 2015

The collected data for regions are reported in the Fig. 5, where the Lombardia, Emilia Romagna, Sicilia and Toscana are the most UGW.

6 WATER INTELLIGENCE: THE BORDERS OF THE URBAN WATER FOOTPRINT

The indicator UBW and UGW proposed in this study are mainly based on some observations:

- not all the anthropic applications of the water are kept under control by the national water accounting, particularly the water used economic operators;
- the calculation of the withdrawals from underground reserves and from superficial water bodies doesn't keep in mind of all the collecting obtained for the agricultural compartment, industrial, tourism and of the leisure time service;
- dirty water's volumes entered in the companies' accounts don't always correspond to the volumes of dirty waters really delivered to the water bodies after treatment, where there are rain water and unauthorized withdrawals.

The two Indicators calculated, blue UBW and green UGW - indicate two impressive ecosystem problems (stress of the basins caused by collecting of superficial / underground waters; the waterproofing process of the ground) that the cities cannot transform in the brief period if not with combined actions of water intelligence. A governance of all players and stakeholders must be able to put together technological, economic, social and eco-compatible factors of water management, for an urban planning that sees in the sustainability the critical element of the urban quality and a decisive factor of the competitiveness and of the ability to attract resources, know how and investors (Papa et al., 2016). We must to take into account the fact that funding of many projects of sustainability water will be out of financial range of the public administrations. Nowadays, a lot of political decisions are turned to improve the drinkable water nets through technologies adept at self-regulation referenced to losses and relative pressures of the flows, to the purpose to reduce water wastage that the service of distribution records in Italy (De Paola et al., 2017). But also the implementation of these soft technologies records the financial difficulties of the administrators. According to Aldaya et al. (2012), all this makes to think that for the future the governance of the water will not be an exclusive domain of a regional government or however public. According to the author, even if the water remains a public resource, this suggest that the role of the companies and the investors can become fundamental in the management of the water resources and that the urban planning must be compared with a plurality of players and tools of governance more effective. Furthermore, the ambitious projects of Smart City financed and realized only by big private investors as the project Masdar in Abu Dhabi, have been the failures from the point of view of competitiveness of the urban areas. In fact, the project of urban sustainability must be accompanied by the incremental growth of the social capital, that is based on great scale of cooperation and interaction among the stakeholders of the cities, (Papa et al., 2013). The water intelligence cannot be understood only as new technologies to restore the waters of urban anthropic cycle. The great transformations of the urban areas can be realized rather with a new to governance putting together the pieces of a highly complex social action, as the ability to coordinate actions, projects and to integrate technologies that are still separately developed the ones by the others, but that they have clear synergies in their operation and they must be shared by their users (Gargiulo & Russo, 2017). Finally, the calculation of the urban water mark here proposed, can be identified as an early-warning systems (Steffen et al., 2011). In fact, according to the authors, the nature of Earth-system dynamics - the nonlinearities, tipping elements, thresholds / abrupt changes strongly, suggests that humanity needs to system to warn us when we are approaching such potentially catastrophic points. An early-warning system is a prerequisite for being able to recognize and steer away from such thresholds. Every edge is situated inside a zone of uncertainty that scientific researches can reduce, to reset or to put in further alarm. So, all depends from the ability to assimilate new scientific information about the terrestrial system, on the ecosystems, on the urban systems. It's necessary calibrate again the objectives of sustainability toward new and necessary dynamic equilibriums. The same occurred with the borders of the climate, first included within the limit of 450 ppms of CO_2, then redefined under the threshold level of 350 . Everything suggests that the anthropic footprint on the planet must be managed in concert with a research capable of analyzing and quantifying the phenomena of our dynamic systems, indicating the limits, the threshold values beyond which our footprint cannot be pushed. And it is on these borders that water intelligence will have to work.

7 CONCLUSION

The purpose of the study was to investigate a little in-depth study of WF's research on urban consumption. We have seen how the consumption data often entrusted to the water service operators, do not give evidence of all the phenomena that compete to the urban water footprint. The blue and green footprint in Italians' cities was calculated, with indicators that could be replicated in other national or local contexts for comparison. The indicators proposed and elaborated according to the Water Footprint methodologies, present two substantial innovations in the studies on anthropic pressures, among which:

- in first place the characterization of the anthropic use of the natural resource starting from the behavior of the networks of social actors – ANT;
- secondly the urban dimension of the green footprint. The GWF in the WF account is defined as the renewable resource that is subtracted from its ideal cycle to enter the virtual cycle of trade in agricultural and zootechnical goods. In our opinion this approach is not sufficient for the characterization of urban territories, because the waterproof surfaces of the city, represent a real consumption of green water that are subtracted from urban soil.

With the use footprint Indicators it's necessary a reflection about how to set a limit to the collecting of water from the hydrographic basins, that implicates the necessity to save the water, keeping in mind of a multiplicity of factors, among which:

- the water in the urban areas is a limited resource, that in the urban territory is imported often for purposes that are not only linked to the drinkable water;
- the urban soil requires "waterways" that can contain the effects of climate change in terms of scarcity and extreme events. Water is therefore called upon to play its role in contributing to the sustainability of the urban territory;
- water quality plays a fundamental role in the quality of life of all animal and plant species that live in the urban area. Therefore, the dilution criterion used to make acceptable the chemical footprint, will lead us in the short term to an appalling emergency caused by enormous volumes of water polluted not usable;
- the water sprawl with which urban areas try to grab the available water resources, could generate huge problems of governance in the future, in which the claim to the right to water could go beyond technical-economic aspects, causing great conflict in the territories. Water sprawl should therefore become the object of study and further study of water footprints in urban areas.

Urban planners need to be equipped to handle these macro processes. The calculation of the footprints of each process and of limit of resources' uses, can support dialogue with stakeholders to manage the major structural transformations of everyday life, which inevitably the management of the anthropic cycle of water will entail in the future. Traditionally the urban planning of the water resources was effected on valuations of variation of the population and the relative demographic dispersion on the urban territory and peri-urban. This study suggests that it is not the number or the density of population that it determines a water footprint. Not only: the urban planning of the cycle of the water has had as objective that to define the volumes to withdraw, little have been investigated the real consumptions and on the relative stress of the hydrographic basins. The characterization of the urban water footprint asks for an analysis of the behaviors the trends to the consumption of the population, as example the distrust of the European consumers towards the waters of net and also the increasing consumption of waters in plastic bottles. As the development of the aquatic parks, a phenomenon in growth both in Europe that in Italy, that strongly engrave on the water stress. It would be necessary to analyze what the consumers want, and to wonder why the ANT nets privilege for the fun the equipped places rather than natural places. The social sciences should investigate more in depth on what we could define a desire of affiliation to an "anthropic landscape", and therefore in some way a "virtual and technological landscape". A territory that is perceived as safe, compared to emerging vulnerability of the urban territories, afflicted by climatic events, drought, atmospheric pollution. It results therefore evident as the urban transformations must pick up these trends of the human behaviors and in the same time they must transforming the cities beginning from the subjects that choose them. The studies of WF can help to stimulate the planners to rely themselves to new paradigms of planning about the available resources in urban area, keeping in mind of the "concept of limit". The indicators developed by the Ecological Footprint from 1999 have had a decisive role in the seeding into the environmental sustainability vision the concept of limit, that necessarily implicates the creation of new tools to plan the anthropic spaces and the activities beginning from what it is indeed available, and that can technologically be improved for a sustainability of the footprint. The urban transformations should for instance integrate the problems of the water losses of the urban nets with the reuse of volumes of used waters, for new projects for the urban sustainability of the next decades. Furthermore, methodologies developed for the Carbon Footprint – CF, the energetic efficiency, and for the Water Footprint - WF, the hydro efficiency, have a scientific value of which is important to take into account into the setting of a new paradigm for the urban constructions, because they represent a tools that are developed of the description of the complex systems. The Indicators already consolidated of CF and WF, represent a method to describe behaviors in which social actors, biochemists agents and physical (partly still to us strangers) process, contemporarily compete with unpredictable courses. What we can do in multivariate contexts as those of the urban territories, is to contribute to the identification of the attributes to describe a process, and it is really this the objective of the CF and WF studies: to describe the phenomena that happen, to quantify them, to select them and categorize to the purpose to improve our knowledge about the holistic systems that surrounds us. The studies of Footprint can contribute to the construction of the objectives of transformation toward the smart cities, because they represent de facto the databases on the dynamics of the processes, on the manner how consumers use the energy rather than the water, but also about their perception of the *value* of the resource they employ. Because if on one side we can agree with the fact that the value of a resource depends on the use that we do of it (Costanza et al., 2014), on the other hand it is also true that the use that we make of a resource, determines also of its value, inexorably.

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