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WATER STRESS AS A THREAT TO MILLIONS:
Challenges and Solutions on the Way to Water Security in the Mediterranean

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Achieving water security is a major challenge in many cities of the Mediterranean where water scarcity is characteristic of severe water stress. It is expected that cities will face increasing challenges in the future in order to manage scarcer and less reliable water resources to secure higher water demands in an efficient way. Therefore, it is necessary to identify and integrate urban water security variables into water resources management at the basin level to ensure its sustainability.

More than 180 million people experience water poverty in the Mediterranean. An additional 60 million face water stress to some degree. Urban areas have been experiencing major transitions and are facing the pressure of increasing demands. Climate change's impact on extreme weather events such as floods and droughts, demography and migration, or socio-economic development are key drivers of increasing urban use of water, which is coupled with aging infrastructure and the existing risks inherent to traditional urban water management. The increasing urban water use poses threats to socio-economic development and human and water security, such as inadequate water and sanitation services, failing stormwater management, and water quality and ecosystem degradation.

Achieving urban water security plays increasing importance for sustainable water management at the basin level. Although irrigation of agricultural lands still accounts for 75% of water diversion in many basins, urban water use is rapidly increasing and is even overpassing irrigation water use in some areas. Unbalance between water supply and demand could lead to vulnerabilities of water systems including competition among different water users which may cause a shift in priorities, quantities, qualities of water allocation at the basin level and emerging challenges and conflicts for the agriculture sector, food security, and the socio-economic condition of farmers.

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Rethinking water management for human security and sustainable development

Ensuring urban water security is an urgent challenge that may threaten humanity's food, economic, ecological, and security if not properly addressed. In order to meet these challenges, there is a need for a paradigm shift to achieve urban water security. This paradigm shift is based on several key concepts including integrated water resources management (IWRM), the resilience of urban water systems, interventions over the entire urban water cycle, shifting from linear systems to a circular economy, greater application of nature-based solutions to identify vulnerabilities in the urban water system at the spatial extent of the entire city, and the use of multi-scale design and evaluation of alternative future scenarios to explore and inform decision-makers of the potential outcomes of different options.

The Mediterranean requires a new paradigm to achieve integrated water security. This paradigm should be based on common objectives: to improve water resource management to tackle climate change, strengthen urban resilience and maximize socioeconomic welfare and environmental conservation. It is noteworthy that cities present specific administrative procedures for the allocation of water resources, as well as the use of unconventional resources (reuse and desalination); different treatments for drinking water and wastewater treatment; diverse degrees of technological development, as well as a broad range of efficiencies both in agriculture and for the supply of drinking water; sorts of tariff policies and cost recovery; drought and flood management approaches; and the participation of users in decision-making, among others. This variety of peculiarities adds value to achieving water security, allowing different perspectives and strategies to tackle global changes in the Mediterranean.

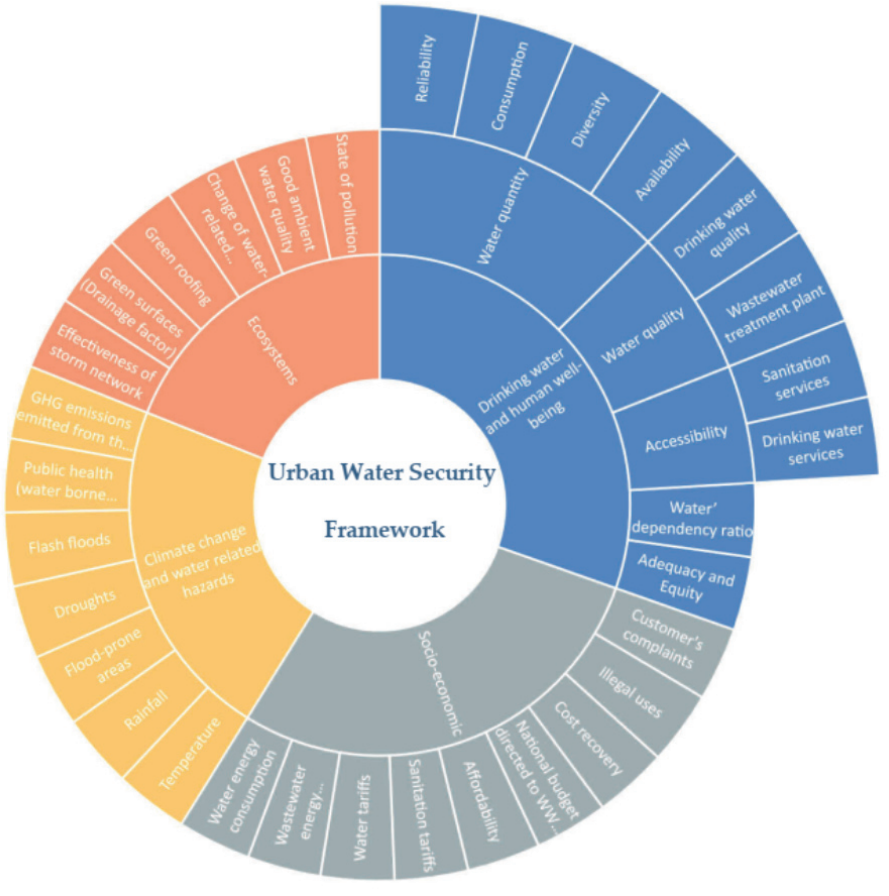
What does urban water security mean for the Mediterranean?

Urban Water Security is understood as the dynamic capacity of water systems and stakeholders to safeguard sustainable and equitable access to water of adequate quantity and acceptable quality that is continuously, physically, and legally, available at an affordable cost for sustaining livelihoods, human well-being, and socio-economic development, ensuring protection against waterborne pollution and water-related disasters, and for preserving ecosystems in a climate of peace and political stability.

The below figure presents a holistic approach, which is based on the comprehensive UN-Water framework of water security and addresses four dimensions: drinking water and human well-being, ecosystem, climate change and water-related hazards, and socio-economic factors (DECS framework)[2]. It integrates the current discourse on urban water security including different definitions, assessment frameworks and indicators of water security, at different levels. It tailors the concept according to the needs of policy-makers and emphasizes the role of adaptive capacities and inclusion of governance mechanisms to ensure water security goes with sustainability.

[2] Tolba Aboelnga, H., Ribbe, L., Frechen, F., Saghir, J., (2019). Urban Water Security: Definition and Assessment Framework. Resources. 8. 178. 10.3390/resources8040178.

Figure 1: The four main pillars of water security



Integrated solutions for water security

In many cases, integrated water resources management (IWRM) is one of the pillars of Urban Water Security. IWRM and the broader concept of Water Security must be applied at the basin scale in order to provide a sustainable framework for Urban Water Security (UWS). Usually, large urban areas get relevant portions of their water supply from outside of the urban agglomeration. Therefore, the impact of climate change on the sources of water and their impacts on water allocation among different uses in the basin are key questions related to Urban Water Security. Moreover, the relationships between different types of sources can only be captured by IWRM, allowing for an adequate assessment of the potential of conjunctive use of different types of sources, such as for instance surface and groundwater, which can produce an increase in reliability and resilience when facing extreme droughts that are characteristics of many basins[3]. Furthermore, for an adequate

[3] Momblanch A., J. Paredes-Arquiola, J. Andreu (2017). Improved modelling of the freshwater provisioning ecosystem service in water scarce river basins. Environmental Modelling & Software, 94, pp. 87-99. http://dx.doi.org/10.1016/j.envsoft.2017.03.033

assessment and implementation of the potential of wastewater reclamation and seawater desalination to improve urban water security, both sources must be incorporated in the IWRM analysis to optimize the design and the efficiency of the resulting system. In addition, besides water quantity, water quality and environmental status of water bodies and the urban environment must also be included in IWRM, ensuring that solutions are sustainable.

Shifting from linear water systems to circular economy should be at the heart of water and human security. This would enable the region to contribute, directly or indirectly, to increasing resource efficiency and decreasing environmental impacts throughout value chains. This can be achieved by applying or enabling one or more of the 9 R's principles (R1 Refuse, R2 Rethink, R3 Reduce, R4 Re-use, R5 Repair, R6 Refurbish, R7 Remanufacture, R8 Repurpose, R9 Recycle). A further R-strategy often mentioned in combination with the above 9Rs, sometimes even as part of a circular economy definition, is the recovery of (embodied) energy from wastes and residues, which contribute substantially to climate change mitigation by displacing the consumption of fossil fuels.

Reforming water policies in the Mediterranean

As far as urban water policies and agriculture require accurate information on which to base their water allocation decisions, the region has to take crucial steps to improve the current methodologies since, despite the higher degree of detail and complexity offered, there are several elements that distort the final objective, which is to manage the available water resources in a just manner for all users. Water stakeholders must play a great role on improving the understanding of urban water security, urban water cycle, and better allocation of water resources from engineering and hydrological perspectives at both urban and utility levels. Moreover, it considers the urban water cycle at the basin level and beyond including non-revenue water (NRW), wastewater treatment, urban hydrology, pluvial flooding, and rainwater harvesting, among others. In this project, urban water accounting will be used to quantify water budgets in urban areas and express benefits, services, and risks from water in tangible terms. For that purpose, this study pulls together information obtained from various sources including hydrological modelling, field measurements, and advanced remote sensing.

Reforming water policies in a such holistic way will support policy-makers and stakeholders in the water sector for a better allocation of water resources. Water accounting can also contribute to supporting farmers with reliable and on-time information on water allocation and irrigation scheduling to optimize the use of water and assess the actual crop water requirements. In the era of digitalization, the region has also to tape into data technologies and applications to quantify water budgets in urban areas at high spatial and temporal resolution. These applications are nourished by new innovative and affordable information services such as citizen observatories. The comparative advantage of these information services will be assured using advanced hydrological modelling and remote sensing techniques and the development of cheaper and more robust sensors.