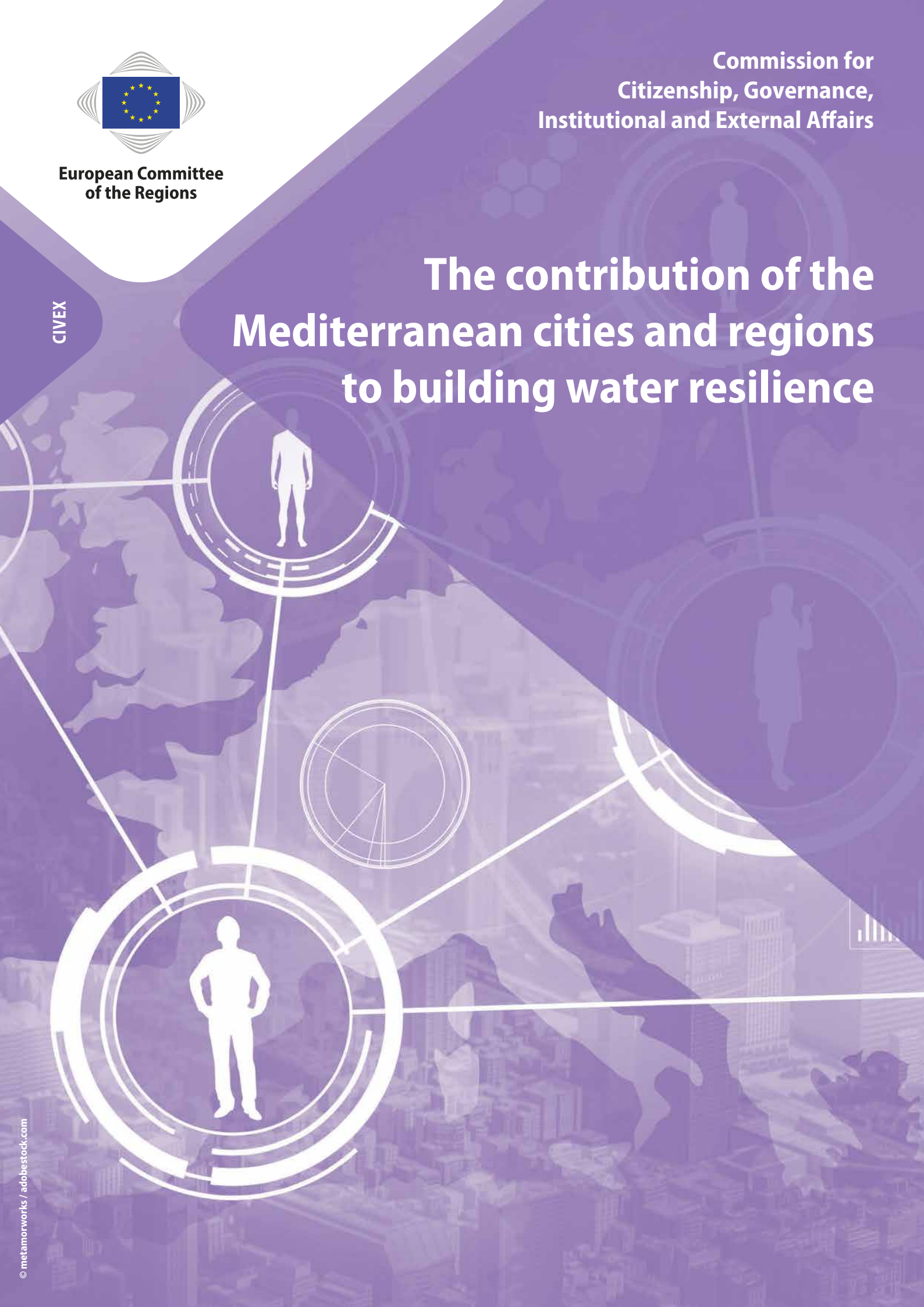
European Committee of the Regions

Commission for Citizenship, Governance, Institutional and External Affairs

CIVEX

The contribution of the Mediterranean cities and regions to building water resilience



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It does not represent the official views of the European Committee of the Regions

Contents

Acronyms and abbreviations

AFD – French Development Agency
CFLI – Canada Fund for Local Initiatives
DSH – Dar Si Hmad for Development, Education and Culture
EBRD – European Bank for Reconstruction and Development
EIB – European Investment Bank
ERDF – European Regional Development Fund
EU – European Union
FFEM – French Facility for Global Environment
ISKI – Istanbul Water and Sewerage Administration
IUWM – Integrated Urban Water Management
LRAs – Local and Regional Authorities
MENA – Middle East and North Africa
NDICI – Neighbourhood Development and International Cooperation Instrument
NGO – Non-Governmental Organisation
NIP – Neighbourhood Investment Platform
OECD – Organisation for Economic Co-operation and Development
PPP – Public-Private Partnership
PRIMA – Partnership for Research and Innovation in the Mediterranean Area
SDG – Sustainable Development Goal
WASH – Water, Sanitation, and Hygiene

Summary

Water is perhaps the Mediterranean region's most scarce commodity, with some 180 million people already suffering from water scarcity. The already water-scarce population is expected to increase to over 250 million before 2050, given predictions about climate change-induced hazards and risks, including water stress. Effectively, an additional 25 billion cubic metres of water will be needed annually to meet the needs of citizens of the broader Middle East and North Africa (MENA) region.

Water resilience guarantees that cities and regions can cope with shocks and stresses related to water, such as periods of prolonged drought, but also sea level rise or storm surges (increased risk of flooding). Acceleration of such resilience is especially important for Mediterranean cities, where overall demographic trends, as well as those linked to urbanisation and additional industrial and irrigation needs, are skyrocketing (hence an increase in water demand, and likewise with mismanagement practices).

This study aims to explore the role that Local and Regional Authorities (LRAs) in ARLEM countries play in building water resilience, current achievements in this area, the remaining challenges, and potential solutions.[1] Lastly, it provides LRAs with recommendations for expanding this role.

This memo consists of:

1. a brief analysis of the water resilience challenges in the Southern Neighbourhood countries;
2. two case studies of LRAs playing an active role in building water resilience;
3. an outline of the role that cities and regions in the Mediterranean can play in efficient water management;
4. identified funding possibilities, but also funding gaps and other financial obstacles to pursuing water resilience-oriented projects.

Key recommendations drawn from the case studies and the challenges faced by the LRAs concerning water resilience vary from soft actions focused on education and awareness-raising campaigns, to technical know-how development of water infrastructure following the rules of Integrated Urban Water Management (IUWM).

[1] These include: Egypt, Türkiye, Algeria, Morocco, Syria (membership currently suspended), Tunisia, Albania, Bosnia and Herzegovina, Israel, Jordan, Lebanon, Mauritania, Palestine, Monaco and Montenegro, along with Libya and North Macedonia which are observers.

Part 1: Water resilience challenges in the Mediterranean region

Water resilience guarantees that cities and regions can cope with shocks and stresses related to water, such as periods of **prolonged drought**, but also **sea level rise** or storm surges **(increased risk of flooding)**.[2] Acceleration of such resilience is especially important for Mediterranean cities, where overall demographic trends, as well as those linked to urbanisation and additional industrial and irrigation needs, are skyrocketing **(hence an increase in water demand, and likewise with mismanagement practices**), and where extreme weather phenomena are becoming more frequent and destructive.[3] Another issue concerns the Mediterranean Sea itself. Its seawaters are **polluted**, and effectively 49% of coastal water does not achieve good environmental status.[4]

As for freshwater resources, 72–74% are concentrated in the northern part of the Mediterranean, typically in European Union (EU) countries, while the remaining 28–26% is shared between the South and East of the Basin **(water availability issues)**.[5] All in all, the region is considered the most water-stressed in the world,[6] with around 180 million people already suffering from **water scarcity**. Six of the world's 17 most water-stressed countries are ARLEM countries (and 14 of the 17 most water-stressed are from the broader Middle East and North Africa – the MENA region) as the table below depicts:

[2] Local/regional water resilience here is understood as a system: to provide access to high quality water resources for all residents; to protect residents from water-related hazards (such as sea level rise or flash floods); to connect residents through water-based mobility.

[3] PlanBleu. (2007). The future of the Mediterranean will depend largely on cities, https://planbleu.org/en/publications/the-future-of-the-mediterranean-will-depend-largely-on-cities/.

[4] PlanBleu, (n.d.). Pollution in the Mediterranean, https://www.unep.org/unepmap/resources/factsheets/pollution.

[5] Ferragina E. (2010). The Water Issue in the Mediterranean. European Institute of the Mediterranean (IEMed), European Union Institute for Security Studies (ISS), https://www.researchgate.net/publication/265012608_The_Water_Issue_in_the_Mediterranean_in_Environmental_and_Sustainable_Development_in_the_Mediterranean#fullTextFileContent, p.54.

[6] Stockholm International Water Institute (SIWI) & United Nations Children's Fund (UNICEF) (2023). Water Scarcity and Climate Change Enabling Environment Analysis for WASH: Middle East and North Africa. Stockholm and New York, p. 5.

Table 1 SDG 6.4.2 Water stress classification and total renewable water resources per capita, global ranking for ARLEM countries (2018)

Country	Level of water stress (%)*	Water stress global rank	FAO classification of water stress level	Total renewable water resources per capita (m3/inhab/yr)	Least total renewable water resources global ranking	Falkenmark water stress indicator level**
Libya	817	4	Critical	104.81	24	Absolute scarcity
Algeria	138	9	Critical	276.28	28	Absolute scarcity
Syrian Arab Republic[7]	124	11	Critical	991.56	48	Scarcity
Egypt	117	14	Critical	584.21	36	Scarcity
Jordan	100	16	Critical	94.3	22	Absolute scarcity
Tunisia	96	17	High	399.04	32	Absolute scarcity

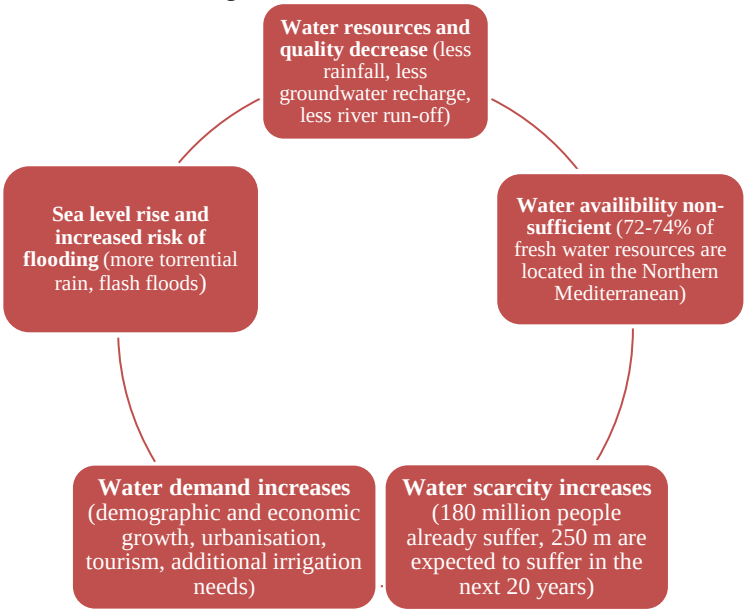
* FAO AQUASTAT data informs SDG 6.4.2, which measures "Level of water stress: freshwater withdrawal as a proportion of available freshwater resources" with a scale ranging from Critical (>100), High (>75-100), Medium (>50-75), Low (>25-50), to No Stress (>0-25).
** According to the Falkenmark water stress index: If the amount of renewable water in a country is below 1,700 m3 per person per year(4657lpcd), that country is said to be experiencing water stress; at below 1,000 m3/capita/yr (2740lcd), it is said to be experiencing water scarcity, and below 500m3/capita/yr (1370lpcd) absolute water scarcity.
Source: based on Stockholm International Water Institute (SIWI) & United Nations Children's Fund (UNICEF) (2023). Water Scarcity and Climate Change Enabling Environment Analysis for WASH: Middle East and North Africa. Stockholm and New York, p. 5.

The already water-scarce population is expected to increase to over 250 million before 2050, given predictions about climate change-induced hazards and risks, including water stress **(further water resources and quality decrease**).[8] Effectively, an additional 25 billion cubic meters of water will be needed annually to meet the needs of citizens of the broader MENA region.[9]

To conclude, water resilience challenges in the Mediterranean predominantly stem from **natural factors**, such as prolonged droughts, but are also caused by **human activities**, such as water pollution, overexploitation of groundwater resources, and inefficient irrigation practices.[10] The interlinkages between all water trends relevant to the Mediterranean region, leading to a **triple crisis of climate change, biodiversity loss and pollution,** can be summarised in the graph below:

[7] Membership currently suspended.
[8] MedECC. (2020). Summary for Policymakers. In: Climate and Environmental Change in the Mediterranean Basin – Current Situation and Risks for the Future. First Mediterranean Assessment Report [Cramer W, Guiot J, Marini K (eds.)] Union for the Mediterranean, Plan Bleu, UNEP/MAP, Marseille, France, pp 11-40, doi:10.5281/zenodo.5513887.
[9] de Waal, Dominick; Khemani, Stuti; Barone, Andrea; Borgomeo, Edoardo. (2023). The Economics of Water Scarcity in the Middle East and North Africa: Institutional Solutions, Washington, DC: World Bank.
[10] The Water Project. (n.d.). Water in Crisis - Middle East, https://thewaterproject.org/water-crisis/water-in-crisis-middle-east.

Graph 1 Interlinkage of water resilience challenges in the Mediterranean



Source: CASE elaboration based on MedECC (n.d.). Water and food in the Mediterranean, https://www.medecc.org/outputs/mar1-infographic-water-food-med/.

Part 2: Case studies of LRAs playing an active role in building water resilience

This subsection provides two case studies of cities and regions chosen for their key experience in addressing particular water challenges mapped in Part 1 of the study. While the first case study explores breakthrough techniques in freshwater harvesting in remote rural environments of Morocco, the second focuses on the deployment of innovative wastewater treatment plants in one of the biggest cities in the world – Istanbul.

Case study 1: Harvesting fresh water from fog in the Ait Baamrane region, Morocco

Background

Water scarcity in Morocco is already creating serious economic constraints, which are expected to grow further the closer Morocco gets to an absolute threshold of 500 cubic meters of water/person/year by 2030.[11] The shortage is caused not only by climate and environmental crises, but also by human factors, including population growth and the mismanagement of groundwater for irrigation purposes – for example, in 2022 the country experienced its worst drought in 40 years.[12] There is a critical need for modern infrastructure and advanced control and monitoring of water distribution systems to address the water scarcity in many Moroccan regions, but most of all so as to ensure sufficient freshwater resources for all citizens, including in rural areas.[13]

Case study description

The southern region of Ait Baamrane is one of the poorest in Morocco. As it is remote and semi-arid, the region faces numerous challenges related to education, health and economic opportunities.

While human and ecological challenges impact the region, there is one thing local communities can always be sure of: fog. Dar Si Hmad for Development, Education and Culture (DSH), a local Moroccan Non-Governmental Organisation (NGO), along with local citizens and an international consortium of engineers and researchers, has designed and installed a fog water harvesting project which in particular addresses the water-related challenges of the community. Although

[11] World Bank (2022). Morocco Country Climate and Development Report, https://openknowledge.worldbank.org/server/api/core/bitstreams/c5c11886-30bf-5350-8e5f-df9722b85fe0/content

[12] CARE. (2022). Drought Assessment Report - CARE Morocco, https://reliefweb.int/report/morocco/morocco-drought-assessment-report-december-2022.

[13] EIB. (2023). A pipeline to better lives, https://www.eib.org/en/stories/morocco-water-scarcity.

LRAs were not the initiators of the project, their educational and knowledge-sharing roles proved crucial for its community impact (see section below).
The fog-harvesting units have been installed at 1,200 metres above sea level, at the summit of Mount Boutmezguida, at an intersection with the Sahara winds.[14] There the fog is caught in nets, and then water runs to the bottom of the netting from where it is funnelled into an underground container.
From there it is sent to a mixing reservoir, where the water is pumped via photovoltaics (PV) power to be mixed with various minerals. The mineralized water is first piped to a village where smaller pipes then veer from the main piping system toward individual households. To receive water from DSH, households pay a combination of a base fee and a per-use fee, which totals an average 45 dirham/per month (approximately EUR 4.15). Once water reaches the household, it can be used for drinking, cleaning or agricultural purposes. And so the fog-catchers deliver drinking water to around 150 rural households that have never had running water.[15]
This project provides an innovative solution to persistent water stress and is based on the engagement of the local community and LRAs and their commitment to education and sustainability stewardship, which is reflected in literacy and numeracy training enabling particularly women to operate and manage household supplies via text messages.
Additionally, the DSH cooperates with not only LRAs but also engineers and social scientists responsible for the project's deployment to share and explain the technology used. Such an approach has significantly improved acceptance of the project among the local community.

<u>Community impact</u>
Benefits to local citizens include, among others:

- An alternative, relatively inexpensive freshwater supply and reduced water-gathering time;
- Reduced incidents of water-borne diseases;
- Community stability and increased livelihood opportunities;
- Increased water supply for agriculture and reforestation, and less need to sell local animals because of water scarcity.
  In addition to the fog-collection project, together with LRAs the project initiators have created several subprojects with and for the local community, including:
- *Adult literacy training – the introduction of information and communication technology (ICT) via mobile phones, personal computers,*

[14] EcoHubMap. (n.d.). Harvesting fresh water from fog in Ait Baamrane, Morocco, https://www.ecohubmap.com/green-spot/harvesting-fresh-water-from-fog-in-ait-baamrane-morocco/b2nmmtnuklmuq4trf.
[15] Reach Alliance. (2022). Water in the Desert: Dar Si Hmad's Fog-Harvesting Program, https://reachalliance.org/wp-content/uploads/2022/10/Fogquest-Morocco-CaseStudy-Final.pdf, p. 8.

tablets, and custom software designed for monolingual and low-literate Berber women to report on the fog net water system's conditions;

- *A water school, WASH (water, sanitation, and health) classes and the installation of eco-friendly toilets.*[16]

Replication potential

Establishing large fog-water harvesting structures could be done relatively inexpensively – production of each fog-harvesting unit, measuring 30 square metres of polypropylene netting, costs around USD 1,000.[17] Once installed, these nets' financial needs are minimal, as nature does the hardest job of evaporating and desalinating the water; someone simply has to regularly remove particles of sand and dirt so that the nets remain clean. Of course, someone must be responsible for water collection from the containers.

Although fog harvesting cannot be replicated in urban settlements, the project offers extensive human and environmental benefits that can be scaled and applied by local authorities to other sustainable development projects across the Mediterranean Basin and other rural arid and semi-arid regions (some fog nets have already been installed in African and South American countries[18]).

This case study shows how crucial user-centred design techniques and participatory action methods are if one wants to gain local actors' acceptance for a project. This seems of the utmost importance for remote rural communities.

[16] Ibidem.

[17] MiddleEastEye. (2016). Fog harvesting brings water to Morocco's rural communities. https://www.middleeasteye.net/news/fog-harvesting-brings-water-moroccos-rural-communities.

[18] Munich Re Foundation. (n.d.), Water - Fog nets Harvesting drinking water from fog, https://www.munichre-foundation.org/en/climate-adaptation/fognets.html.

Picture 1. Harvesting fresh water from fog in Ait Baamrane, Morocco

Source: EcoHubMap. (n.d.). Harvesting fresh water from fog in Ait Baamrane, Morocco, https://www.ecohubmap.com/green-spot/harvesting-fresh-water-from-fog-in-ait-baamrane-morocco/b2nmmtnuklmuq4trf.

Case study 2: Wastewater treatment with paddle dryers in Ambarli and innovative Membrane Bio-Reactor (MBR) in Atakoy Plant (Istanbul), Türkiye

Background

As water resources diminish and demand keeps on growing, Türkiye is challenged with a growing threat of water scarcity.[19] What is more, poor water quality and the poorly balanced distribution of water resources are leading most of the Turkish population to consume bottled water for drinking purposes.[20] Demographic growth, urbanisation, industrialisation and tourism, as well as resource mismanagement, have led to water pollution, while climate change is only intensifying this trend. There is therefore a need for a water management strategy and the strong involvement of all relevant stakeholders.[21]

To resolve the situation, Türkiye's Ministry of Environment, Urbanization and Climate Change started promoting various initiatives to tackle water scarcity,

[19] PreventionWeb. (2021). Climate shifts and rising demand leave Turkey battling growing water stress, https://www.preventionweb.net/news/climate-shifts-and-rising-demand-leave-turkey-battling-growing-water-stress.

[20] Ayranci U, Yildiz MS, Demirci A. (2022). Water consumption habits of a north-western Turkish community: a cross-sectional study. J Water Health. 2022 Sep;20(9):1457-1468. doi: 10.2166/wh.2022.164. PMID: 36170199.

[21] Maryam, B. And Buyukgungor, H. (2019). Wastewater reclamation and reuse trends in Turkey: Opportunities and challenges. Journal of Water Process Engineering , vol.30 .

including through wastewater reuse.[22] There are already results to be seen, since the target has been slightly overtaken, from the 5% initially planned for treated wastewater reuse for 2023 in the first half of the year to 5.2%.[23] The ministry has decided to increase the rate to 15% by 2030.[24]
The Istanbul Metropolitan Municipality, with its 16 million inhabitants,[25] is particularly challenged to find new water sources and resolve its pollution problems to protect the Marmara Sea from further pollution via deployment of wastewater treatment plants.[26]

Case study description

Ambarli Plant
In 2010s, in the European quarter of Istanbul-Ambarli, the local authorities and Istanbul Water and Sewerage Administration (ISKI) decided that its outdated and inefficient wastewater treatment needed modernisation (the plant had been functioning since 1991). A solution that complied with EU Directive 91/271/EEC concerning urban wastewater treatment to strengthen Turkey's implementation capacity for the EU environmental acquis had to be found quickly, as more than two million people depended on the capabilities of this wastewater treatment plant.
The biggest challenge concerned the limited area of land, because the modernised plant not only had to be up and running and treat more sewage and sludge while complying with stricter regulations of the EU Directive, but was also required not be harmful to the environment.
Wastewater treatment typically produces a waste stream of digested sludge. After dewatering, it can have a dry solids content of around 25%, perfectly suitable for further thermal treatment. In 2012, at the Ambarli plant, ISKI's private contractors installed six paddle dryers, thanks to which they managed to achieve a dry solids content of up to 95% by heating.[27] Although the investment volume for the modernisation of the entire plant amounted to EUR 118 million, the Ambarli wastewater treatment plant helped significantly in reducing pollution of the Sea of Marmara, since the dried sludge started being used for various purposes, unlike wet sludge which would most likely be discharged into the sea. From Ambarli, for example, the dried sludge goes to cement plants, where it is used as an

[22] Eight National Communication and Fifth Biennial Report, https://iklim.gov.tr/db/english/dokumanlar/eight-national--8230-1105-20230601110557.pdf.
[23] Daily Sabah. (2023). Türkiye aims to achieve 15% wastewater reuse amid global crisis, https://www.dailysabah.com/turkiye/turkiye-aims-to-achieve-15-wastewater-reuse-amid-global-crisis/news.
[24] Ibidem.
[25] City of Istanbul. (2024). Istanbul Population 2024 [Current and Historic], https://cityofistanbul.net/istanbul-population/.
[26] PWT. (2014). Waste Water Treatment Plant Ambarli / Istanbul, https://www.pwt.de/app/uploads/2019/07/WWTP_Ambarli_engl-rev_2014.pdf.
[27] Andritz. (n.d.). Sustainability that complies with stricter environmental regulations, https://www.andritz.com/separation-en/references/reference-cases/success-story-ambarli.

alternative, high-grade fuel.[28] In addition, the biogas generated through sludge digestion is used in gas turbines to generate electricity, while the resultant heat goes towards drying the sludge.[29]

Atakoy Plant

The installation of a membrane at a different plant run by the municipal water utility – ISKI – is once again the result of collaboration between local authorities and the private sector. The works began in 2016, and involved modernising the existing part of the plant and adding another water treatment process to it using a Membrane Bio-Reactor (MBR). The MBR, "uses microorganisms to degrade organic pollutants, but instead of using a bulky clarifier, it uses advanced membranes to reject suspended solids",[30] and is capable of recycling 30,000 cubic metres per day of wastewater to then be used for street cleaning and irrigation.[31]
As an indication of these numbers and the plant's importance in the context of the Istanbul metropolis, its capacity will be at least 10% of the combined 5.8 million cubic metres of wastewater treated daily by all other plants in the region.
The conventional method of wastewater treatment is to separate the sludge into solids and liquids by what is called an activated sludge model. With the MBR, another step is added with the installation of membranes with the tiniest of pores that enable a second round of filtering for the liquids. In this way, the water comes out even cleaner, and water can be reused for more purposes.

<u>Community impact</u>

- Türkiye's expanding wastewater reuse practices showcase the critical role that responsible water management plays in addressing global, national and local water challenges. Istanbul's LRA and ISKI's endeavours serve as an inspiring example of proactive environmental stewardship in the urban environment.
- Ecological-environmental goals (the significance of wastewater reuse in protecting water resources, conserving water and preventing coastal pollution, while reuse can provide additional resources, particularly in regions with low rainfall and water shortages, in industry and agriculture);
- Economic goals (financial benefits for the LRAs in the long-term, for example, due to more extensive water resources, and savings in the health sector, among others).

[28] Ibidem, pp. 2-3.
[29] PWT. (n.d.). Construction and operation of a large scale sewage treatment plant – Ambarli, Turkey, https://pwt.de/en/magazin/construction-and-operation-wwtp-ambarli/.
[30] Seven Seas Water Group. (n.d.). Membrane Bioreactor (MBR) Wastewater Treatment, https://sevenseaswater.com/membrane-bioreactor-mbr/.
[31] AquaTech. (2019). Wastewater treatment boosted in Istanbul with MBR upgrade, https://www.aquatechtrade.com/news/wastewater/fisia-italimpianti-expands-wastewater-plant.

Replication potential

High, despite high entry costs (Ambarli: EUR 118 million; Atakoy completion cost almost EUR 84 million[32]), as wastewater is the only source of water that increases as population and water use grow.[33] All cities across the region need wastewater treatment as water reuse has great potential to help overcome some of the challenges posed by the increasing pressure on already stressed water resources while reducing pollution. Water treatment is also less harmful than desalination practices. The case study also shows that modernisation of already built and functioning infrastructure should be considered by urban authorities willing to improve water resilience in their respective territories.[34]

[32] Ibidem.

[33] Mateo-Sagasta, J.; Al-Hamdi, M.; AbuZeid, K. (Eds.). 2022. Water reuse in the Middle East and North Africa: a sourcebook. Colombo, Sri Lanka: International Water Management Institute (IWMI). 292p. doi: https://doi.org/10.5337/2022.225.

[34] Case study sources:
https://www.andritz.com/resource/blob/305568/9fe21181176a5f348c9ddf4b06fc847e/se-success-story-ambarli-data.pdf
https://www.fao.org/platforms/water-scarcity/Knowledge/partners-contributions/detail/water-reuse-in-the-middle-east-and-north-africa-a-sourcebook-by-iwmi/en
https://pwt.de/en/magazin/construction-and-operation-wwtp-ambarli/
https://www.pwt.de/app/uploads/2019/07/WWTP_Ambarli_engl-rev_2014.pdf

Part 3: The role of Mediterranean cities and regions in building water resilience

Countries across the Mediterranean were heavily engaged in building water infrastructure such as dam storage and digging into groundwater resources in the past. At the same time, they imported water-demanding crops from outside the region, significantly expanding not only agricultural production but, in the long term, also water stress.[35] The situation is particularly taxing on Mediterranean cities where the Water, Sanitation, and Hygiene (WASH) sector needs are the biggest, given urbanisation rates and the fact that water is seen as a key element of sustainable and just urban transformation.[36] This further indicates the importance of building water resilience locally, through a bottom-up approach.

Obstacles to taking action

However, there are multiple challenges for cities and regions in pursuing action in this respect. The list below presents some of the key obstacles to LRAs taking action towards ensuring water resilience.

Centralisation of institutional framework. A top-down approach to water management is still dominant across the Mediterranean. Governments and national state bodies (and in particular national agencies) decide on water management, both its supply and demand.[37] To achieve societal acceptance and understanding of water resilience, national water authorities should improve the inclusion of LRAs in overall water management. Apart from Israel and Türkiye (to some extent, as depicted by the case study above), there is currently a lack of integration of LRAs in the defining of national policies and actions, their role and responsibilities, and finally in ways to better coordinate the different institutional levels and stakeholders. Clear distinction of the roles and responsibilities would contribute to improving planning and decision-making at all levels, including in the LRAs.

Insufficient (or inadequate) financial resources. Building water resilience is a resource-intensive process, requiring significant capital to finance the increasing costs of augmenting the resource, such as through wastewater treatment, distribution infrastructure, or simply increasing the WASH standards. For example, the high initial costs of construction and the maintenance costs of desalination plants are frequently an obstacle. Donors typically fund only the

[35] de Waal, Dominick (…) op.cit., p. 48.
[36] State of Green. (2020). Water as a key element in urban transformation, https://stateofgreen.com/en/news/water-as-a-key-element-in-urban-transformation/.
[37] de Waal, Dominick (…), op.cit. p. 161.

kick-off phase of water-oriented projects, as in Aarsal and Deir El Ahmar in Lebanon,[38] and access to finance is particularly challenging for small-scale projects usually led by LRAs in ARLEM countries, which are not considered sufficiently profitable by local (and international) banks. However, a growing spectrum of innovative financing instruments and partnerships is becoming available to finance water resilience projects (including the emission of green bonds, credit guarantees, crowdfunding, international climate finance, and PPPs[39]). Nevertheless, the general lack of awareness and preparedness in LRAs to establish such instruments needs to be mentioned.[40]

Rapid urbanisation. Urbanisation rates across the region are among the highest in the world (particularly in Israel, Jordan and Lebanon[41]). As the urbanisation trends progress, and uncertainty abounds regarding urban sprawl and the future structure of many cities, capital-intensive investments are often postponed. At the same time, how cities manage water will have an enormous impact on the entire water cycle, which is emphasised in reviews of progress on Sustainable Development Goal 6 (SDG 6) on clean water and sanitation.

Lack of knowledge and insufficient social capital. The level of knowledge on water-related issues is still unsatisfactory in society. For example, the results of the seventh Arab Barometer survey, which presents opinions on regional perspectives on climate change and the water and environmental challenges, highlight that citizens in the Southern and Eastern Mediterranean are concerned about what affects them most directly (insufficient freshwater resources), and not about macro-challenges (that is, the need for increased water resilience), which demonstrates a lack of understanding on how the climate crisis is affecting them now and how it will affect them and water availability and quality in the future if certain bold endeavours are not undertaken.[42]

Severe electricity rationing. As the afore-mentioned case studies on wells installed in the Aarsal and Deir El Ahmar in Lebanon point out, electricity rationing can significantly hinder the functioning of water infrastructure when

[38] The case of projects implemented in Aarsal and Deir El Ahmar in Lebanon where communities struggles with further functioning of the infrastructure developed: https://www.pseau.org/outils/ouvrages/awar_water_water_sector_governance_in_lebanon_potential_role_of_local_governments_2022.pdf.

[39] For example, "Egypt has become the first Arab country to issue sovereign green bonds to finance its sustainable development needs, with particular focus on environment friendly projects, namely, renewable energy and energy efficiency, pollution reduction and control, sustainable water and waste management", https://www.unepfi.org/wordpress/wp-content/uploads/2021/01/Sustainable-Arab-Finance-Report-Jan-2021.pdf p. 18.

[40] Organisation for Economic Co-operation and Development (OECD). (n.d.). Public-Private Partnerships in the Middle East and North Africa. A Handbook for Policy Makers, https://www.oecd.org/mena/competitiveness/PPP%20Handbook_EN_with_covers.pdf.

[41] World Bank. (n.d.) Urban population, https://data.worldbank.org/indicator/SP.URB.TOTL.IN.ZS.

[42] Arab Barometer Wave VII, https://www.arabbarometer.org/surveys/arab-barometer-wave-vii/.

energy sufficiency is not ensured and the functioning of all appliances depends on external energy sources.

Lack of technical capacity and know-how. Deployment of water-related projects depends on a high level of technical skills for planning and execution. LRAs, especially small municipalities, suffer from a lack of internal expertise in managing and implementing such investments. In this context, it is particularly important to train dedicated teams from LRAs, led by qualified engineers from national water authorities, or to join forces with the private sector. Similarly, the enforcement of regulations regarding water norms is sometimes insufficient due to a lack of support mechanisms for LRAs.

Opportunities for LRAs in strengthening water resilience

Despite these challenges, some opportunities for local actors to strengthen water resilience are evident. These include, among others:

Supply-side

Urban planning and Integrated Urban Water Management (IUWM). IUWM includes environmental, economic, social, technical and political aspects of water management. It brings together ***freshwater, wastewater, stormwater and solid waste,*** and enables better management of water quantity and quality in the urban environment, also when it comes to flood prevention. That is because the IUWM approach integrates planning for water management with other urban sectors, such as land, housing, energy and transport, so as to avoid fragmentation and duplication in policy- and decision-making.[43]

Looking for alternatives: fog and rainwater harvesting. As the Moroccan case study depicts, fog and rainwater harvesting (i.e. collecting water from roofs, cisterns and other sources, diverting runoff into ponds and reservoirs) for personal and agricultural use can be highly successful and relatively cheap for LRAs to deploy. Rainwater harvesting can also be pursued in urban environments.

Sequential water use. Sequential water use describes the process of capturing and treating water that has been used in one sector so that it can be reused for other purposes. The cleanest water is ideal to be used in households first, then in industry, and agriculture respectively. Urban wastewater can be recycled and transferred from cities to rural areas, decreasing the need for chemical fertilizers. For example, in Israel municipal wastewater has been treated and used to irrigate

[43] GWP. (2012). Integrated Urban Water Management (IUWM): Toward Diversification and Sustainability, https://www.gwp.org/globalassets/global/toolbox/publications/policy-briefs/13-integrated-urban-water-management-iuwm.-toward-diversification-and-sustainability.pdf.

nearby farms for years already.[44] Similarly, "brown water" from Tunis has been used to "irrigate citrus and olive orchards near the city, as well as golf courses, hotel gardens, and certain crops" for decades.[45]

Desalination. Despite numerous successes in this respect, extracting salt from seawater is still extremely expensive, and in most cases would need to be at least partially financed by national authorities or with private capital. A significant majority of the world's desalination capacity lies in the oil-rich Gulf states due to this technique's high up-front installation costs.[46] What is more, it can also have negative environmental consequences, especially due to using large quantities of heat.

Demand-side

Education, community involvement and conservation. LRAs can educate and encourage behavioural changes such as voluntary conservation, especially by linking such campaigns with World Water Day.[47] Participatory approaches in launching new strategies can also ensure the acceptance of new water systems, community adoption, and expansion. Training sessions for local actors can be organised on how to operate new water systems and appliances. Local community can also be useful in deciding what type of technology will work best in local conditions. In Tunisia, for example, there are numerous water associations managing drinking and irrigation water systems.[48]

Deployment of efficient WASH technologies and ensuring water distribution efficiency. As the described case studies show, better technologies (which do not have to be expensive, see subchapter on fog nets) may help reduce long-term costs and improve water distribution efficiency. Other measures for "improving distribution, such as repairing leaking systems and sewer pipes, expanding central sewage systems, metering water connections, and rationing and restricting water use, can also play important roles"[49]. For example, Jordan's construction codes

[44] Hinrichsen D. et al. (1998). Solutions for a Water-Short World, *Population Reports*, series M, no. 14 (Baltimore: Johns Hopkins University School of Public Health, Population Information Program.
[45] Gleick, The World's Water 2000-2001.
[46] Iberdrola. (n.d.). Desalination, https://www.iberdrola.com/innovation/desalination.
[47] MENA Water. (2024). World Water Day 2024, https://mena-water.com/news/world-water-day-2024/.
[48] Schmitz, Tobias and Rensen, Bas. (2020). Participation in the Implementation of the Human Right to Water in Tunisia, Utrecht Law Review, Vol. 16, No. 2, p. 85–95, 2020, Available at SSRN: https://ssrn.com/abstract=3809384.
[49] https://www.prb.org/resources/finding-the-balance-population-and-water-scarcity-in-the-middle-east-and-north-africa/.

mandate that "buildings be constructed in line with water conservation specifications".[50]

Local strategies and regulations. Urban and regional authorities are in a position to develop local and regional strategies and a regulatory framework for water resilience – concerning water efficiency or in the form of codes for new buildings when it comes to water (and energy consumption). In their local climate adaptation plans, LRAs can also focus on strategies towards reducing water-related risks and enhancing preparedness and response to disasters, that is, by investing in water-sensitive urban design, such as the Izmir Sponge City in Türkiye.[51]

[50] https://static1.squarespace.com/static/5671433fc647ad9f55531f40/t/56c474c960b5e94c66063818/1455715709953/Office-Buildings-Water-Efficiency-Guide-EN.pdf

[51] Izmir Sponge City Programme: Salata, S.; Velibeyoğlu, K.; Baba, A.; Saygın, N.; Couch, V.T.; Uzelli, T. (2022). Adapting Cities to Pluvial Flooding: The Case of Izmir (Türkiye). Sustainability 2022, 14, 16418. https://doi.org/10.3390/su142416418.

Part 4: Funding possibilities for LRAs to fund projects related to water resilience

As mentioned in previous parts of the study, access to finance for water infrastructure-oriented projects is one of the biggest barriers to LRAs ensuring water resilience at the local level. This section briefly presents such financial obstacles and explores what types of funds are available for LRAs.

Obstacles and funding gaps

The overall problems with securing the funds for water-related projects have been mentioned in brief in the section above. These obstacles can be divided into at least four different categories:

a) **Costs of most large-scale WASH-sector projects are way beyond the capacity of LRAs**
   This issue can be illustrated with the example of the above-mentioned Aarsal and Deir El Ahmar municipalities in Lebanon, where international donors funded water-oriented projects only partially, and LRAs were unable to invest in the remaining actions due to high up-front investment costs, too high for small and remote LRAs. As a result, the majority of the infrastructure installed during the pilot is not in use anymore.[52]

b) **Segmented nature of internationally funded interventions**
   Funds are often only provided for the kick-off phase of water projects, such as the feasibility study or the construction of infrastructure, but without securing funds for the project's functioning in the early stages.[53]

c) **Legal obstacles to accessing the funds of multilateral development banks**
   As the water sector in ARLEM countries is heavily centralised, it is difficult for LRAs in the region to access major loans for this purpose. This is a particularly significant obstacle where rural and semi-rural municipalities are concerned.[54]

d) **Insufficient knowledge and experience with private sector partnerships and PPPs in general**

[52] https://www.pseau.org/outils/ouvrages/awar_water_water_sector_governance_in_lebanon_potential_role_of_local_governments_2022.pdf.
[53] Ibidem.
[54] de Waal, Dominick (…), op.cit.

Last but not least, as already mentioned, according to the OECD, LRAs across the region are still inexperienced when it comes to collaboration with the private sector and accessing even more innovative forms of capital (for example through the emission of green bonds).[55]

Available financial resources

Some funds have been introduced to minimise the above-mentioned barriers for LRAs, who can thereby seek funding or at least technical assistance in developing water-oriented projects:

Neighbourhood Investment Platform (NIP)

An EU regional blending facility that addresses critical funding gaps in the EU's neighbourhood. Financed under the Neighbourhood Development and International Cooperation Instrument (NDICI) – Global Europe, it aims to boost economic development and improve living standards for citizens in neighbouring countries. The NIP mobilises additional funding to finance capital-intensive infrastructure projects that contribute to the achievement of the Sustainable Development Goals (SDGs). The facility prioritises projects with a special focus on climate, social inclusion and human development, gender equality and biodiversity. NIP provides investment grants, technical assistance, interest rate subsidies and risk capital operations.

Interreg NEXT MED Programme

The NEXT MED for the period 2021–2027 under the framework of the European Union's Cohesion Policy and its specific "Interreg" instrument allows for cooperation between EU Member States and Southern Neighbourhood partner countries.

The programme aims to contribute to smart, sustainable and fair development across both shores by supporting cooperation and multilevel governance. The programme's mission is to finance cooperation projects that address joint socio-economic, environmental and governance challenges at the Mediterranean level, such as sustainable water management and the deployment of relevant technologies, climate change adaptation, and transition to a circular and resource-efficient economy.

Interreg NEXT Italy-Tunisia Programme

The programme for the period 2021–2027 is focused on ensuring inclusive growth, sustainable development and good governance. It has a total budget of around EUR 36 million from the European Regional Development Fund (ERDF), the NDICI and national co-financing.

[55] OECD. (n.d.). op. cit.

Partnership for Research and Innovation in the Mediterranean Area (PRIMA)

PRIMA provides grants for research, innovation and academic consortia consisting of public and private actors (including local authorities) in the Euro-Mediterranean region working with:

1. Water resources availability and quality within catchments and aquifers;
2. Sustainable, integrated water management;
3. Irrigation technologies and practices;
4. Use of alternative water resources, among others.

Facility for Euro-Mediterranean Investment and Partnership (FEMIP)

This fund facilitates investment and has been addressing funding gaps in the EU's Southern Neighbourhood since its creation in 2004 by the European Investment Bank (EIB). The FEMIP objectives reflect the cooperation Agenda between the EU and its Southern Neighbours as well as the EIB's expertise. Since the adoption of the New Agenda for the Mediterranean in 2021, FEMIP's priorities have been: human development; strengthening resilience, building prosperity and seizing the digital transition; and green transition (including climate resilience, water and the environment).[56]

French Facility for Global Environment (FFEM)

The FFEM which is governed by the French Development Agency (AFD) provides financing opportunities between EUR 500,000 and EUR 3,000,000 per project for all types of actors, including LRAs from the Mediterranean region.[57] The priority is given to initiatives focused on "biodiversity, climate, international waters, land degradation – including deforestation, chemical pollutants and the stratospheric ozone layer".

Canada Fund for Local Initiatives (CFLI)

The CFLI finances ideas addressing the needs of local communities designed in a bottom-up approach. LRAs are eligible to apply when in partnership with local civil society organisations for projects averaging ca. CAD 31,000. The calls are announced once a year. The priority areas under CFLI include environmental and climate actions, particularly on adaptation and mitigation, as well as on water management.

[56] EIB. (2023). Facility for Euro-Mediterranean Investment and Partnership Trust Fund, https://www.eib.org/attachments/publications/20230044_femip_trust%20fund_en.pdf.

[57] „A maximum of 50% for NGOs, local public stakeholders, research institutions, and firms from social and solidarity based economy (which does not include mission-based firms)": https://www.ffem.fr/en/working-ffem.

EBRD Municipal and Environmental Infrastructure

Under this financial stream, the EBRD supports LRAs and the private sector in the delivery of essential urban services, notably in water and wastewater, public transport, urban roads and lighting, solid waste management, district heating and energy efficiency.

InsuResilience Solutions Fund

The fund offers grants co-funding of up to EUR 2.5 million to consortia consisting of public and/ or private organisations, including LRAs from the Mediterranean region. The co-funding is available for projects focusing on the development and implementation of climate risk insurance coverage and adaptation to climate change.

Part 5: Conclusions and recommendations

The challenge of building water resilience in ARLEM countries is aggravated by the region's ongoing population pressures and water mismanagement, as well as the climate crisis. Above all, tapping new sources of freshwater to meet the elevated needs would tackle the issue of making up for at least some of the region's shortages.

Regional cooperation and political, legal, and institutional support are critical for enabling ARLEM countries to address their freshwater shortages. Sound government policies regarding water allocation, distribution and use could enable them to adopt better practices in managing their scarce freshwater resources and coming up with alternative sources, without harming the already vulnerable environment. Conservation is important in balancing the region's freshwater shortages and increased demand.

Despite numerous benefits, ensuring increased water resilience faces various challenges. The major obstacles faced by LRAs include:

- Rapid urbanisation and uncertainty concerning urban sprawl (relevant for urban areas);
- Centralisation, the legal environment and regulatory barriers;
- Lack of financial resources and high entry barriers for water-related projects and integrated urban planning;
- Energy rationing;
- Social capital and (lack of) collective action (for example lack of knowledge and understanding);
- Lack of technical capacity and know-how.

  The section below provides some recommendations that could be helpful for Southern Mediterranean LRAs willing to build water resilience.

Recommendations

This section outlines some general recommendations, as well as those tailored to Mediterranean cities and regions, on building water resilience.

<u>General recommendations</u>

- Water sectors across the ARLEM region need a new vision based on inclusivity, in terms of both institutional setup and universal access to WASH for all citizens.
- All public institutions – including local authorities – that are eager to contribute to water management at local, regional and national levels should be encouraged and supported to do so. A clear division of competencies needs to be in place, meaning that there need to be local

water and sewage administrations (as in the case of Istanbul, where innovative wastewater treatment plans are administered by ISKI).

- Climate change vulnerability or risk assessments need to be carried out, along with related adaptation planning exercises for water and WASH at different scales within a country/region. This could provide the climate science basis and the rationale for prioritisation of WASH in climate-related investment plans (as they are typically extremely capital-intensive), and introduce water and WASH in overall development policies and strategies at all levels.
- However, an imperative for any meaningful actions by LRAs towards WASH provision at the local level is a major capacity development programme by all national governments across the ARLEM region (perhaps except for Türkiye and Israel), for all local authorities to boost their institutional, financial, and human resources capacities.

<u>LRA-specific recommendations</u>

- Addressing water supply via a variety of measures. This can be done through: urban planning and IUWM; installation of wastewater treatment plants (for larger cities, closer to the places where drinking water is used); mobilisation of non-conventional water resources and small-scale investments in alternative sources such as rainwater harvesting appliances (or fog, in the case of remote mountainous communities such as the Ait Baamrane region, Morocco); or sequential water use.
- Addressing water demand via: education, community involvement and conservation; deployment of efficient and innovative WASH technologies and ensuring water distribution efficiency, especially in public buildings; and developing and implementing local and regional strategies and a regulatory framework for water resilience.
- Advocating in the community of donors and multilateral banks to make them less restrictive in terms of supporting LRAs in long-term involvement in water service provision at the local level.
- Collaboration with local NGOs and scientists (as in the Moroccan case) and the private sector (as with ISKI) and exploring innovative financing schemes, such as the emission of green bonds, that can help secure funds for projects aimed at green and blue urban infrastructure.
- Taking part in cross-border projects on water. The new Interreg NEXT MED Programme allows numerous LRAs from around the region to take part in endeavours aimed at raising awareness of water issues, including those affecting neighbouring local communities and municipalities. Similarly, local authorities should participate in training sessions tackling water issues, for example on the “toolbox of instruments, methods and approaches that integrate early warning and anticipatory action to manage

and mitigate water-induced conflict risk" as organised in early 2024 in Amman, with their equivalents from other countries from the region.[58]

[58] WPS. (2024). Reflections on the WPS MENA Training in Amman, Jordan, https://waterpeacesecurity.org/info/blog-03-19-2021-reflections-on-the-WPS-MENA-Training-in-Amman-Jordan.

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