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Information Note

Water Use Efficiency and Water Productivity within Sustainability Boundaries for Resilient Transformation of Agrifood Systems in NENA.

Executive Summary

Water is a foundational component of agrifood systems, yet it is the number one limiting factor for agriculture in the NENA region. With the recent years of drought and increased climate vagaries, most countries of the NENA region are reaching their limits for sustainable water use. To guard against a deepening crisis, better strategic actions are required towards increasing water efficiency and productivity to enhance the resilience of rural communities.

This necessitates rethinking water use by incorporating climate-proof interventions and setting water efficiency and water productivity limits to sustainability boundaries. This is in order to avoid negative impacts on the environment, society, and the economy while also ensuring that water resources are managed within the capacity of the ecosystem.

To deliver on this imperative, concerted efforts are required to coordinate national and regional measures towards aligning water, energy and food strategies to address current challenges and overcome future systemic risks caused by water, food and energy insecurity in the region. These imperatives were highlighted at the First Joint Meeting of Arab Ministers of Agriculture and Water in Cairo, 2019. These statements are also framed in the ministerial Cairo Declaration, which reaffirms the critical role of incentive mechanisms for sustainable land and water management practices in achieving the sustainable development agenda (SDGs).

Building on FAO ongoing efforts under the Regional Water Scarcity Initiative (WSI), this information note aims to offer a roadmap for sustainable water use for food security while proposing subject areas for discussions during ***FAO Regional Technical Dialogue (RTD) on Water Scarcity***. The paper explores the interactions between water use efficiency and productivity approaches with land and water sustainability and promotes transition pathways for sustainable water use in agriculture, by breaking down the available courses of action required to accelerate Agrifood systems transformation, using four related response areas:

1. Advancing water and agriculture sustainability by investing in improved water efficiency and productivity tools to meet sustainable boundaries of water use, towards a more resilient economy.
2. Facilitating the transformation of legal and institutional frameworks by promoting multi-disciplinary and cross-sectoral governance and by strengthening policy coherence.
3. Fostering a solid & standardized knowledge base for adaptive decision-making.
4. Managing sustainability within uncertainty by maintaining a climate-smart transformation.

I. Background

1. For the countries and populations of the NENA region, chronic water shortages and scarcity have always been a fact of life; it is a serious constraint to their potential for economic growth and rural development. Today, this situation is becoming increasingly acute for many of these communities, as they face more extreme climate fluctuations and continued population growth.

2. With 6 % of the global population and only 0.6 % of the world's accessible renewable water, NENA is the driest and most water-scarce region of the world (NERC 2020; FAO 2022)[1]. With fast population growth, freshwater availability per capita declined in NENA by 78 % between 1962 and 2018 (FAO,2022)[2]. Currently, the per capita freshwater availability in NENA is around one-tenth of the global average (Ward, 2016)[3] but the rates are expected to decline further by 2050 as the population continues to grow.

3. Desalinised water and wastewater reuse represent a very low share of the supply except in some high-income gulf countries such as Qatar, Bahrain and Kuwait as illustrated in (Figure 1). In fact, most of the water demand is covered by renewable water resources (surface water or groundwater).

4. Over-abstraction of groundwater is leading to widespread depletion, quality deterioration and saline intrusion (NERC 2020; FAO, 2022[1]). Recovering control over groundwater once it has been lost or polluted is very hard. The lack of rules and control over these invisible resources combined with the free-rider strategy is behind the fast rate of degradation observed across the region.

5. Agriculture negatively affects the environment, changing water availability downstream and discharges to the sea or lakes, reducing environmental flows and harming the downstream aquatic ecosystem, landscapes and riverine ecology. The chemicals used for production when mismanaged add pollution to the harm done. The Water stress levels calculated considering the need for environmental flow show that the region is already in a critical situation (Figure 2).

6. The lack of good governance of water resources is one of the major causes of the over-allocation as freshwater management falls under multiple mandates, hence across many government agencies, impeding coordinated and integrated policies. This is more complex with international basins. About 60% of surface water is transboundary, but there are no legal and functional agreements on sharing the water (FAO, 2019b cited in FAO, 2022)[4].

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[1] NERC.2022 Ensuring environmental sustainability in the context of water scarcity and climate change-fao-NERC/20/6.Oman. https://www.fao.org/3/nc215e/nc215e.pdf.
[2] FAO. 2022. The State of Land and Water Resources for Food and Agriculture in the Near East and North Africa region – Synthesis report. Cairo. https://doi.org/10.4060/cc0265en
[3] Ward, C. 2016. regional strategic review paper for NENA.

[4] FAO. 2019b. Land and water governance to achieve the SDGs in fragile systems. Background paper prepared for the plenary session on land and water governance. Cairo, 3 April 2019. www.fao.org/3/ca5172en/CA5172EN.pdf.

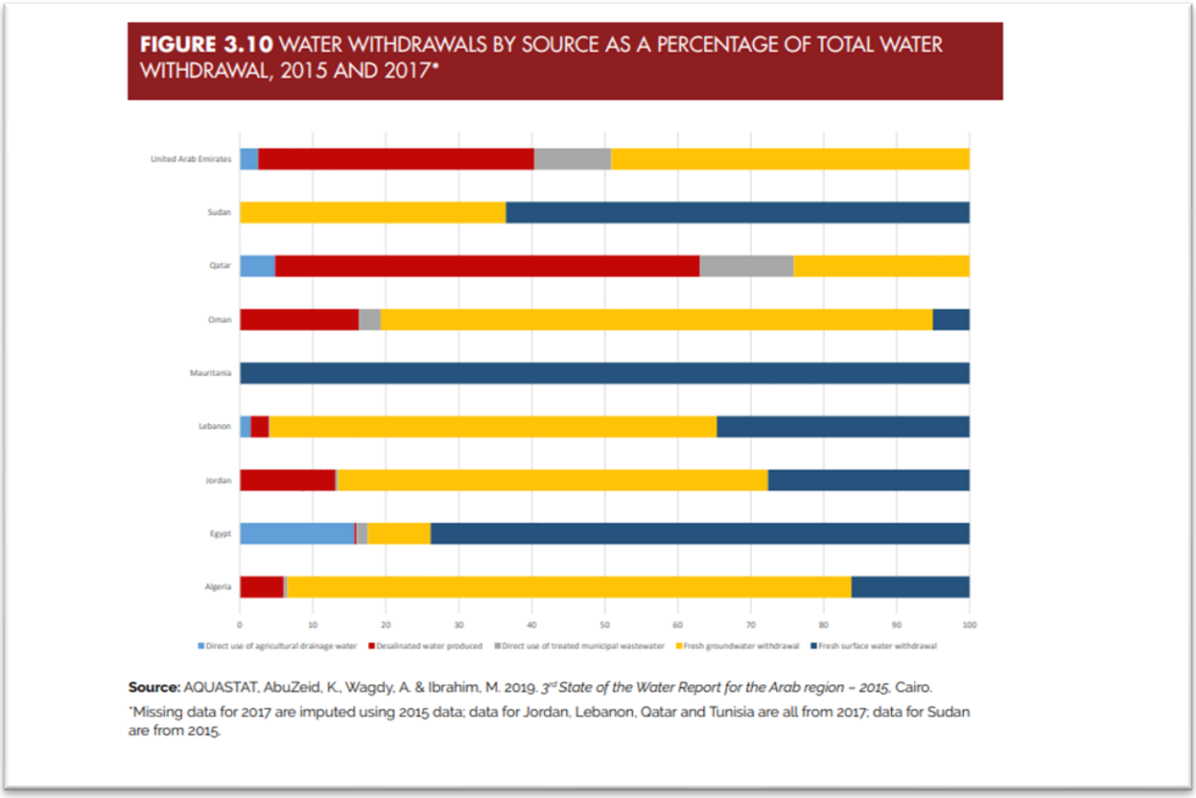

Figure 1: Water Withdrawals per Source per Total Water Withdrawal in NENA, 2015 and 2017 (FAO, 2022)[2]

7. Past policies and investments in water development have often been directed to increase irrigation for improved food production. This resulted in many cases of over-allocated surface water to agriculture. The government response through modernized irrigation by shifting large areas from surface to localized irrigation did not result in reduced water demand (and evapotranspiration) but often in an extension of irrigation areas and a shift to groundwater pumping particularly when surface water access was restricted (quotas, reduced allocation).

8. The region needs to prepare fast for a changed environment as its agriculture sector is highly dependent on water supply. In many countries in the NENA region, there are gaps between actual and attainable yields for many of the current crops cultivated in the region. Closing these gaps requires combining the skills of engineers, sociologists, economists, agronomists and governance specialists.

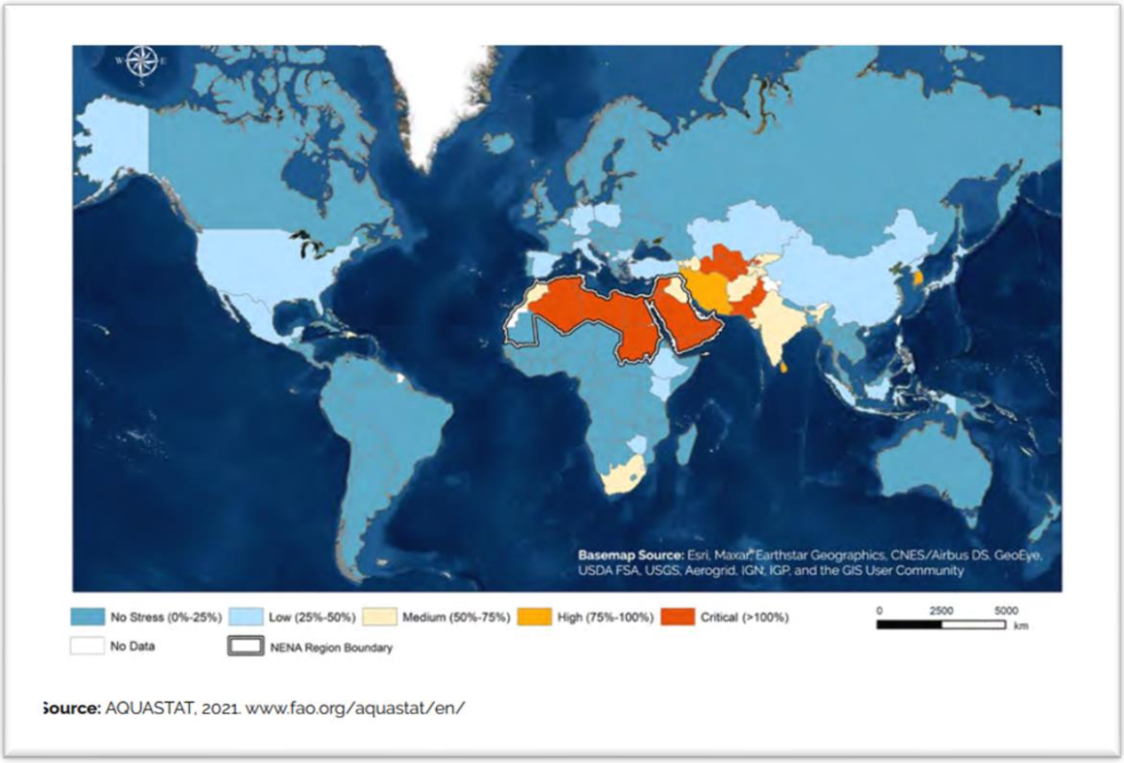

Figure 2: Water Stress Level – SDG 6.4.2 (Latest reporting year) (FAO, 2022)[2]

9. In this context, this information note aims to offer a roadmap for sustainable water use for food security and propose subject areas for discussions during ***FAO Regional Technical Dialogue (RTD) on Water Scarcity***. The paper builds on more than 10 years of work for FAO's ***Regional Water Scarcity Initiative*** (WSI), facilitated by its multi-stakeholders partnership as well as its recently concluded "***Water Efficiency, Productivity and Sustainability in the NENA Region Project***" (WEPS-NENA). The paper explores the interactions between water use efficiency and productivity approaches with land and water sustainability and promotes transition pathways for sustainable water use in agriculture by breaking down the available courses of action required to accelerate Agrifood systems transformation, using four related response areas:

   1. Advancing water and agriculture sustainability by investing in improved water efficiency and productivity tools to meet sustainable boundaries of water use towards a more resilient economy.
   2. Facilitating the transformation of legal and institutional frameworks by promoting multi-disciplinary and cross-sectoral governance and by strengthening policy coherence.
   3. Fostering a solid & standardized knowledge base for adaptive decision-making.
   4. Managing sustainability within uncertainty by maintaining a climate-smart transformation.

II. Promoting Transition Pathways for Sustainable Water Use in Agriculture

10. Water is a foundational component of agrifood systems, yet it is the number one limiting factor for agriculture in the NENA region. This necessitates rethinking water use by incorporating climate-proof interventions and setting water efficiency and water

productivity limits to sustainability boundaries in order to avoid negative impacts on the environment, society, and the economy while ensuring that water resources are managed within the capacity of the ecosystem.

11. Transition pathways are proposed thereafter to frame policy action for sustainable water use (Figure 3). These pathways offer the Near East and North Africa Region approaches to guide sustainable water management within sustainable boundaries. The building blocks of these pathways include:

- **Water Accounting** gives a clear picture of the current situation, and of the evolution of water resources and its uses over time to help set sustainable actions and limits for water consumption.
- **Water Governance** analysis highlights the hidden causes of water scarcity and reveals hidden or informal users that need to be considered in water allocation systems.
- **Water Productivity** performance monitoring encourages optimal water use for food production, and along the value chain, where all actors will benefit from more income per drop.
- **Farmer-led =Experimentation** and demonstration, for example: in Farmers Field Schools (FFSs); good agricultural practices showing improved water productivity in real-world situations; and Farmers Business Schools (FBS) that equip them to add value to each drop of water and understand the benefits of careful water management.
- **Cross-Sectoral Dialogues on the Water-Energy-Food Nexus** inform holistic national water policies.

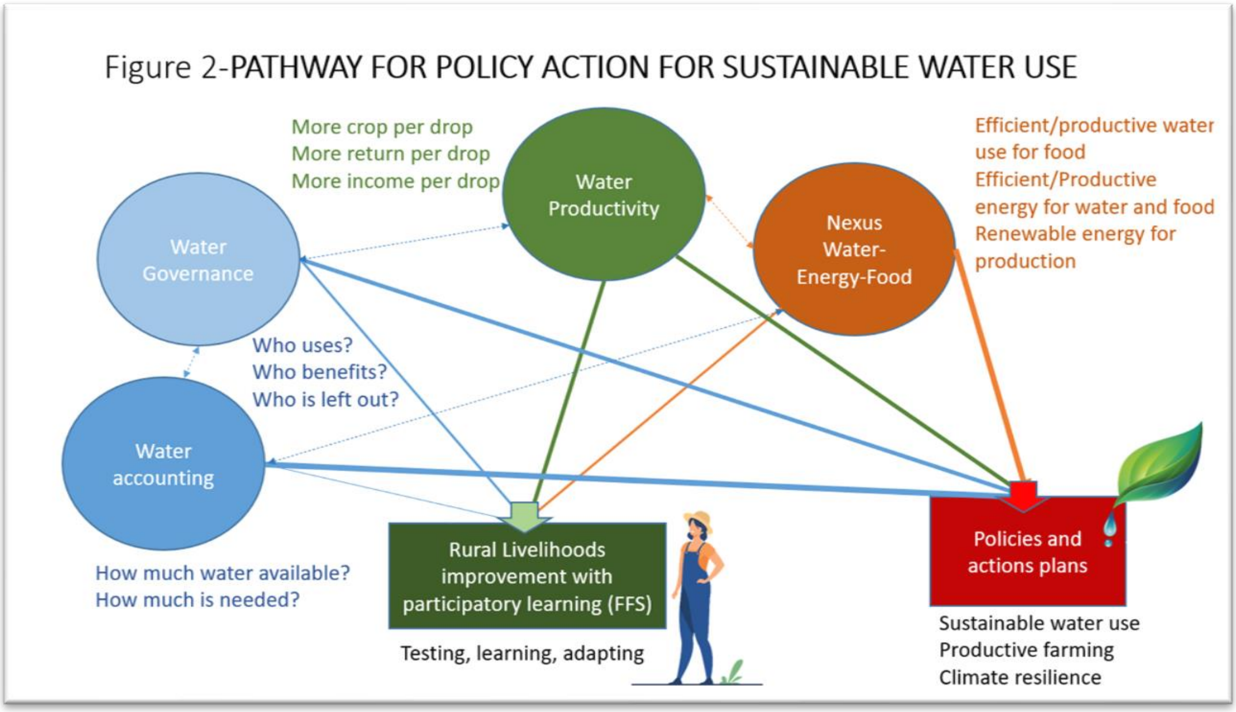

Figure 3: Pathways for Policy Action for Sustainable Water Use –. (FAO- Forthcoming[5])

[5] FAO, Forthcoming, Water efficiency, productivity and sustainability in the NENA regions: The WEPS-NENA project; Transformative thinking and action to improve water for food in the Near East and North Africa, Cairo.

12. In the framework of the WEPS-NENA project, the above transition pathways were piloted in 8 countries of the NENA region (Algeria, Egypt, Iran, Jordan, Lebanon, Morocco, Palestine, and Tunisia). When applied at scale in national systems, these approaches combine to give planners accurate forecasting information, cropping and natural resource maps, and related datasets that support evidence-based decisions that will improve water use over the long term.

13. All these approaches also call for a multiscale territorial approach that addresses the various levels of the local irrigation scheme, watershed, river basin and subnational administrative landscapes, while also applying at country level and across groups of countries.

14. To accelerate the required transformation using these pathways, FAO Regional Water Scarcity Initiative (WSI) is proposing courses of action using four related response areas, these areas are further elaborated under the following sections:

III. Advancing Water and Agriculture Sustainability by Investing in Improved Water Efficiency and Productivity Tools to Meet Sustainable Boundaries towards a More Resilient Economy

A. Scope for Improving Water Use Efficiency

15. Indicator SDG 6.4.2 of SDG 6 measures change in water-use efficiency over time for all the economic sectors and is considered an economic indicator that aims to monitor the dependency of the economy on water. The NENA region has been showing low results for this water use efficiency indicator for most countries, except for some Gulf countries that are more industrial and service-oriented (FAO, 2022)[2]. Reallocation across sectors is still possible, however, if agricultural water efficiency and productivity are improved. Jordan for example, has achieved the necessary shift through robust national policies that prioritise water allocation and cap water allocation to agriculture based on performance. It also made positive improvements in water use efficiency by primarily allocating treated wastewater for the expansion of irrigated agriculture.

16. No one can argue that investing in water efficiency and water productivity brings substantial benefits. Yet, improvement in the context of growing scarcity calls for a careful selection of options favouring water-smart technologies and approaches with long-term sustainability criteria.

17. There is a large scope of improvement possible in the different farming systems with a spectrum of options such as i) improved farming and grazing practices, ii) the adoption of technologies and practices that increase water efficiency (reduced transport and local use losses) and water productivity (more crop per drop), iii) reduce water application with water-efficient appliances, iv) manage soil moisture, and v) ensure water recycling in sequence between users or within a productive system.

B. Improved Farming Practices for Enhanced Water Productivity

18. In water scarcity situations, the focus should become on obtaining the most per unit of water used, leading to the water productivity (WP) concept, a measure of the efficiency of water use. Normally, WP is defined as the ratio of production to the water consumed, but production is only one measure of the output obtained when using water in agriculture. It would be important to assess all the benefits that an additional unit of water could bring to society in the NENA Region. Defining WP at different scales and

with different perspectives is therefore critical to assess the value of water in agriculture for the NENA Region.

19. The regional WEPS-NENA project has made an initial attempt to do so and created a baseline of the existing knowledge on water productivity for eight countries of the NENA region. It built its strategy on the need to focus on the WP gap that is the difference between the actual WP and the maximum potential WP which can be achieved. This assessment led to the identification of various opportunities for WP enhancement and achieving more efficient use of water in agriculture.

20. Understanding the behaviour of the major agricultural systems is essential in identifying avenues for WP improvement, therefore the WP work in WEPS-NENA project started by benchmarking the existing WP in NENA through the development of a novel methodology to determine a WP baseline. Detailed farmers' surveys were conducted to characterize the existing agricultural practices related to WP and to identify good agricultural practices. To assess the WP gap, it was deemed necessary to determine potential or maximum yield, which was achieved through the use of Aqua Crop, a crop simulation model developed by FAO. The baseline and local assessments covered a range of crops but show overall a wide variability for the same crop in the same location. This point is further illustrated in (Figure 4) below showing an example on wheat, a strategic crop for food security.

21. The results of the regional and national assessments produced by the WEPS-NENA project (Figure 4) reveal that there are still substantial WP gaps in most crops and NENA countries. Much of these gaps are attributed to yields being much lower than potential yields, leaving significant room for improvement through plant breeding, agronomic measures and better farming practices. Improved irrigation management can also play a role in improving productivity. Land levelling and raised beds can do a lot in reducing water usage.

Figure 4a.Actual and simulated potential biophysical WP of consumed water as ET for wheat. (UCO 2022)

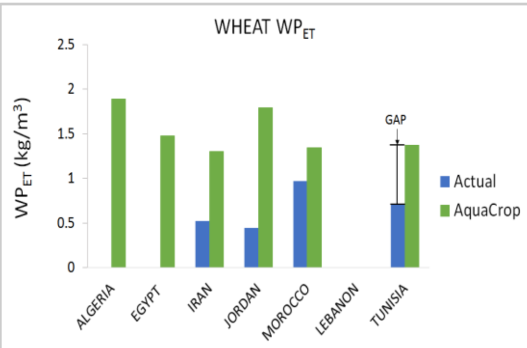

Figure 4b.Actual and simulated potential biophysical WP of applied irrigation water for wheat. (UCO 2022)

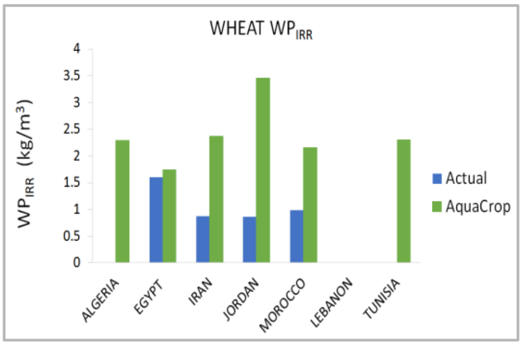

Figure 4 shows some values that compare the actual averages (blue bars) obtained from the publications and the simulated maximum or potential productions (green bars), in this case, the potential WP, obtained using the AquaCrop model. When considering WP calculated on the basis of evapotranspiration (WP ET), significant WP gaps have been detected for Iran, Jordan and Tunisia while Morocco has a smaller one. In terms of the actual values of WP of irrigation water, (WPIRR) Figure 9b shows that there is still a gap when comparing with AquaCrop maximum values, except in the case of Egypt, where wheat is fully irrigated. In fact, Egypt's wheat crop is very productive, and this is reflected in achieving actual WPIRR values close to the theoretical potential.

C. Role of Non-Conventional Water Resources in Transforming Agricultural Water Management and Planning Paradigm

22. With decreasing freshwater resources, water managers need to rethink the water supply and integrate the management of green water, grey water and other non-conventional resources in their plan. FAO State of Land and Water Report in the NENA Region (SOLAW) 2022, stresses the need for a transformational shift in the agricultural water planning and management paradigm. This shift involves the inclusion of resilience principles in the sector, which requires an understanding of the agricultural and water system's capacity to adapt and transform over time and in the face of stress conditions.

23. Desalinated water represents a growing share of drinking water supplies particularly in the Gulf countries and increasing all around the Mediterranean. However, its use for agriculture remains marginal in the NENA region.

24. Desalination Technology is also evolving offering a broader range of options to countries particularly for isolated sites with abundant brackish water and scarce freshwater as is the case in Gaza, Palestine.

25. Land degradation and desertification processes in NENA are significantly influenced by the salinization of soils. Rehabilitation of desert systems necessitates the adoption of multiple strategies, such as the rehabilitation of degraded natural ecosystems and the use of limited water resources in agriculture production, afforestation, and aquaculture systems in certain conditions. Biosaline agriculture represents an excellent opportunity to combat salinity in marginal agricultural systems, especially when combined with Nexus approaches for the Water, Food, and Energy.

26. For water supply augmentation, drainage water and wastewater can represent a significant opportunity. Today 55 percent of the wastewater is discharged untreated into the water bodies and less than 10% is reused.

27. Egypt shows that drainage water can be reused multiple times within a basin: it is reused 7 times along the Nile before being finally discharged. Recycling and reuse are key options for agriculture requested to free water for other uses. Jordan has already institutionalized and operationalized the wastewater reuse for agriculture ensuring that all water discharged is collected and directed to storages that are then brought to the main carrier canal where treated water is mixed with freshwater to limit the risk of increased salinity. In Maghreb, the Union of Maghreb countries (UMA) has signed a joint declaration on the need to expand the reuse of wastewater for agriculture, greenspaces, and groundwater recharge.

28. In light of the above, during the second Joint Water-Agriculture Ministerial meeting held at the League of Arab States in January 2022, Ministers of Water Resources and Ministers of Agriculture decided a set of resolutions on different topics, inter alia, the use of non-conventional water resources for agriculture. The meeting emphasized the importance of the use of non-conventional water resources to reduce the over-exploitation of freshwater in agriculture (surface water and groundwater): agriculture being the highest consumer of freshwater in the region.

29. Since 2019, FAO and ESCWA have been supporting the Joint Technical Secretariat (composed of the Technical Secretariat of the Arab Water Ministerial Council and the Arab Organization for Agricultural Development) in the implementation of the Joint

Water-Agriculture Ministerial Council resolutions to accelerate the required transformation on the use of non-conventional water resources in agriculture.

30. Consequently, FAO supported the Joint Technical Secretariat in the implementation of the recommendations of the HLJTC through its leadership in the following activities:

- Supporting interested countries in designing and implementing sanitation safety plans at a pilot scale according to WHO Guidelines.
- The development of a technical paper on the safe use of sludge resulting from treated wastewater for agriculture in the Near East and North Africa region.
- The development of a technical paper on the status, treatment methods, and use of brackish water in the Arab region.
- Elaboration of a paper on the status, challenges, and prospects of desalination in the Arab region.
- Elaboration a paper on the status, treatment methods, and use of brackish water in the Arab region.
- Contributing to and Translating into Arabic a sourcebook on treated wastewater reuse in the MENA region, prepared in collaboration with IWMI and CEDARE.

IV.Facilitating the Transformation of Legal and Institutional Frameworks by Promoting Multi-disciplinary and Cross-Sectoral Governance and by Strengthening Policy Coherence.

31. Transforming food systems in the NENA region requires a collaborative, interdisciplinary, and integrated approach that considers the complex interplay of factors affecting food security, sustainability, and resilience. By bringing together experts from various fields and aligning policies across sectors, the region can work towards creating a more resilient, equitable, and sustainable food future. This is what has been established starting with water and agriculture gathering the ministries in charge of water, irrigation, and agriculture in a conference in 2019. The conference concluded with the need for a joint action plan and the setting of a regional level meeting annually under the auspices of the League of Arab states and with the facilitation of ESCWA and FAO. This committee informs meetings of two regional ministerial councils (the Arab Ministerial Water Council and the General Assembly of the Arab Organization for Agricultural Development (AOAD), comprising Ministers of Agriculture).

32. Water allocation has been the first topic of attention of the high-level technical committee. Indeed, managing the demand for agricultural water in anticipation of reallocating it to higher economic productive uses like domestic and industrial purposes requires a multifaceted approach that takes into account various factors, stakeholders, and strategies. This is the approach proposed in the 'Guidelines for Sustainable Allocation of Water for Agriculture' developed through support from FAO and ESCWA adopted by the country of the League of Arab States in 2021. These guidelines propose to get the process to move across four factors as illustrated in (Figure 5).

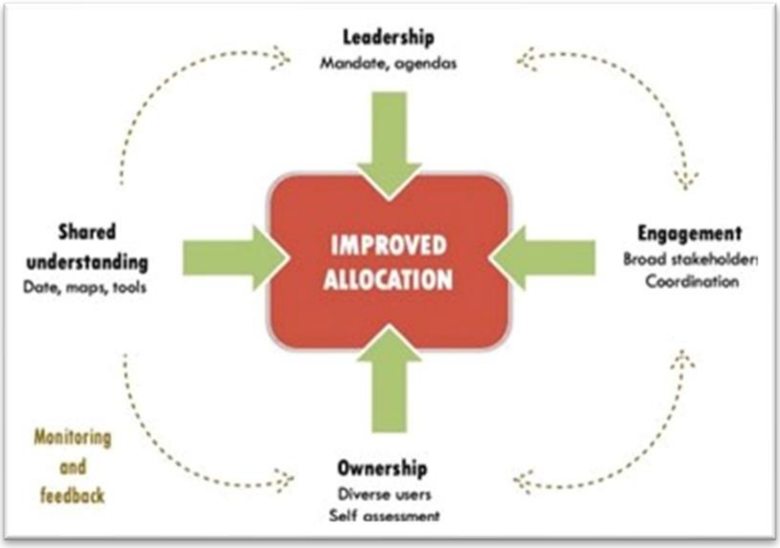

Figure 5 – Four Building Blocks of the Guidelines for Sustainable Allocation of Water for Agriculture

33. The guidelines are currently being tested in Tunisia, Egypt, Jordan, and Palestine using pilot sites. As illustrated above, the NENA region is already well endowed with technologies and approaches with convincing examples. However, many of the interventions stay at a pilot scale and are not considered in broader strategies with the exception of localized irrigation that received significant support in many countries of the region. In many cases, the institutional and human dimensions of the proposed transformation have been underestimated.

V. Fostering a Solid & Standardized Knowledge Base for Adaptive Decision Making.

34. In the last 20 years, a lot of emphasis has been put on irrigated agriculture, namely on increasing irrigation efficiencies and productivity with success in many countries. However, this was done without establishing a process to verify the effects of combined interventions on water resources. Evidence is now available that shows that those investments often result in increased water use rather than real water savings.

35. As improving water use efficiency or productivity remain key for sustainable water use, they need to be incorporated within sustainable limits. Modernizing irrigation requires first a good understanding of the actual state and after-use of the water supplied for irrigation.

36. In this respect, the use of remote sensing techniques can be useful to determine hotspots of water stress and low performance (low water productivity, salinization) and bright spots (healthy ecosystems and water-productive fields). Spatial and temporal monitoring of a set of key water metrics and indicators will support both short-term decision-making and strategic investments ensuring more sustainable and efficient use of natural resources.

37. A significant effort is also necessary to provide capacity development on key tools and approaches, investment, and governance to support the change process and allow for increased adaptability.

38. A regional evidence base on integrated assessment of water scarcity is needed to drive continual improvement of sustainable water allocation for food systems and sustainable livelihoods, based on approaches standardized and tested. Results and knowledge can be shared on an open platform that also presents water scarcity metrics and monitoring, for example using the Regional Water Scarcity Initiative and the FAO-led Interregional Technical Platform on Water Scarcity (IRTP-WS) to enhance knowledge sharing across the world. Such systems and data platforms also need to be matched by country systems using the same standards and metrics to enable joint analysis and comparison for knowledge sharing.

39. On the other hand, water consumption that leads to evaporation losses (ET) needs to be known to avoid over-allocation. The regional network on ET developed under the Regional Water Scarcity Initiative and the International Center for Agricultural Research in the Dry Areas (ICARDA) with six WEPS-NENA country teams to pilot the approach could be expanded to all countries. This regional network allows the comparison of data with other ET measurement instruments and satellite remote sensing for spatial analysis technology and could become a standard instrument for crop ET in the region.

VI. Managing Sustainability within Uncertainty – Ensuring a Climate Smart Transformation.

40. This region is being negatively affected by climate change at a faster and more extreme rate than other parts of the world. To effectively target their investments, interventions and strategies for mitigation and disaster reduction, countries need to better understand where their climate change hotspots are. On-site and off-site water harvesting and climate-smart agriculture options should be proposed only where feasible, even in extreme climate change scenarios.

41. Climate impacts affect the hydrology and temperature and already result in increased water demand with adaptive measures –supplementary irrigation, evaporation from new storages, etc- but also threaten the water and irrigation infrastructure with extreme events and temperature.

42. The extreme heat and drought of 2022 – 2023 stressed upon in the media[6] leave no doubt on the need for enhanced preparedness and climate resilience for the NENA countries. Three watershed-level vulnerability exercises realized by ESCWA for the WEPS-NENA project in Lebanon and Algeria show the urgency of coping strategies informed by an integrated assessment of long-term scenarios for climate change and sustainability (ESCWA, 2022)[7] and their implications for the hydrology and farming systems. Figure

[6] https://www.theguardian.com/environment/2023/apr/20/frightening-record-busting-heat-and-drought-hit-europe-in-2022; https://english.alarabiya.net/News/middle-east/2023/04/29/How-is-the-Middle-East-and-North-Africa-affected-by-climate-change-

[7] ESCWA, 2022 -Commission économique et sociale des Nations Unies pour l'Asie occidentale (ESCWA), Centre arabe d'études des zones arides et des terres arides (ACSAD), Ministère des Ressources en Eau et de la Sécurité Hydrique en Algérie, Organisation pour l'alimentation el l'agriculture (FAO). 2022. Directives de gestion des bassins versants et de leur résilience à l'épreuve du climat : Bassin Versant Algérois, RICCAR Technical Report, Beirut, E/ESCWA/CL1.CCS/2022/RICCAR/TechnicalReport.13. 150 pp.

6 illustrates hotspots of vulnerability for the Algerois basin in Algeria which risks affecting 86% of the total population. 58% of the area shows a low capacity for adaptation mainly in the rural areas of the mountainous areas in the south.

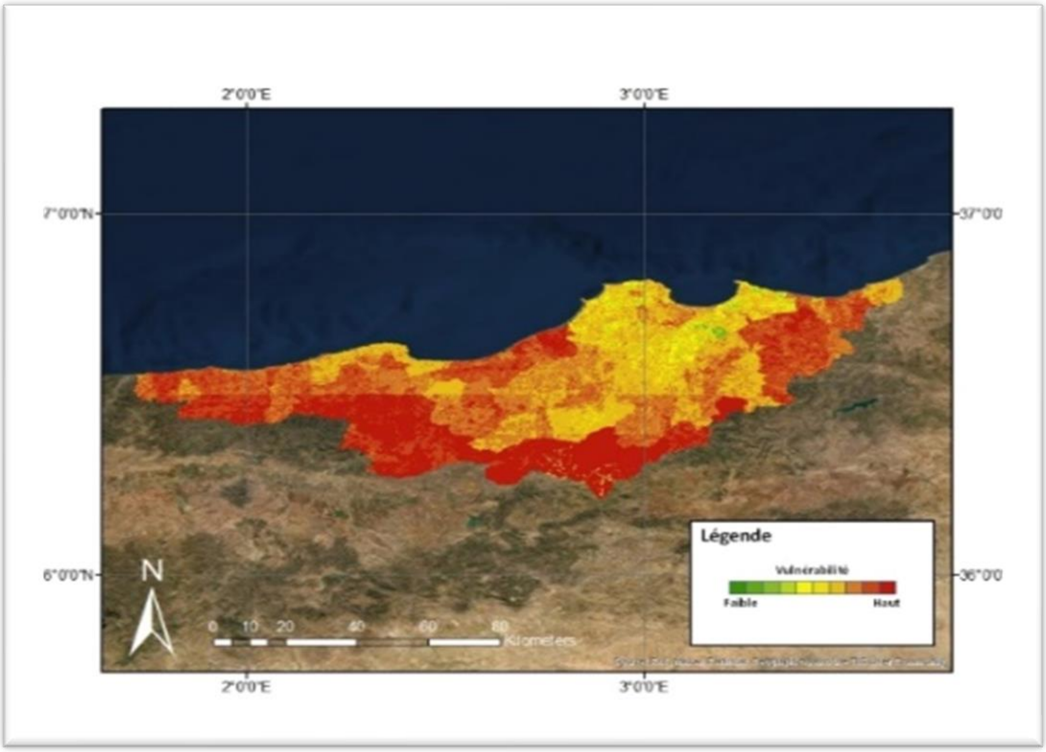

Figure 6 a Vulnerability Composite Indicator of the Mid-term Period (2041-2060) for the Algeroi, Algeria[8]

43. The example shared above shows the urgency to prepare the rural areas for change by transforming and reengineering the farming systems. The spectrum of options available to managers and decision-makers is a lot wider but should include water-smart technologies and approaches but considering specifically climate-smart ones.

D. Tailoring Water-Smart Technologies and Approaches to Support Increased Resilience

44. Water smart technologies are innovative solutions that leverage technology to efficiently manage and conserve water resources. In the context of the Near East and North Africa (NENA) region, these technologies play a crucial role in sustainable water management. The following examples showcase the diverse range of water-smart technologies that are being implemented in the Near East and North Africa region to address water scarcity and improve water resource management. As technology continues to advance, these innovations will play an increasingly important role in ensuring sustainable water availability for the region's growing population and evolving needs:

[8] **ESCWA, ACSAD, Ministère des Ressources en Eau et de la Sécurité Hydrique en Algérie & FAO.** 2022. *Directives de gestion des bassins versants et de leur résilience à l'épreuve du climat: Bassin Versant Algérois, RICCAR Technical Report*. Beirut, ESCWA.

- **Smart Irrigation Systems**: This applies to both surface and localized systems. The FAO WAPOR[9] database enable many applications to guide water manager and water user in water application.
- **Smart Water Metering**: Smart water meters provide real-time monitoring of water usage in homes, businesses, and agriculture.
- **On-site weather measurement** controllers and the use of weather data collected on-site to calculate continuous ET measurements and water accordingly.
- **Water Leak Detection and Management Systems and Tools**
- **Data Analytics and Decision Support Systems** that apply advanced data analytics and modelling tools assist water managers in making informed decisions about water allocation, usage, and infrastructure development.
- **Rainwater Harvesting Systems**: Rainwater harvesting involves collecting and storing rainwater for various uses. Smart rainwater harvesting systems integrate sensors and automated controls to manage the collection, storage, and distribution of rainwater. These systems are particularly valuable in arid regions where rainwater events are infrequent but significant.
- **Smart Water Management Apps**: Mobile applications and software platforms can empower farmers, homeowners, and water authorities to monitor water usage, receive real-time data, and make informed decisions about water management.

E. Getting Water-Efficient Methods to Become Climate Smart

45. Along with the "smart" technologies, there is a large spectrum of water-efficient technologies and practices well known in the Near East and North Africa region that have demonstrated their benefits. If well-tailored within sustainability boundaries and reengineered to be climate smart, they will allow the region to better manage its limited water resources, mitigate water scarcity challenges, and ensure a more sustainable future for water availability and usage. Examples of these technologies include: Modernizing traditional surface irrigation methods, such as furrow or basin irrigation; Soil Moisture Management Monitoring sensors and simple probes and others.

VII. Outcomes and Recommendations

46. To conclude, achieving water use efficiency and water productivity within sustainability boundaries is crucial to address NENA water challenges while ensuring long-term ecological and socio-economic stability. It represents the main building blocks of the transition pathways required to achieve water resilience and sustainability.

47. Planning large investments with high water stress levels and an uncertain climate can no longer rely on long-term trends of the past, it requires combining long-term planning with innovative approaches for rapid adaptation based on regular updates on the status and trends of key resources such as soil supporting crops (including its capacity to store water in-situ), water (resources and uses), and key ecosystem services (buffering capacity).

48. Governments and intergovernmental entities play a vital role with development partners in advancing adequate multi-sectoral policies that encourage the adoption of not only water-smart or water-efficient technologies, but also policies that consider supply without underscoring non-water policies because water matters to all. These polices should emphasize cross-sectoral collaboration and providing incentives such as

[9] https://www.fao.org/in-action/remote-sensing-for-water-productivity/data-applications-uses/en

subsidies for efficient irrigation equipment, tax breaks, or regulatory frameworks that promote sustainable water use practices.

49. Transition pathways require spatial information systems that combine ground-truthing with modelling and remote sensing-based information, linked to expert knowledge and secondary information. This view gives policymakers and planners a clear picture of the strategic water allocation decisions and trade-offs needed.

50. Alongside technological solutions, raising awareness and providing training on water-efficient practices are also essential. By educating farmers, communities, and stakeholders about the benefits of these technologies, it becomes more likely that they will be adopted and implemented effectively. Non-Formal education through on-the-job experimentation work well with smallholder farmers as demonstrated with farmers field schools.

51. Delivering dynamic regional platforms for exchange, learning and awareness raising plays a crucial role in linking existing communities of practice on water accounting, water productivity, non-conventional water use, the water-energy-food nexus, farmer experimentation with farmer field schools, rainwater harvesting, crop water modelling (Aqua Crop), evapotranspiration (ET) measurement, gender and food systems. FAO iRTP-WS represents a practical example of successful exchange platforms that can facilitate documentation of experiences, and support the exchange of knowledge with other regions and within the region.