E

联合国粮食及农业组织 | Food and Agriculture Organization of the United Nations | Organisation des Nations Unies pour l'alimentation et l'agriculture | Продовольственная и сельскохозяйственная организация Объединенных Наций | Organización de las Naciones Unidas para la Alimentación y la Agricultura | منظمة الأغذية والزراعة للأمم المتحدة

# FAO REGIONAL CONFERENCE FOR THE NEAR EAST

**Thirty-seventh Session**

**Amman, Jordan, 5-8 February 2024 and 4-5 March 2024**

# 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 Near East and North Africa (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. This necessitates rethinking water use by incorporating climate-proof interventions and setting water efficiency and water productivity limits to sustainability boundaries.

These imperatives were highlighted at the First Joint Meeting of Arab Ministers of Agriculture and Waterin Cairo, in 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 Goals (SDGs).

Building on FAO's ongoing efforts under the Regional Water Scarcity Initiative (WSI), this Information Note offers a roadmap for sustainable water use for food security. 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, using four related response areas:

a. 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;

b. facilitating the transformation of legal and institutional frameworks by promoting multi-disciplinary and cross-sectoral governance and by strengthening policy coherence;

c. fostering a solid and standardized knowledge base for adaptive decision-making; and

d. managing sustainability within uncertainty by maintaining a climate-smart transformation.

*Queries on the content of this document may be addressed to:*

RNE NERC Secretariat

FAO-RNE-NERC@fao.org

# I. Background

1. For the countries of the Near East and North Africa (NENA) region, water scarcity has always been a serious constraint for economic growth and rural development. Today, this situation is becoming increasingly acute with more extreme climate fluctuations and continued population growth.

2. With 6 percent of the global population and only 0.6 percent 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 percent between 1962 and 2018.[2] Currently, the per capita freshwater availability in NENA is around one-tenth of the global average[3] but the rates are expected to decline further by 2050 as the population continues to grow.

3. Most of the water demand across the region is still covered by renewable water resources (surface water or groundwater). Desalinated water and wastewater reuse represent a low share of supply except in some high-income Gulf countries such as Bahrain, Kuwait and Qatar (Figure 1).

4. Over-abstraction of groundwater is leading to widespread depletion, quality deterioration and saline intrusion. The lack of rules and control over this invisible resource combined with the free-rider strategy is behind the fast rate of degradation observed across the region.

5. Water stress levels calculated considering the environmental flows indicate that the region is in a critical situation (Figure 2). Additionally, agriculture negatively affects the environment, reducing environmental flows and harming the downstream aquatic ecosystem, landscapes and riverine ecology.

6. The lack of good governance of water resources is a major cause of the over- allocation as freshwater management falls under multiple mandates. This is more complex with international basins. About 60 percent of surface water is transboundary, but there are no legal and functional agreements on sharing the water.[4]

7. The government response through modernized irrigation by shifting large areas from surface to localized irrigation did not result in reduced water demand but often resulted in the extension of irrigation areas and a shift to groundwater pumping particularly when surface water access is restricted.

8. 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.

[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. https://www.fao.org/3/ca5172en/CA5172EN.pdf

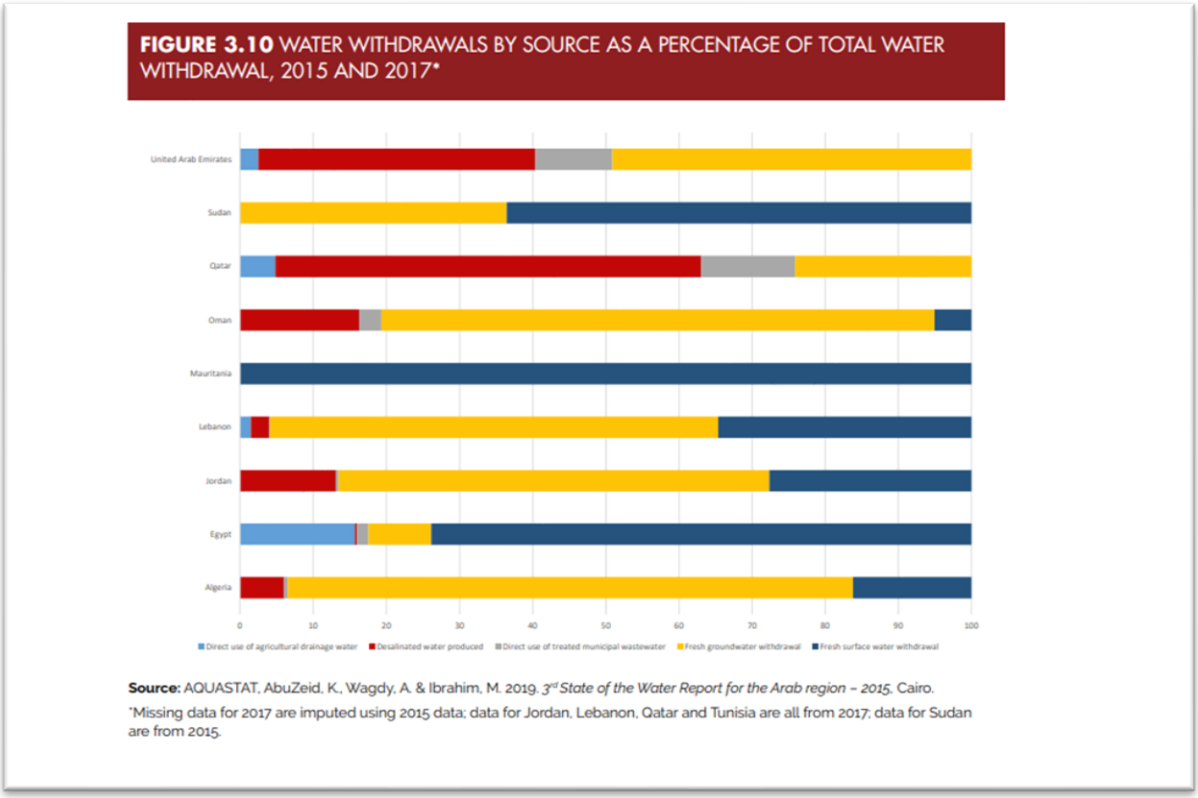


**Figure 1 – Water Withdrawals per Source per Total Water Withdrawal in NENA, 2015 and 2017**

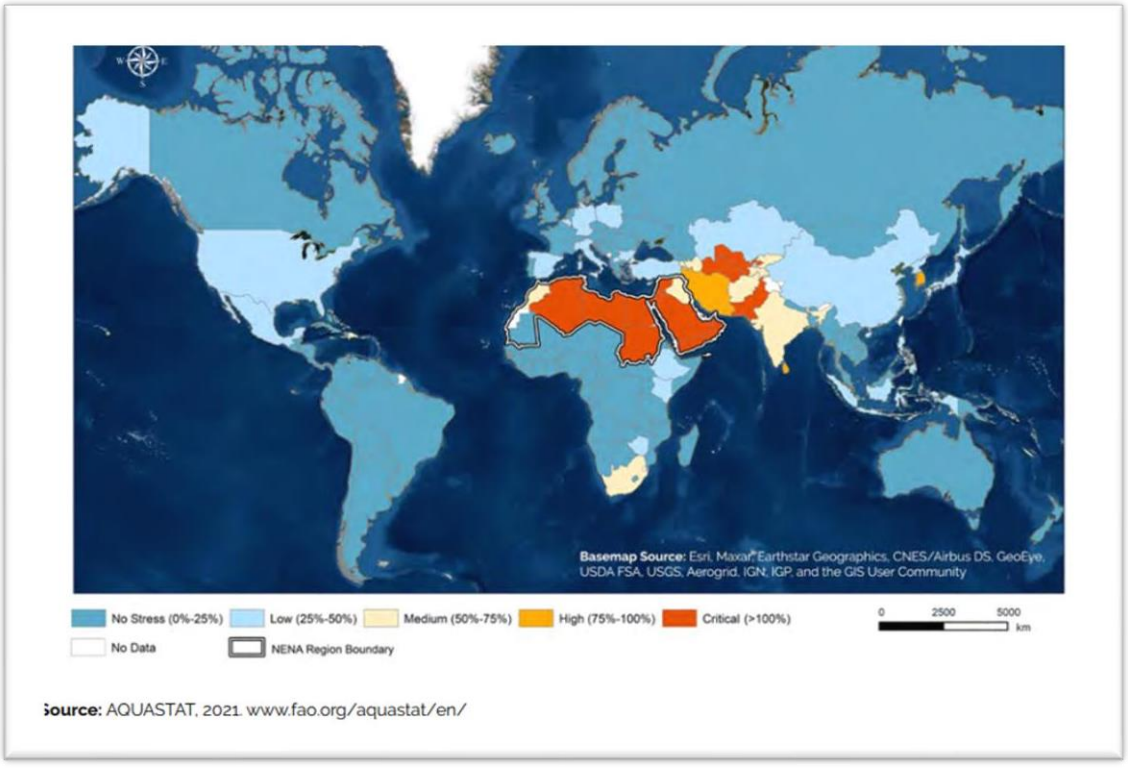


**Figure 2 – Water Stress Level – SDG 6.4.2 (Latest reporting year)**

9. This Information Note aims to offer a roadmap for sustainable water use for food security. It builds on the work of FAO's Regional Water Scarcity Initiative (WSI), as well as its recently concluded "Water Efficiency, Productivity and Sustainability in the NENA Region Project" (WEPS-NENA). The paper promotes transition pathways for sustainable water use in agriculture, using four related response areas:

a. advancing water and agriculture sustainability by investing in improved water efficiency and productivity tools to meet sustainable boundaries of water use towards amore resilient economy;

b. facilitating the transformation of legal and institutional frameworks by promoting multi-disciplinary and cross-sectoral governance and by strengthening policy coherence;

c. fostering a solid and standardized knowledge base for adaptive decision-making; and

d. 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.

11. Transition pathways are proposed thereafter to frame policy action for sustainable water use (Figure 3). The building blocks of these pathways include:

a. **Water Accounting** to provide a clear picture of the water resources situation and uses over time to help set sustainable limits for water consumption.

b. **Water Governance** to highlight the hidden causes of water scarcity and reveal informal uses that need to be considered in water allocation systems.

c. **Water Productivity** to encourage optimal water use for food production along the value chain, where all actors will benefit from more income per drop.

d. **Farmer-led Experimentation** and demonstration, for example: in Farmer Field Schools (FFSs); and Farmer Business Schools (FBS) to understand the benefits of careful water management.

e. **Cross-Sectoral Dialogues on the Water-Energy-Food Nexus** to inform holistic national water policies.

12. In the framework of the WEPS-NENA project, the above transition pathways were piloted in eight countries across the NENA region (Algeria, Egypt, Iran [Islamic Republic of], Jordan, Lebanon, Morocco, Palestine and Tunisia). When applied at scale in national systems, these approaches tend to give planners accurate forecasting information and related datasets that support evidence-based decisions.

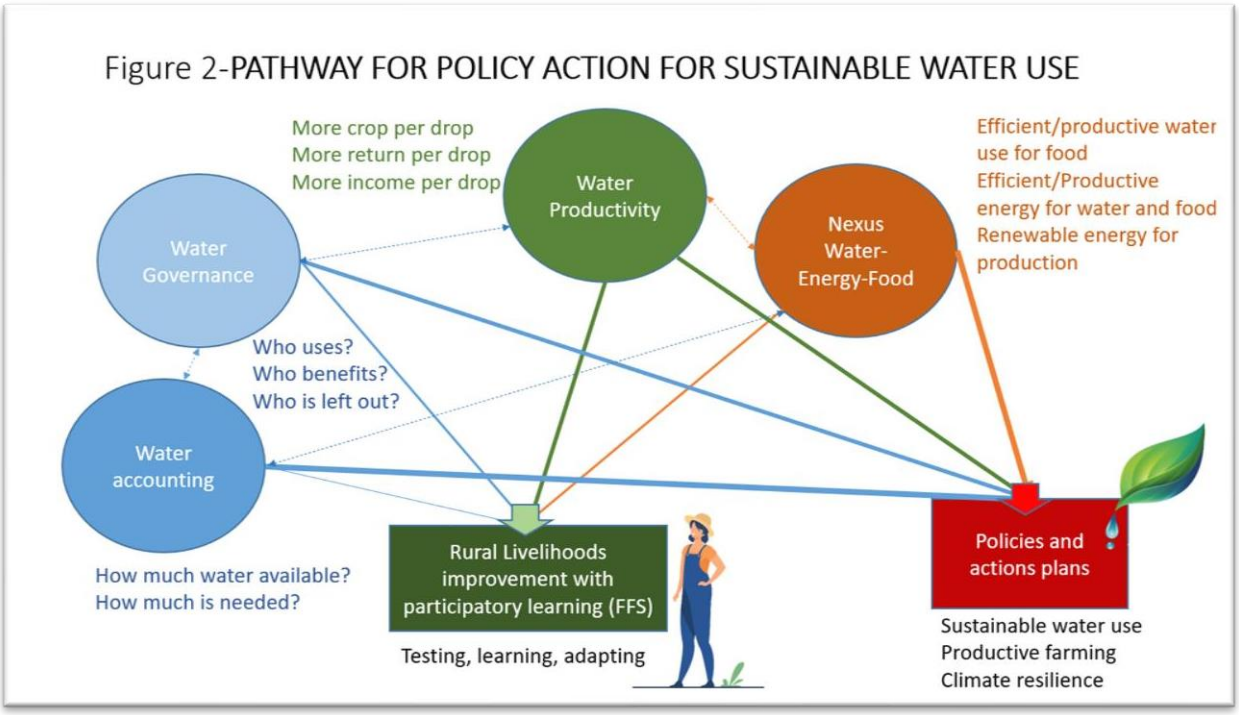


**Figure 3 – Pathways for Policy Action for Sustainable Water Use –. (FAO- Forthcoming)**

13. These approaches 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.

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

### Improving Water Use Efficiency

14. The NENA region has been showing low results for the water use efficiency indicator Sustainable Development Goal (SDG) 6.4.2 for most countries, except for some Gulf countries that are more industrial and service-oriented (FAO, 2022). Reallocation across sectors is still possible if agricultural water efficiency and productivity are improved. Jordan for example, has achieved the necessary shift through robust national policies that cap water allocation for agriculture based on performance. It also made positive improvements in water use efficiency by primarily allocating treated wastewater for irrigated agricultural expansions.

15. 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.

### Improved Farming Practices for Enhanced Water Productivity

16. 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. Defining WP, at different scales and perspectives, is therefore critical to assess the value of water in agriculture.

17. The WEPS-NENA benchmarked existing WP in eight countries across the NENA region through the development of a novel methodology that focuses on the difference between the actual WP and the maximum potential WP which can be achieved.

18. Detailed farmers' surveys were used to characterize the existing agricultural practices related to WP and identify good agricultural practices. To assess the WP gap, it was 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 strategic crops, including wheat.

19. The results of the regional and national assessments produced by the project (Figure 4) reveal that there are still substantial WP gaps in most crops in 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.

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

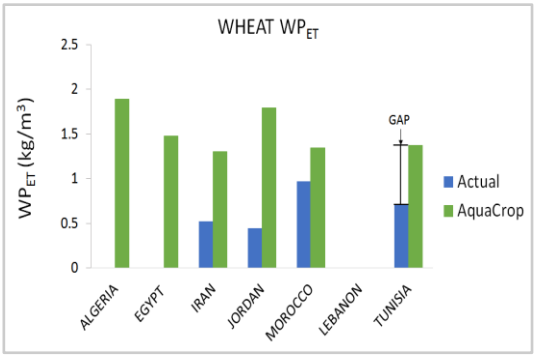


*Figure 4b. Actual and simulated potential biophysical WP of applied irrigation water for wheat. (UCO 2022)*

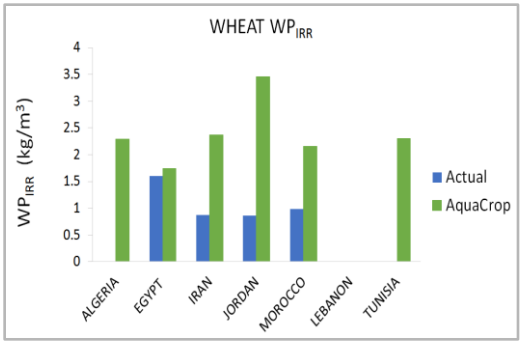


**Figure 4 Shows some values that compare the actual averages and the potential productions, using the AquaCrop model.**

**Role of Non-Conventional Water Resources (NCWR) in Transforming Agricultural Water Management and Planning Paradigm**

20. The t State of Land and Water Resources for Food and Agriculture in the Near East and North Africa Region (SOLAW) 2022, stresses the need for a transformational shift in the agricultural water management paradigm through the inclusion of resilience principles in the sector.

21. Desalinated water represents a growing share of drinking water supplies particularly in the Gulf countries; however, its use for agriculture remains marginal in the NENA region.

22. Desalination technology is also evolving offering a broader range of options to countries, particularly for isolated sites as in the case of Gaza, Palestine.

23. Land degradation and desertification processes in NENA are significantly influenced by the salinization of soils. Rehabilitation of desert systems necessitates the rehabilitation of degraded natural ecosystems and the use of afforestation and aquaculture systems in certain conditions. Bio saline agriculture also represents an excellent opportunity to combat salinity in marginal agricultural systems, especially when combined with Nexus approaches.

24. For water supply augmentation, drainage water and wastewater represent a significant opportunity.

25. Egypt shows that drainage water can be reused multiple times within a basin; it is reused seven times along the Nile before being finally discharged. Jordan has already institutionalized and operationalized wastewater reuse for agriculture. In the Maghreb region, the Arab Maghreb Union (UMA) has signed a joint declaration on the need to expand the reuse of wastewater for agriculture, green spaces and groundwater recharge.

26. In light of the above, during the second Joint Water-Agriculture Ministerial (JWAM) meeting held at the League of Arab States in January 2022, Ministers of Water Resources and Ministers of

Agriculture emphasized the importance of the use of non-conventional water resources to reduce the over-exploitation of freshwater in agriculture.

27. Since 2019, FAO and the United Nations Economic and Social Commission for Western Asia (ESCWA) have been supporting the Joint Technical Secretariat in the implementation of the JWAM meetings' resolutions to accelerate the required transformation on the use of non-conventional water resources in agriculture.

28. Consequently, FAO supported the Joint Technical Secretariat in the implementation of several activities, including: the development of guidelines on the use of brackish water in the Arab region; the elaboration of a paper on the prospects of desalinationin the Arab region; contributing to a sourcebook on treated wastewater reuse in the MENA region, prepared in collaboration with The International Water Management Institute (IWMI) and Center for Environment and Development for the Arab Region and Europe (CEDARE).

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

29. Transforming food systems in the NENA region requires interdisciplinary and integrated approach that considers the complex interplay of factors.

30. Water allocation has been the first topic of attention of the High-level Technical Joint Committee (HLTJC) which informs the Joint Water-Agriculture Ministerial meetings. Indeed, managing the demand for agricultural water in anticipation of reallocating it to higher economic productive uses requires a multifaceted approach that takes into account various factors. This approach is proposed in the *Guidelines on Improved Water Allocation for Agriculture* developed by FAO and ESCWA and adopted by the League of Arab States in 2021. The guidelines propose four factors to get the process to move as illustrated in (Figure 5).

31. The guidelines are currently being tested in Egypt, Jordan, Palestine and Tunisia using pilot sites.

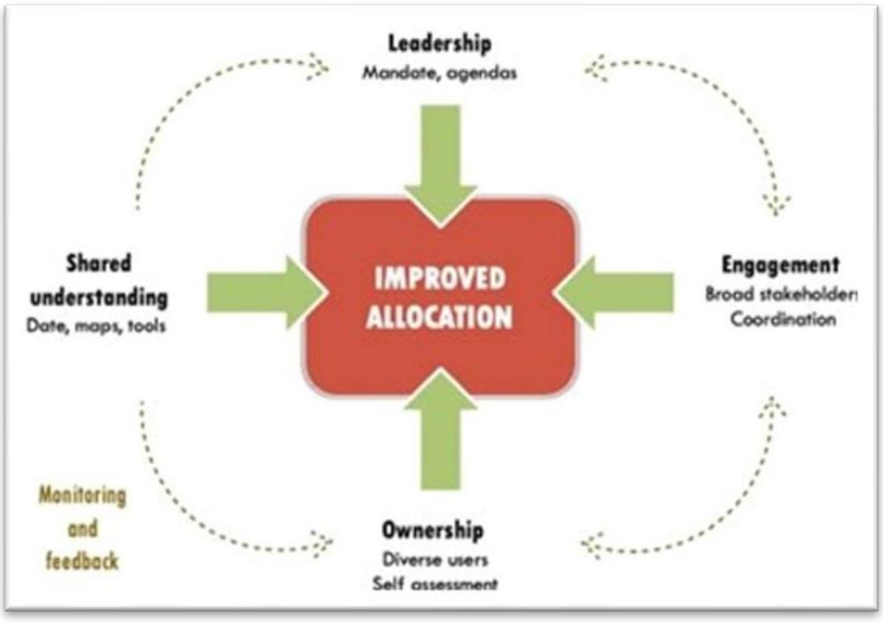


**Figure 5 – Four Building Blocks of the Guidelines for Sustainable Allocation of Water forAgriculture**

## V. Fostering a Solid and Standardized Knowledge Base for Adaptive Decision-Making.

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

33. Consequently, the use of remote sensing techniques is useful in determining hotspots of water stress, low performance and bright spots.

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

35. A regional evidence base on integrated assessment of water scarcity is needed to drive continual improvement of sustainable water allocation based on standardized and tested approaches. Results and knowledge can be shared through open platforms, for example using FAO inter-Regional Technical Platform on Water Scarcity (IRTP-WS) to enhance knowledge sharing across the region and beyond.

36. On the other hand, water consumption that leads to evaporation losses (evapotranspiration - 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) allows the comparison of data with other ET measurement instruments and satellite remote sensing technologies and could become a standard instrument for crop ET in the region.

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

37. This region is being negatively affected by climate change at a faster rate than other parts of the world. To effectively target investments, countries need to better understand where their climate change hotspots are.

38. The extreme heat and drought of 2022–2023 leave no doubt on the need for enhanced preparedness and climate resilience for the NENA countries. Figure 6 illustrates hotspots of vulnerability for the Algerois basin in Algeria affecting 86 percent of the total population.

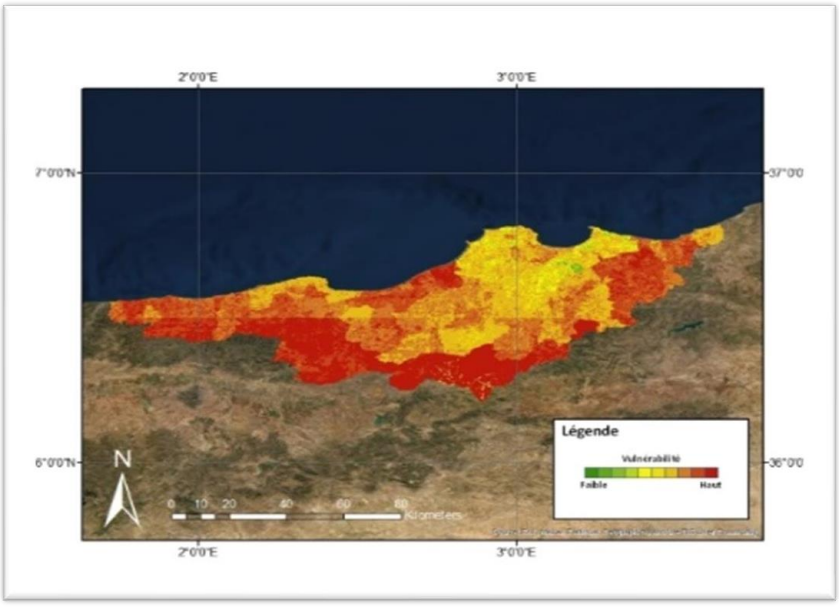

**Figure 6 – Vulnerability Composite Indicator of the Mid-term Period (2041-2060) for theAlgerois, Algeria**[5]

39. The example shows the urgency to prepare the rural areas for change by transforming and re--engineering the farming systems through various options available, including water-smart technologies.

40. Water smart technologies are innovative solutions that leverage technology to efficiently manage water resources. 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 NENA to improve water resource management:

a. Smart Irrigation Systems;
b. Smart Water Metering;
c. On-site weather measurement;
d. Water Leak Detection and Management Systems and Tools;
e. Data Analytics and Decision Support Systems;
f. Rainwater Harvesting Systems;
g. Smart Water Management Applications.

41. Along with "smart" technologies, there is a large spectrum of water-efficient practices that have demonstrated their benefits across NENA. Examples of these technologies include modernizing traditional surface irrigation methods, such as furrow or basin irrigation; soil moisture management; monitoring sensors; simple probes and others.

## VII. Outcomes and Recommendations

42. Achieving water use efficiency and water productivity within sustainability boundaries is crucial to address NENA water challenges. It represents the main building blocks of the transition pathways required to achieve food security, water resilience and sustainability.

43. Planning large investments 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.

44. Governments and intergovernmental entities play a vital role in advancing adequate multi-sectoral policies that encourage water-smart technologies and policies that consider supply without underscoring non-water policies. These polices should emphasize cross-sectoral collaboration and provide incentives such as subsidies for efficient irrigation equipment, tax breaks and regulatory frameworks that promote sustainable water use practices.

45. 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.

46. Raising awareness and providing training on water-efficient practices are also essential. By educating farmers, communities and stakeholders about the benefits of technologies, it becomes more likely to be adopted and implemented effectively.

47. Delivering dynamic regional platforms for exchange and learning plays a crucial role in linking existing communities of practice. The FAO iRTP-WS represents a practical example of successful exchange that facilitates documentation of experiences and exchange of knowledge within the region and beyond.

[5] 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.