

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

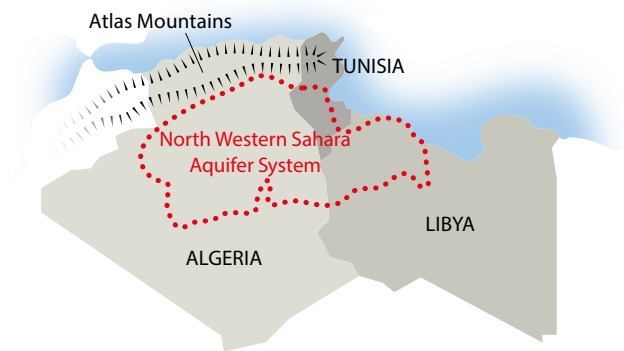
Policy Brief : Improving sustainable development in the North Western Sahara Aquifer System through a transboundary nexus approach



© Michael Runkel / Alamy Stock Photo

Coordination among the water, energy, food and environment sectors is fraught with difficulties, and the complexity increases substantially in transboundary contexts. The nexus approach to managing interlinked resources aims to enhance water, energy and food security by increasing efficiency, reducing trade-offs, building synergies and improving governance while protecting ecosystems. Such an approach helps reconcile different sectoral objectives and supports progress towards the closely interlinked Sustainable Development Goals at the national and regional levels.

.....

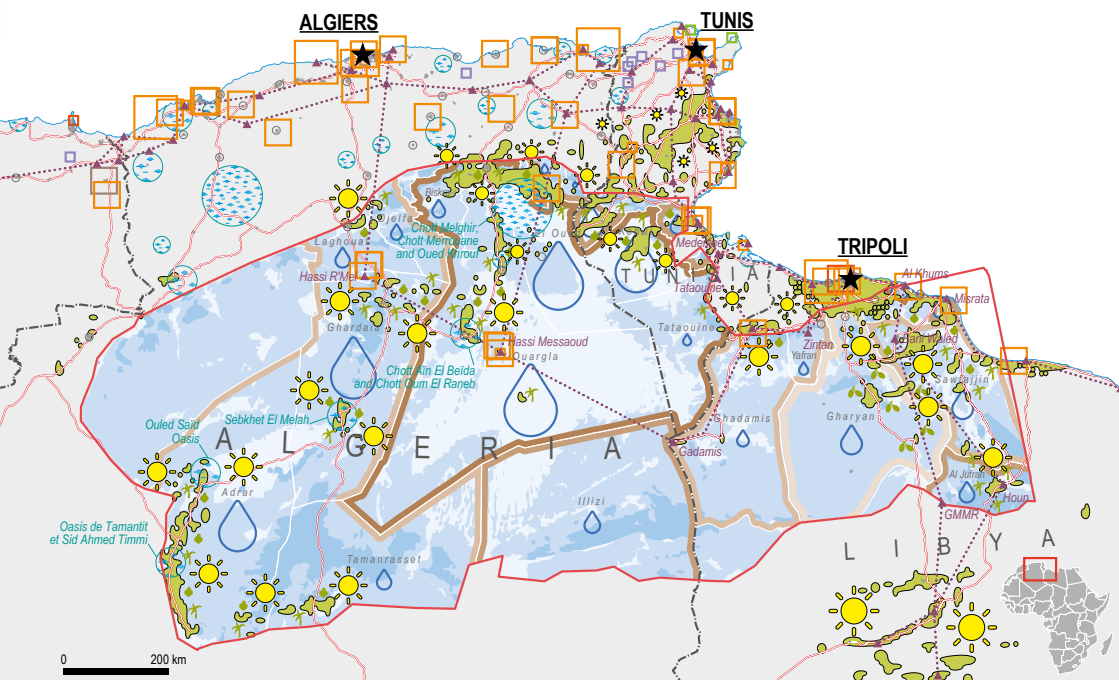


This Policy Brief highlights the main results of a participatory assessment of the water-food-energy-ecosystems nexus in the North Western Sahara Aquifer System (NWSAS).

Shared by Algeria, Libya and Tunisia, the aquifer is among the largest transboundary groundwater reserves of North Africa, extending over one million square kilometres. Its water resources are largely non-renewable, with limited replenishment. In addition, socioeconomic development in the basin over the last decades and technological progress in well-drilling have led to steadily growing water abstraction. Currently the combined abstraction from the aquifer by the three countries exceeds three times the natural rate of recharge. As a consequence, the countries are facing important challenges – among them depletion and the loss of groundwater pressure; salinization; degradation of soil and reduced agricultural productivity; increased energy demand to pump water; and demineralization, etc.

Political will and action in the area have already laid a concrete basis for enhanced cooperation. Since the 1970s, Algeria, Libya and Tunisia have been developing cooperation in information exchange and consultation that inform the management of the shared aquifer. The NWSAS Consultation Mechanism, established in 2006, has a work programme with a budget, and operates through annual meetings of senior officials, ad hoc working groups and national committees. Recently, the countries initiated discussions to explore opportunities to enhance the Mechanism's functioning and further strengthen transboundary cooperation. The countries have also programmed into their national policies and strategies for adaptation to climate change a set of actions that can help promote joint action by taking advantage of and building synergies among the sectors of the water-food-energy-ecosystems nexus. The strengthening of multi-sectoral and multi-level coordinated and synergetic actions through a full-scale nexus approach can help ensure a sustainable future of the North Western Sahara Aquifer System.

Selected water, agriculture, energy and environmental features of the North Western Sahara Aquifer System (NWSAS)



Sources: KTH Royal Institute of Technology in Stockholm, The World Bank, The Ramsar Convention, CIESIN GPW v.4, FAO, World Resources Institute, GRIP global roads database, The United Nations Geospatial Information Section, NaturalEarth, ESRI.

Disclaimer: The boundaries and names shown and the designations used on this map do not imply official endorsement or acceptance by the United Nations © United Nations Economic Commission for Europe (2020)

Cartography: Stéphane Kluser (Komplot)

NWSAS

Urbanized area

Ramsar site

75-100% irrigation w/ groundwater

Electricity transmission network

Electricity transmission node

★ Capital city

○ Other populated place (> 100K people)

Main road

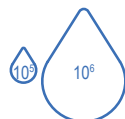
Groundwater table depth (m)

<-25

-25 / -100

-100 / -335

Water abstraction by province (km³)



Total Dissolved Solids by province (g/l)

< 1

1 - 2

2 - 3

3 - 4

Main crops

Palm date

Vegetables

Olive

Power plants

Gas

Oil

Coal

Hydro

Wind

Photovoltaic potential (kWh/kWp per year)

< 1700

1700 - 1800

1800 - 1900

> 1900

Generating capacity of power plants (MW)

1000-5000

100-1000

<100

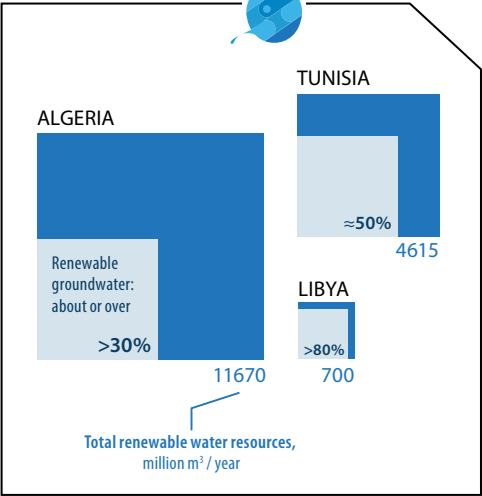
The NWSAS Nexus Assessment is an outcome of a participatory process that included national consultations and two transboundary workshops.

The assessment mobilized representatives from the three countries and the four sectors,

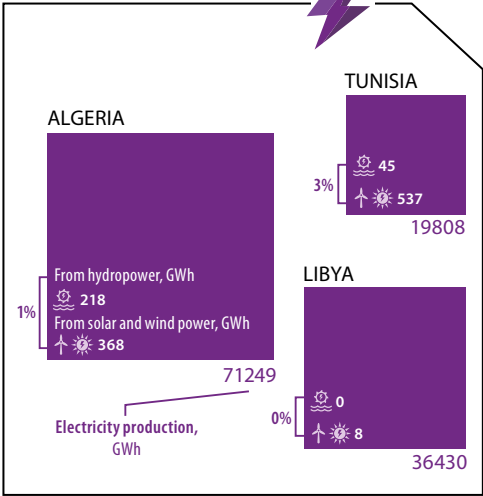
and engaged local and international multi-disciplinary experts. Through a transboundary dialogue, the nexus assessment has helped identify key linkages among energy, water, land, and ecosystem resources, together with potential solutions for making resource management sustainable and efficient.

Key indicators describing the resources of NWSAS countries

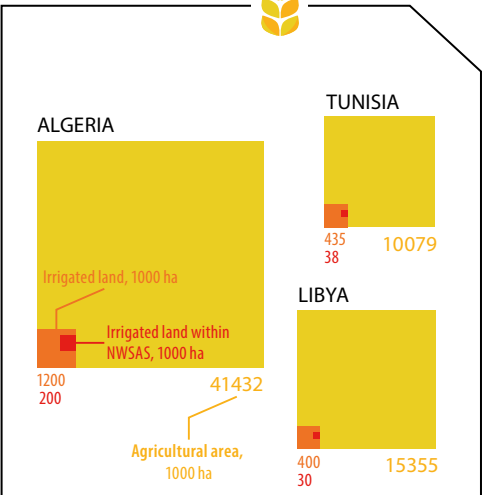
Water resources



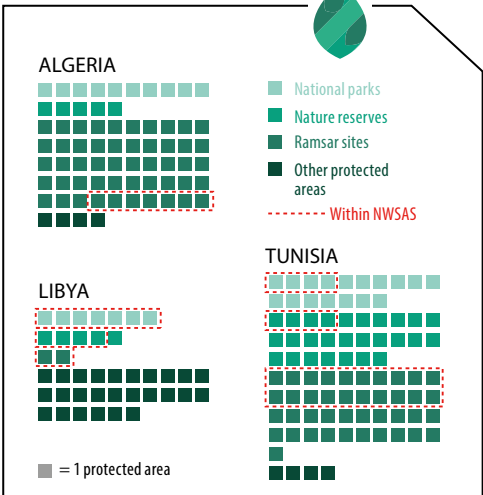
Electricity production



Agricultural land



Protected ecosystems



Sources: report "Reconciling resource uses: assessment of the water-food-energy-ecosystems nexus in the North Western Sahara Aquifer System" and Sahara and Sahel Observatory

Improving the management of NWSA resources is highly important to the socioeconomic development of the three countries and the region as a whole.

The aquifer system comprises two deep aquifers, one on top of the other, in a highly arid environment with annual rainfall less than 150 millimetres and summer temperatures exceeding 40°C. The riparian countries are water-scarce, and groundwater represents a large share of renewable water resources (over 30 per cent in Algeria, about 50 per cent in Tunisia and more than 80 per cent in Libya). The current withdrawals from the aquifer greatly exceed the recharge capacity, and put the sustainability of the development in the area at high risk.

Agriculture is the largest water consumer in the three countries, and irrigation efficiency is very low: water consumption on average is around 11,000 m³/ha but may reach 16,800 m³/ha. This inefficient irrigation – exacerbated by inadequate infrastructure and poor agricultural practices – leads to salinization and to further loss of soil fertility. Together with the naturally high mineral and low organic content in soils, this puts serious constraints on irrigation: out of almost a million hectares of soil mapped to date a little less than a tenth is considered irrigable. In this dry climate with high evaporation, traditional oasis-based agriculture remains the prevalent mode of production. Yet new industrial agriculture has developed over the past three decades, and agricultural expansion puts fragile and vulnerable pastoral ecosystems and important wetland habitats for migratory birds under pressure. The low physical and economic productivity of land and water exposes the local population to unprecedented economic vulnerability, which ultimately leads to emigration and rural exodus in search of other sources of income.

Fossil fuels are among the most abundant natural resources in these countries, and Algeria and Libya are net exporters and rank among the top

worldwide producers of natural gas and crude oil. Rich in solar and wind energy, the countries nonetheless mostly rely on fossil fuel for the generation of electricity, while the implementation of ambitious plans for renewable technologies remains challenging – and progress towards decarbonization slow.

The tightly linked challenges experienced by the different sectors reinforce the strong nexus in the North Western Sahara Aquifer area.

The key to the interdependence is the sectors' reliance on common groundwater resources that are becoming scarcer vis-à-vis increasing demands. Policy responses are linked too, through indirect and often unintended impacts of specific measures such as energy subsidies, renewable energy deployment, or the popularization of high-value crops. These intertwined sectoral challenges call for synergetic actions taken in the different sectors in a coordinated way.

These challenges are all directly or indirectly connected to water and have been clustered in three groups:

- Those related to the management of water from the perspective of economic development and water security
- Those related to the economic, social, and environmental sustainability of the agricultural sector and, more specifically, the oasis agro-systems
- Those related to energy security and energy developments, particularly renewable energy and its potential to help transform water management and agriculture

The nexus package includes **15** high-priority, implementable solutions ranging from governance and international cooperation, to economic and policy instruments, infrastructure and innovation.

Package of NEXUS solutions for the development of the North Western Sahara aquifer system¹

WATER



1. Enhance local water management through stronger participation and enforcement
2. Reinforce transboundary cooperation for sustainable management of groundwater
3. Set up dedicated policies and incentives for wastewater reuse in agriculture and urban areas
4. Strengthen water demand management, including through water saving
5. Scale up the use of non-conventional water resources from desalination and wastewater

ENERGY



6. Enhance coordination of energy development with other sectoral plans
7. Develop a multi-purpose renewable energy programme and sustainably scale up small-scale solar irrigation
8. Improve the reliability of the electricity grid in rural areas and integrate renewables

FOOD



9. Set up policies for reasonable, sustainable and productive agriculture
10. Increase the value of local products, support a more balanced diet, and involve women and youth in the economic and social development of oases
11. Promote a circular economy, such as agroecological practices, through economic and social measures
12. Enhance and scale up innovation for sustainable soil and crop management

ENVIRONMENT



13. Increase awareness in public institutions of trade-offs and synergies between different sectors
14. Consider environmental needs in the water balance of the aquifer
15. Systematize environmental and social impact assessments for all new infrastructure

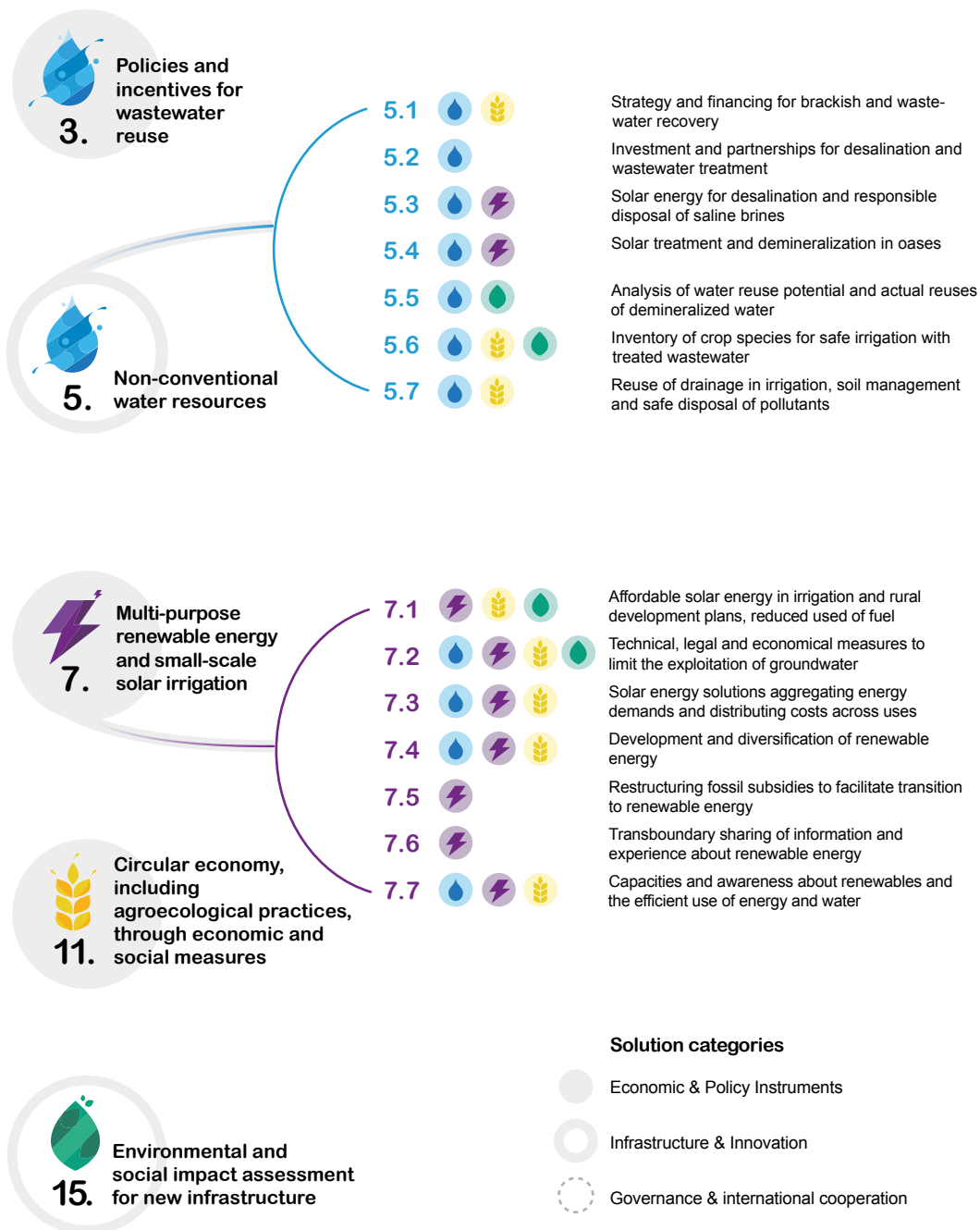
The solutions are broken down into 65 actions to be taken by actors in the water, energy, food, and environment sectors. While each solution pertains to a certain sector that leads its implementation, others outside the sector often play a key supporting role, and intersectoral cooperation ensures the effectiveness of solutions. At a more strategic level, implementing various solutions simultaneously and in a coordinated manner will also help achieve cross-sectoral goals, like coherent planning for sustainable development, enhanced local resilience, and a circular economy, while still contributing to sectoral development, by minimizing intersectoral trade-offs and negative

impacts, and maximizing synergies. This nexus approach to implementation would help achieve such common objectives as the 2030 Agenda for Sustainable Development and international climate action commitments under the Paris Agreement.

The benefits of a nexus approach to managing the NWSAS are multiple, and applying it has considerable potential to support further development of transboundary cooperation, as detailed in the policy report "The benefits of transboundary water cooperation in the North Western Sahara Aquifer System basin".

¹ The formulations are simplified from the report "Reconciling resource uses: assessment of the water-food-energy-ecosystems nexus in the North Western Sahara Aquifer System"

Example of solutions: circular economy through non-conventional water resources and renewable energy



Benefits of implementing a transboundary nexus approach in the NWSAS

Economic benefits

- Reduction of economic risks related to climate change impacts through enhanced adaptation capacity
- Improved water productivity
- Added value of agricultural products
- Avoided costs of over-exploitation of water and soil
- Ensured availability of water for economic sectors
- Reduction of costs for concerted action on innovation, notably on, sustainable farming and irrigation practices

Regional economic cooperation benefits

- Impulses for regional trade and commerce based on shared objectives and complementarities
- Investments facilitated, including through harmonized policies
- Innovation spurred by cooperation
- Impulses for economic growth through concerted action on nexus solutions

Social and environmental benefits

- Enhanced climate change resilience
- Reduced poverty
- Preservation of ecosystems
- Enhanced capacity of farmers to manage resources, improve resilience, and increase productivity
- Higher incomes for farmers
- Connection of communities in different countries through joint projects

Peace and security benefits

- Stronger basin identity through concerted implementation of nexus actions
- Mutual trust thanks to transparency and enhanced knowledge of natural resources
- Support for positive relationships through regional trade and cooperation
- Reduction of conflict potential through reduced resource scarcity

This Nexus Assessment of the NWSAS was carried out under the UNECE Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention), applying an assessment methodology² developed in its framework, in close cooperation with the Global Water Partnership Mediterranean and the Sahara

and Sahel Observatory as part of the project, “Making water cooperation happen in the Mediterranean (Med Water Matchmaker)”, funded by the Swedish International Development Cooperation Agency. The assessment also built on synergies with the Water, Climate and Development Programme (WACDEP) of the Global Water Partnership.

² Information on the methodology is available at <http://www.unece.org/env/water/nexus.html>