NEXUS ASSESSMENT FOR THE NORTH-WESTERN SAHARA AQUIFER SYSTEM (NWSAS)

26-JUL-2022

Lucia de Strasser (UNECE)
Youssef Almulla (KTH)

THE NORTH WESTERN SAHARA AQUIFER SYSTEM (NWSAS)

BACKGROUND

The NWSAS consists of:

1) The Continental Intercalary (CI):

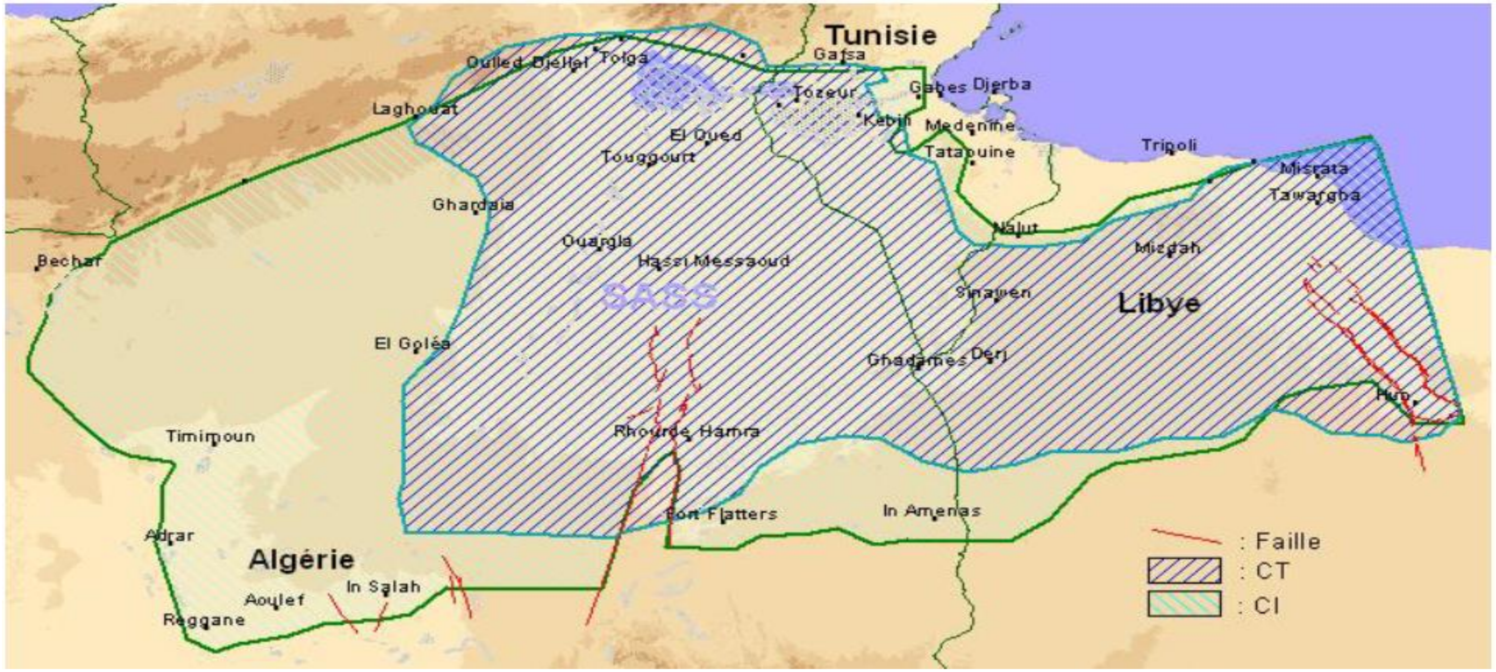
a surface area of 1000,000 km²

depth 1500 – 2800 m

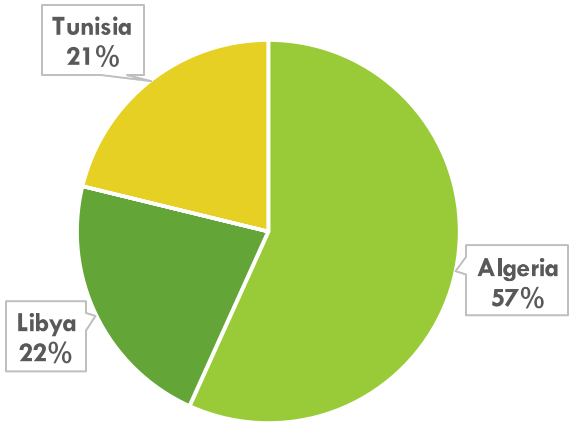
2) The Complex Terminal (CT):

area of 600,000 km²

depth of 100 – 600 m



Population in the NWSAS (2014)

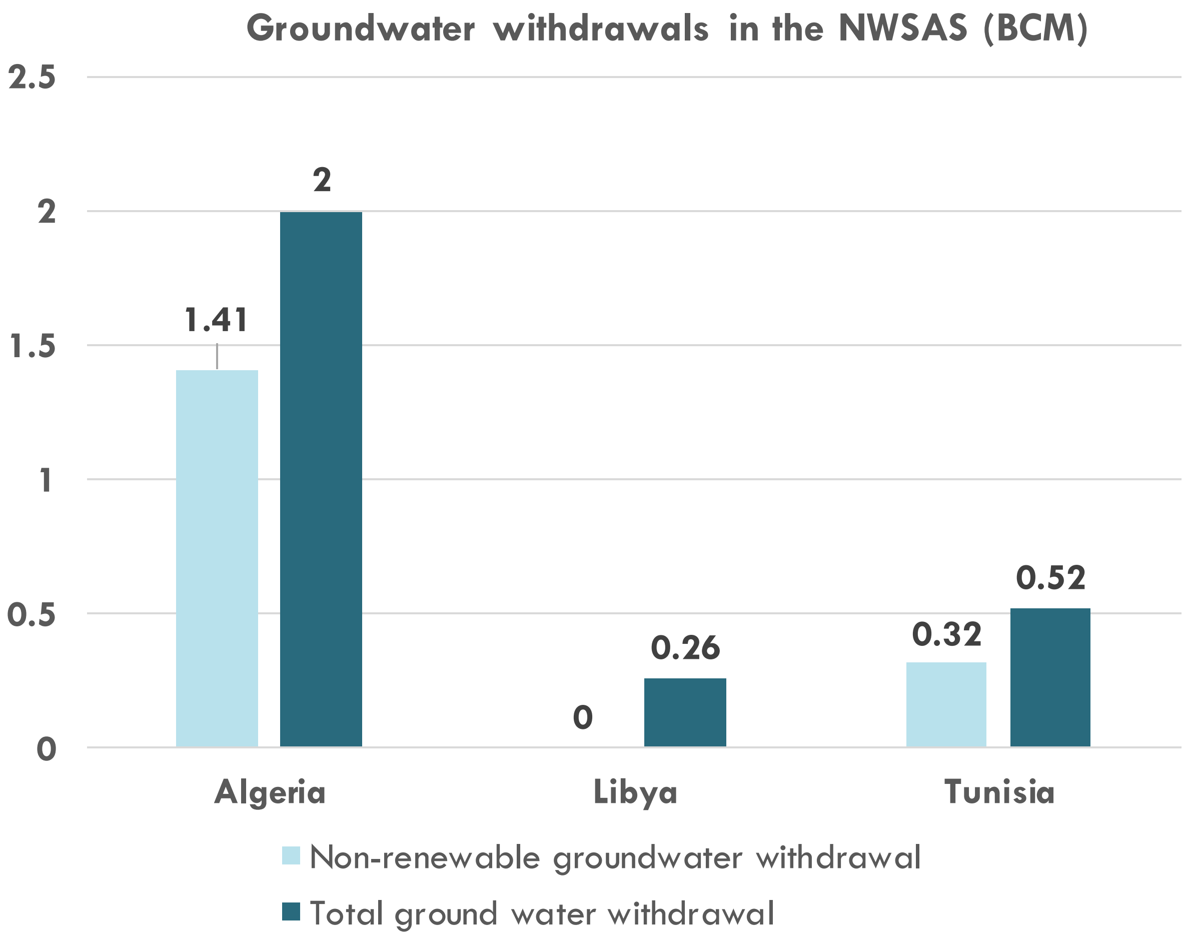


	Algeria	Tunisia	Libya
Country area (km²)	2,381,741	163,610	1,759,540
Country area in the basin (km²)	700,000	80,000	250,000
Share of national territory in the NWSAS (%)	29	49	14
Share of NWSAS (%)	68	8	24

BACKGROUND

Selected Nexus challenges:

- Heavy exploitation of the NWSAS;
- Reduced piezo-metric head;
- Loss of artesian pressure;
- Lower water table;
- High and increasing pumping (energy) demand.



Agricultural activity

- What is the total irrigated area in the region?

Water demand

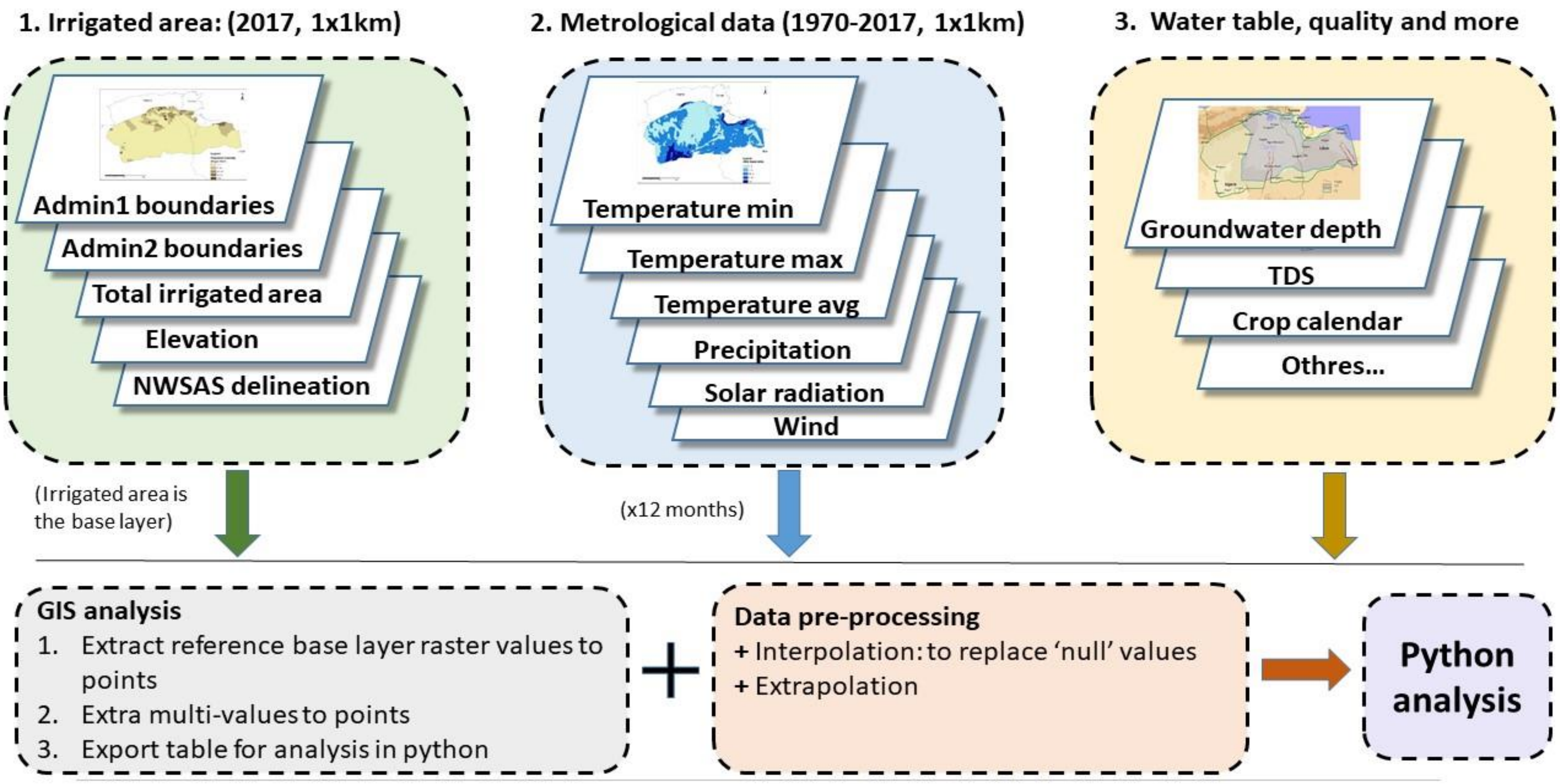
- What is the total water demand for irrigation?
- What is the impact of improving irrigation systems?

Electricity demand

- How much energy required for pumping?
- If desalination would be needed, how much energy would be required?

Electricity Supply

- What is the least cost electricity supply option?
- What makes PV more competitive in the region?



Approach: *To develop an open source GIS-based model that informs integrated planning in the NWSAS.*

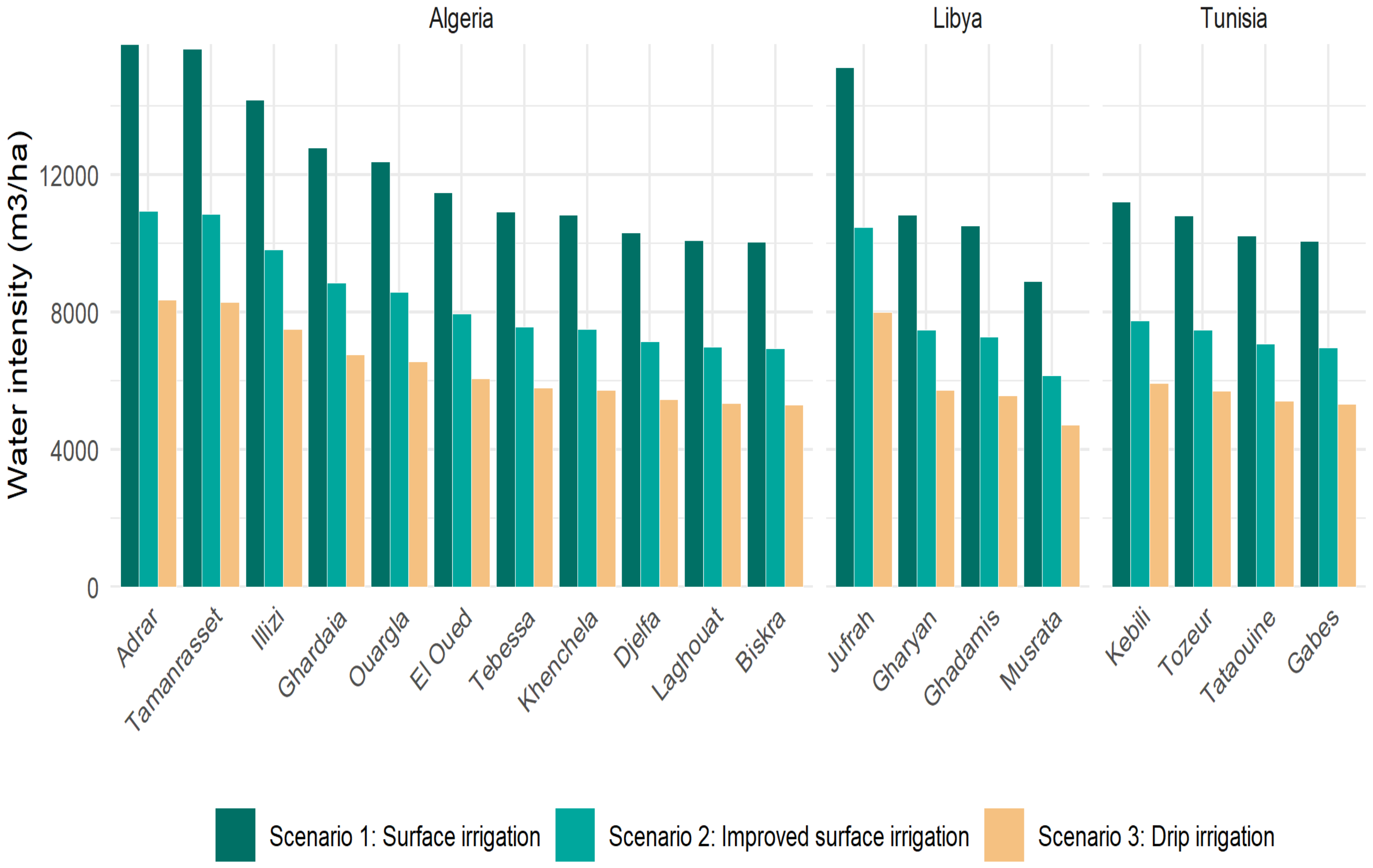
SELECTED RESULTS – IRRIGATION WATER DEMAND

- Investment in improving irrigation efficiency can lead to 47% saving in water demand.

- In terms of volume can save on average 5500 m3/ha.

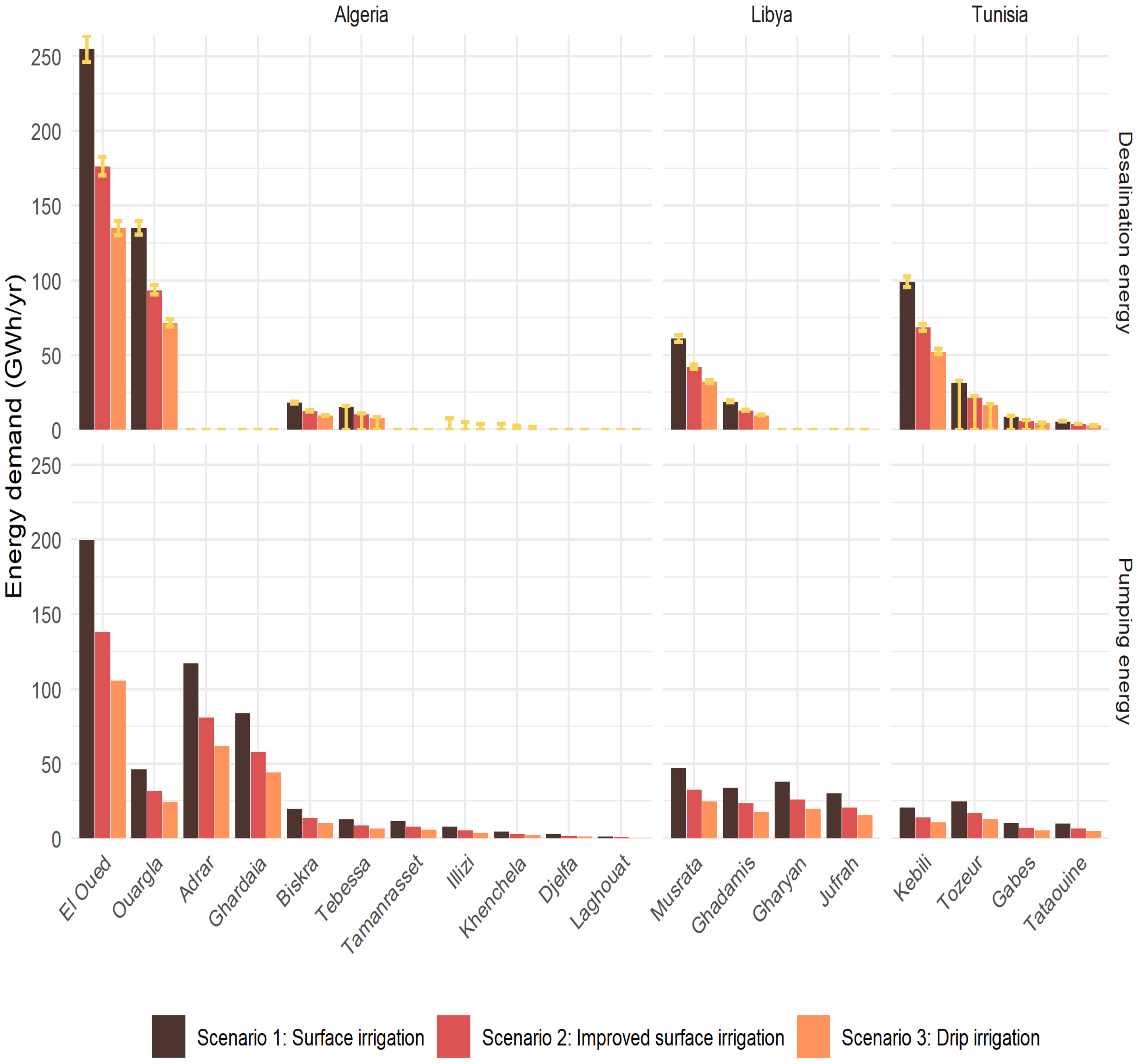
- NOTE!!:

Water efficiency does not equal water conservation!!



SELECTED RESULTS – ENERGY DEMAND

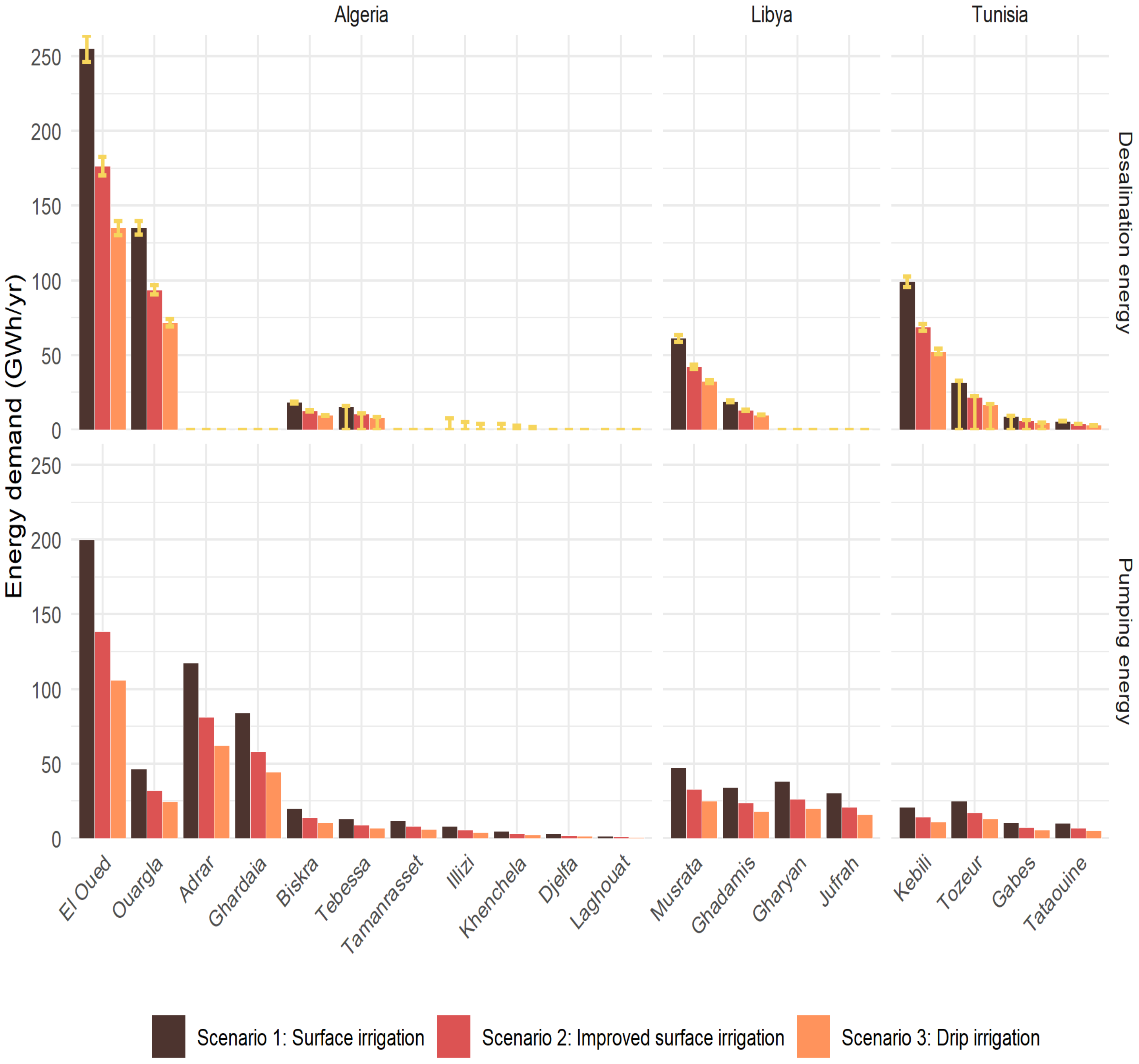
- The energy demand for pumping groundwater is about 730 GWh annually. (Algeria accounts for 70%).
- The Total Dissolved Solid (TDS) levels were studied (2000, 2500 and 3000).
- Tolerating higher TDS level (from 2000 to 3000) reduces energy demand for desalination from ca. 685 GWh/yr, to ca. 574 GWh/yr (**16% Savings**).



SELECTED RESULTS – ENERGY DEMAND

What messages we get from this:

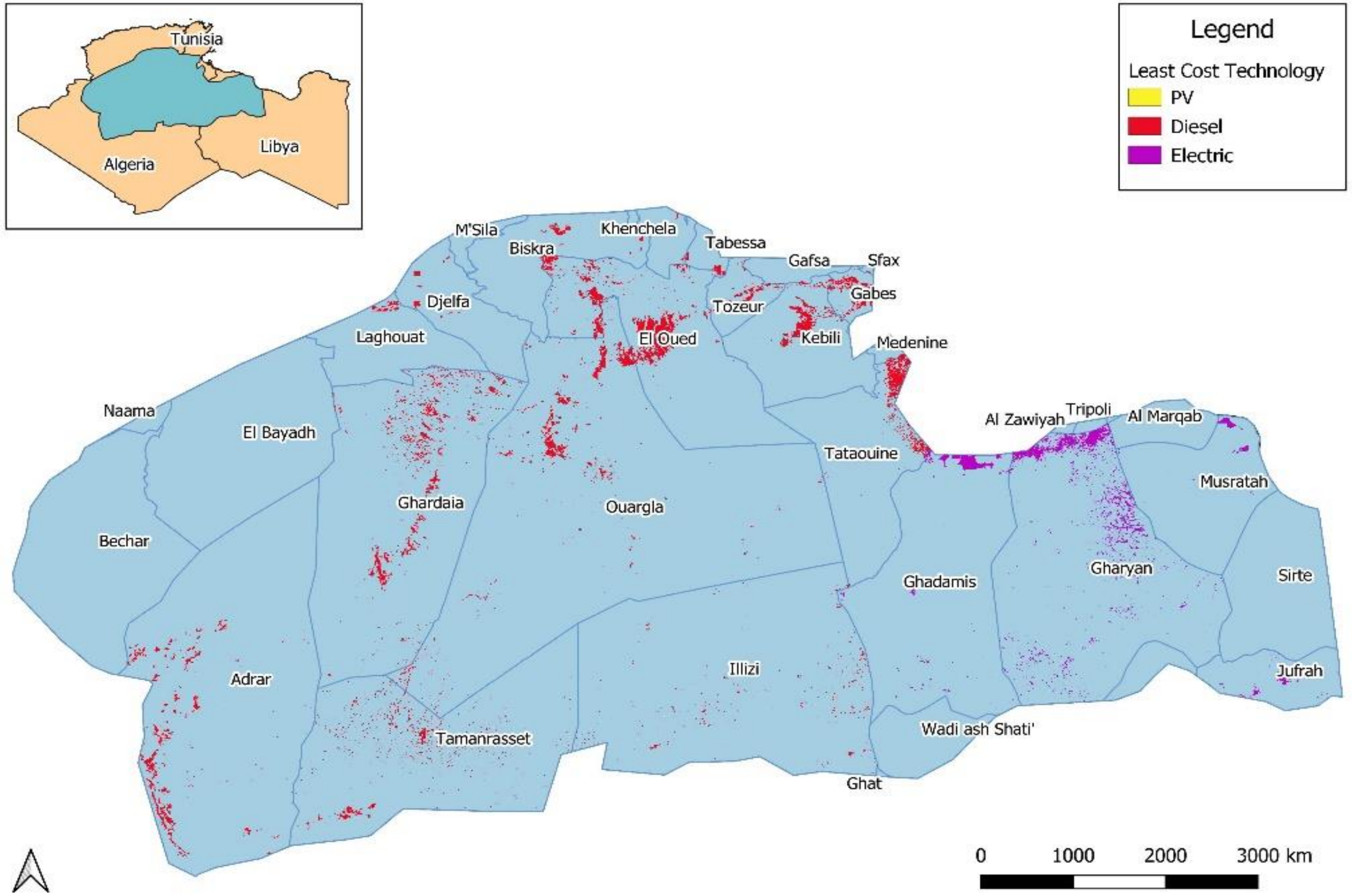
- Improving the irrigation system reduces both energy and water demand.
- Salt resistance crops reduce the energy requirement for desalination.



SELECTED RESULTS- THE LEAST COST ELECTRICITY SUPPLY OPTION

<u>Baseline:</u>

PV CAPEX: 1140 USD/KW.
Diesel price: 0.17-0.62 USD/litre
Electricity price: 0,168 USD/KWh



Q: What makes PV more competitive in the region?

Changing fossil fuel subsidies?

Or

reducing solar PV cost?

Technologies	Parameter	Units	Sensitivity Levels			Source
			1	2	3	
Diesel Gen sets	Capital Cost (CAPEX)	USD/KW	938	938	938	(WB, 2016b) and (WB, 2016a)
	O & M	USD/KWh	0,1	0,1	0,1	
	Life Time	Years	10	10	10	
	Fuel Cost (Algeria)	USD/Litre	0,17	0,21	0,26	
	Fuel Cost (Tunisia)	USD/Litre	0,62	0,78	0,93	
Electric Pump	Capital Cost (CAPEX)	USD/KW	845	845	845	(WB, 2016b) and (WB, 2017)
	O & M	USD/KWh	0,1	0,1	0,1	
	Life Time	Years	10	10	10	
	Fuel Cost (Libya)	USD/KWh	0,168	0,21	0,252	
Wind	Capital Cost (CAPEX)	USD/KW	1300	1105	910	(IRENA, 2012a)
	O & M	USD/KWh	0,02	0,02	0,02	
	Life Time	Years	20	20	20	
PV	Capital Cost (CAPEX)	USD/KW	1140	970	680	(Gager and Lahham, 2019) and (IRENA, 2012b)
	O & M	USD/KWh	0,01	0,01	0,01	
	Life Time	Years	15	15	15	

SELECTED RESULTS- THE LEAST COST ELECTRICITY SUPPLY OPTION

Sensitivity analysis:

- Capital cost of PV (CAPEX):

  Level 1: 1140 USD/KW (ref)

  Level 2: 970 USD/KW (15% decrease)

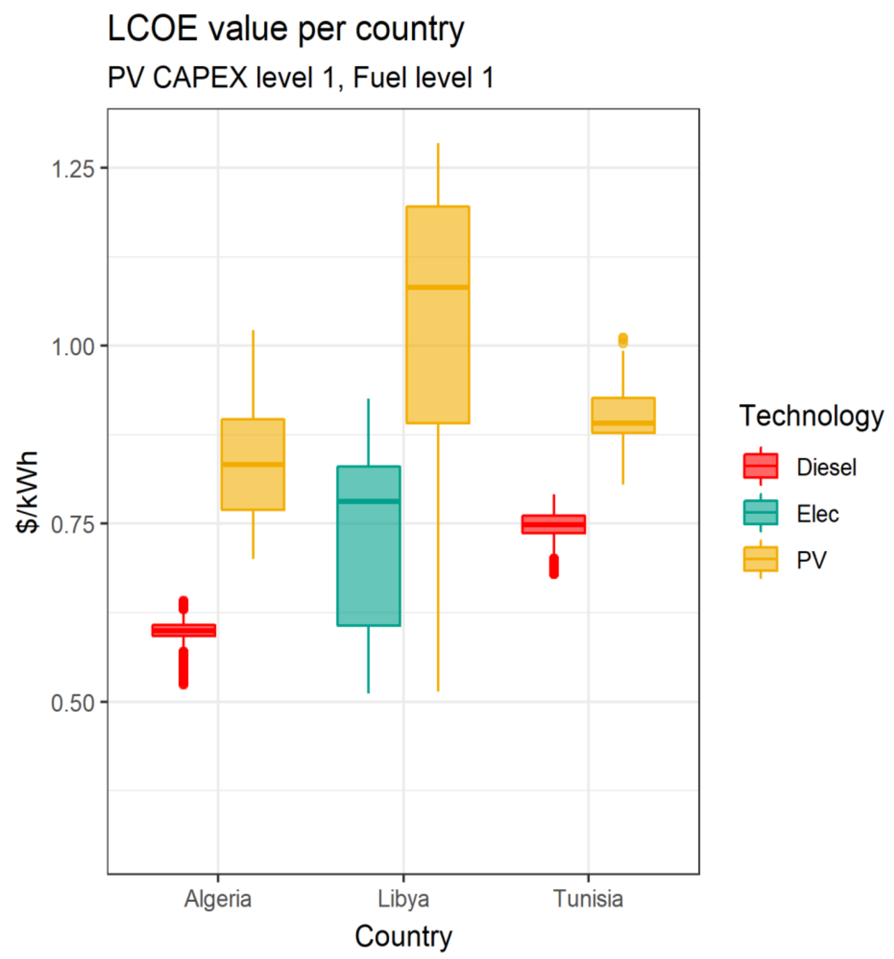
  Level 3: 680 USD/KW (30% decrease)

- Fuel subsidy (Fuel):

  Level 1: Current cost of diesel and electricity in each country

  Level 2: 30% increase

  Level 3: 50% increase



	Water	Energy	Agriculture	Environment
Governance & international cooperation	1. Enhance **local water management** including by: revitalising **participatory** models in oasis and enhancing the enforcement of **existing laws** on water. 2. Reinforce **transboundary cooperation** for sustainable groundwater resource management.	6. Enhance mechanisms for the **coordination of energy development with other sectoral plans**, to anticipate tradeoffs and build on intersectoral synergies.	9. **Set up agricultural policies** oriented toward **reasonable, sustainable and productive agriculture.** 10. **Valorize local products** and strengthen programs for a more **balanced diet** while involving **young people and women** in economic and social development of the oases.	13. Increase **awareness of the trade-offs and synergies** between different sectors in public institutions.
Economic & Policy Instruments	3. Set up dedicated **policies and related incentives** for **wastewater reuse** in agriculture and urban areas. 4. Strengthening **water demand management**, including through water saving programs.	7. Develop a sustainable program for diversified, **multi-purpose renewable energy** and the **sustainable upscale of small-scale solar irrigation.**	11. Promote the **circular economy** including **agroecological practices,** by means of ad-hoc **economic measures and social instrument**.	14. Upgrade **inter-sectoral cooperation** based on a detailed **water balance of the aquifer** that includes sectoral demands as well as environmental needs.
Infrastructure & Innovation	5. Upscale the use of **non-conventional water resources** through desalination and wastewater treatment.	8. Improve the reliability of the **electricity grid in the rural area**, thereby enhancing the integration of renewables for remote and multiple uses.	12. Enhance **innovative practices and techniques for sustainable soil and crop management** and invest in their upscaling and dissemination.	15. Systematize **environmental and social impact assessment** for all new **infrastructure** (large and small scale).

Synergy e.g.

KEY MASSAGES

Integrated planning requires ‘system thinking’ and high level of coordination.

Tackling sustainable development challenges through an integrated/nexus approach can maximizing benefits (and reduce cost). (e.g. investments in irrigation save water and energy).

Data availability and accessibility is usually an issue in this type of studies which calls for another dimension of coordination in data collection, updating and sharing.

Capacity building, procedures and systems to be set in place to enable the integrated planning.

NEXUS ASSESSMENT FOR THE NORTH-WESTERN SAHARA AQUIFER SYSTEM (NWSAS)

26-JUL-2022

Lucia de Strasser (UNECE)
Youssef Almulla (KTH)