Enhancing transboundary water cooperation in the MENA region: progress, challenges & opportunities
3-4 March 2020, Beirut

Session 3: Managing water scarcity – water adaptation to climate change

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Evolution of the abstraction in the NWSAS
Evolution of the wells and boreholes in the NWSAS

1950

1980

2000

2012
Resulting Challenges in the NWSAS

- Abstraction volumes in the NWSAS increased from 0.3 billion m³/year in 1950 to 3.2 billions m³/year in 2016
- Water table drawdown reaching more than 2m/year in certain areas
- Decrease of the agriculture yields
- Increase of the production cost (energy consumption due to deeper water table, water treatment for brakish water,...)
- High socio-economic vulnerability
- Water salinisation
- Marine intrusion in the Djeffara (coastal part of the aquifer)
- Reduction of the artesianism
- Drying-up of the outlets and the natural springs
- Lands salinisation and degradation
WACDEP is contributing to implement the climate change commitments of the Sharm el-Sheik Declaration and the «Priority Program of Action for Water Resources Management in Africa (PPA-GRE) 2016-2025».

**Objective** support countries to:

- Mainstream water security and climate resilience in development planning processes,
- Develop **partnerships and institutional capacities** of stakeholders in order to reinforce climate resilience through better water management,
- Develop **investment and financial strategies** to promote water security and climate adaptation.
WACDEP in the NWSAS

• Coordination with the NWSAS Consultation Mechanism

• Activities validated during the NWSAS CM - 20 & 21 November 2013 in Algiers

• Collaboration with OSS for the programme implementation
Project Components

- Evaluation of CC impacts in the NWSAS and integration in the hydrogeological model

- Technical/institutional capacities reinforcement

- Consultation Mechanism institutional & legal framework enhancement

- Funds leverage: Climate funds Mapping / Nexus project preparation
Evaluation of CC impacts on water resources in the NWSAS
Climate characteristics

• Arid and desert climate in the three NWSAS countries

• Rainfall irregularity

• Extremely High Temperature: (above 40°C in the desert areas)

Initially, there was some reluctance from the countries:
- talking about CC under these conditions??
- & for fossil water??
CC impacts on water resources

- **Direct Impacts**: Recharge reduction (in the Djeffara)
- **Indirect Impacts**: Increase in the water demand

CC impacts on agricultural and pastoral systems

- The parameters through which important CC impacts is observed:
  - Hydraulic stress affecting the phenology and the growth.
  - Thermal factor limiting growth and development of all types of culture.
  - The increase of risks for sensitive species to the raise of winter temperatures (e.g. alfalfa, palm) which could have an impact on the choice of cultivated varieties.
In order to estimate CC impacts, we considered:

- Socio-economic projections for population growth, development and sectoral orientations based on the national strategies of the countries
- Climate projections: based on the countries modelling

**Algeria:**

Projections for 2020 and 2050 by UKHI model (United Kingdom Meteorological Office High Resolution) considering the IPCC «IS92a» scenario for the two hypothesis low and high

**Libya:**

No national climate projections to our knowledge

**Tunisia (2050):**

Increase of 1,2 to 2,3°C in 2050 et and 2.9°C to 4.3°C in 2100

Decrease of 20% to 5% in 2050 and 10% to 35% in 2100
Results: Reduction of the crop production in the NWSAS under the impact of CC

The reduction of production (kg/ha) for the 2030 and 2050 horizons are significant and varies depending on the types of crops:

<table>
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<tr>
<th>Reduction of Production</th>
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<tr>
<td><strong>For 2030</strong></td>
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<td>• 2528 kg/ha for the tomatoes</td>
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<tr>
<td>• 489 kg/ha for potatoes</td>
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<tr>
<td>• 173 kg/ha for date palms</td>
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In percentage, the reduction is about 5%. It varies from 5% for pomegranate trees to 2.3% for date palms

In percentage, the reduction is about 25%. It varies from 32% for pomegranate trees to 15% for date palms
The Climate Change impacts depend on vegetation formations:

- Less vulnerable formations are those based on *Haloxylon schmittianum* and *halophytes*.
- Those having medium vulnerability are based on *Rhanterium suaveolens*
- The most vulnerable pastoral ecosystems to CC are formations based on *Stipa tenacissima* (where biomass productions and livestock units are expected to be reduced by 75%)

➔ A reduction of pastoral production between 60 et 70 depending on the vulnerability of ecosystems
Results: Impacts of CC on Water Resources: 4 scenarios examined

Zones at risk in the NWSAS in 2050

- **Bassin Artésien**: Baisse conséquente de l’artésianisme, voire sa disparition
- **Chotts**: Arrivées d’eaux sursalées et dégradation irréversible de la ressource
- **Exutoire Tunisien**: Baisse conséquence du débit, voire Tarissement
- **Syrte**: 1. Inversion des écoulements et intrusion marine; 2. Tarissement de la source de Ain Tawargha
- **Jufrah-Hun-Soknah**: Rabattements plus importants en amplitude qu’en extension en zone à surface libre
Results: Impacts on the Djeffara Aquifer

- POTENTIEL OF THE AQUIFER: 600 Mm$^3$ among which 330 Mm$^3$ directly linked to rainfall

- For a rainfall reduction of 10% in 2030 and 29% in 2050, estimated losses are around 33 Mm$^3$ in 2030 et 96 Mm$^3$ in 2050

- Sea level rise (1 m in 2100) lead to a loss of 12.6 Mm$^3$ in the North of Gabes Nord (salinity can reach 10 g/l) (APAL, 2015)
Recap of the Results

• Large lowering of the water table and degradation of water quality

• By 2050, the piezometric drop is alarming:
  - CI: drop of 100 m in Adrar up to 500 m in Souf and 700m in the center of the basin
  - CT: 360 m drop at Oued Rhir
  - Level less than 100 to 150 m under the chotts

• Risk of drying up of the Tunisian outlet that feeds the Djeffara

• Risk of inversion of the aquifer-chotts gradient

• Salinization of the aquifer

• Absence of adaptation actions leads to a loss of yields under the CC effect:
  - 5% by 2030
  - between 20 and 30% by 2050
• Increasing pumping volume to expand irrigated surfaces does not lead to an increase in the overall income of the farmers

• In addition to the Temperature and Rainfall, the frequency of sandstorms is important

• Parameters promoting CC adaptability:
  ✓ Size of the farm: small farms are more efficient
  ✓ Family workforce provides flexibility and enhances resource valorisation
  ✓ The livestock component in the farms makes it possible to compensate revenues losses due to CC
  ✓ Higher profitability of three-levels oases compared to monoculture of palm trees, in addition to the biodiversity reservoir they represent
Conclusions

• The CC impacts in the NWSAS and Djelfara are not negligible
  ✓ Water withdrawals increase (for agriculture & domestic use)
  ✓ Reduction of agriculture revenues

• Population highly aware about CC impacts

• CC accentuates an already alarming situation of the evolution model in the NWSAS
  ➔ Importance to take into consideration CC impacts in sectoral and development planning
  ➔ Impacts are beyond the water sector: Relevance of the Nexus Water – Food – Energy – Ecosystems Approach
  ➔ Build a Shared Vision for the development in the NWSAS reconciling economic revenues, resources sustainability and population well-being
Thank you for your kind attention

Merci pour votre attention

مع خالص شكري وامتناني