A NEXUS APPROACH TO TRANSBOUNDARY COOPERATION & THE NWSAS ASSESSMENT

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UNECE Water Convention

NWSAS NEXUS
Libya National Workshop

Tunis, 1-2 April 2019
OUTLINE

The Water Convention of UNECE
The Nexus Project: why, what, where
... but what is the Nexus?
The Methodology we have developed
Nexus Solutions and their implementation
The NWSAS Nexus Assessment
Let’s work together!
THE WATER CONVENTION OF UNECE

Supports transboundary cooperation through:

A legal framework

An institutional framework

Projects on the ground

Based on 3 principles:

Prevent, control, and reduce transboundary impact

Ensure reasonable and equitable access to water

Obligation of parties to cooperate through specific agreements and joint bodies

=> Objective: sustainable management of water resources
WHY A NEXUS APPROACH TO TRANSBOUNDARY COOPERATION?

Need for communication, collaboration, and joint action!

**nexus dialogue**
inter-sectoral, cross-country

on water-food-energy-ecosystems:
resources, uses, security, and governance
WHAT ARE THE OUTCOMES?

- Strong **capacity building**, promoting practical addressing of the **transboundary nexus**
  - 5 meetings of the Water-Food-Energy-Ecosystems Nexus Task Force
  - 1 global stocktaking workshop (2016)

- Policy brochure on **renewable energy and nexus**

- Synthesis: **consolidated methodology & summary** published (2018)

- 6 **Basin assessments** (with Nexus Solutions)
WHERE ARE WE APPLING IT?

Sava (Bosnia and Herzegovina, Croatia, Serbia, Slovenia, Montenegro)

Alazani/Ganykh (Azerbaijan, Georgia)

Syr Darya (Kazakhstan, Kirgystan, Tajikistan, Uzbekistan)

Drina (Bosnia and Herzegovina, Serbia, Montenegro)

Isonzo/Soča (Slovenia, Italy)

North West Saharan Aquifer (Algeria, Tunisia, Libya)

Alazani/Ganykh (Azerbaijan, Georgia)

Drin (Albania, Kosovo*, FYR Macedonia, Montenegro)

NWSAS

• FIRST AQUIFER
• DIFFERENT CLIMATE
• DIFFERENT ISSUES

completed ongoing incomplete

* United Nations administered territory under the UN Security Council Resolution 1244 (1999)
NEXUS DIALOGUE = A MATTER OF PERSPECTIVE
METHODOLOGY 6 STEPS

1. Socioeconomic context
   - Factual questionnaire
   - Stakeholder mapping

2. Key sectors, key actors
   - Opinion questionnaire
   - Sectoral presentations
   - Brainstorming exercise

3. Analysis of key sectors
   - Nexus indicators

4. Intersectoral issues
   - Data to quantify interlinkages
   - Opinion indicators

5. Nexus dialogue
   - Modelling using fit-for-purpose toolkits

6. Solutions and benefits
   - Assessment of benefits
   - Nexus report of the basin:
     nexus issues, solutions and benefits

Participatory methods
- Nexus indicators

Information and tools
- Desk study:
- Sectors, resources and governance analysis

Outputs
- Nexus report of the basin:
- Nexus indicators

(for the NWSAS, we are at the last step)
TWO “TRACKS” OF ANALYSIS

Nexus analysis carried out on a technical track (resource based) and a governance track, closely coordinated.

Resource base and resource uses (water, energy, land/agriculture, ecosystem services), efficiency, planned development

- Integrated modeling, depending on focus and resources available

Governance analysis looks at the legal and regulatory basis, organizations and actors, main policies, planning cycles

- Institutional and stakeholder mapping
<table>
<thead>
<tr>
<th>TYPE OF NEXUS SOLUTION</th>
<th>EXAMPLES</th>
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| Institutions                                   | • Clarify roles and responsibilities of organizations.  
• Set up or improve existing mechanisms for coordinating across sectors at the national and/or the transboundary level.  
• Ensure coherence between sectoral strategies. |
| Information                                    | • Improve monitoring of resource availability, quality, uses etc., as well as forecasting and prediction.  
• Identify policy implementation barriers.  
• Introduce and improve standards (e.g. for efficiency) and develop and apply integrated planning principles and guidelines.  
• Share data across borders and with different users. |
| Instruments                                    | • Policy instruments, targets and plans for key sectors  
• Economic instruments to provide incentives for rational and sustainable resource use, including tariffs by consumption and fees  
• Legal instruments such as agreements and protocols |
| Infrastructure (and investments)               | • Direct investments towards multi-purpose and environmentally sound infrastructure projects (both “grey” and “green”).  
• Improve resource efficiency in transmission and conveyance networks on the user side as well, taking into account indirect and cross-sectoral impacts.  
• Account for different needs (including environmental needs) in optimizing the use of existing structures. |
| International coordination and cooperation     | • Improve basin-wide monitoring, data verification and exchange, as well as knowledge-sharing.  
• Define areas of common interest for regional development and potential complementarities of resources and between policy goals.  
• Facilitate trade to improve water, energy or food security, optimize the use of resources and infrastructure at the regional level.  
• Develop common rules and joint guidelines for key sectors. |
PRACTICALLY: IMPLEMENTATION OF SOLUTIONS

Through **existing platforms** and cross-sectoral **policy frameworks**

- transboundary: ISRBC (Sava and Drina); OSS Consultation Mechanism (NWSAS)
- cross-sectoral: sustainable development, NDCs, adaptation plans, environmental regulation
- revision/expansion of organizational mandates
- consider and compare objectives and planning cycles

Applying/developing **policy instruments** such as Strategic Impact Assessment (policy) and Environmental Impact Assessment (projects), **specific guidelines** (e.g. sustainable hydropower), **economic instruments** (e.g. cross-subsidization)

Embracing “**nexus thinking**” in cooperation and policy development (new platforms, instruments, etc?) as well as in sustainable/synergetic project development and green financing
IMPACT OF THE NEXUS ASSESSMENT PROCESS (EXAMPLE SAVA-DRINA)

- Identification of stakeholders, issues, possible directions for solutions
- Governance analysis, modelling

- Clusters of challenges & solutions packages defined, benefits of coordinated hydropower operation quantified
- Benefits of cooperation, participatory methods

Drina follow-up project
- Support to selected solutions. E.g. RES investment discussions take on water and environment considerations

KTH, ISRBC, JRC
- Network forming, sectors meeting & exchanging

Italy, ISRBC, GERE, KTH, GEF, World Bank
- Debate with utilities about the benefits; Publication with GERE: nexus and RES; Forums on Energy

Italy, GERE, GWP, ADA
- Regional level nexus initiative provides for sharing experience; transfer of lessons Drina -> Drina

Stakeholder activity/lead, energy sector involvement, partnership, resource mobilization, impact
THE NWSAS NEXUS ASSESSMENT: WHERE ARE WE?

- Multi-sectoral dialogue & benefits of cooperation: still ongoing

- Track 1: Integrated Water-Food-Energy model of the NWSAS (preliminary results ok)

- Track 2: Governance analysis (stakeholder mapping done, institutional study done)

  -> now the real questions: what are the issues of governance? And how to overcome them?

- Developing the NWSAS Nexus Assessment Report
MODELING THE NWSAS

INFORMING POLICY:

• water savings from improving irrigation efficiency,
• estimating the energy economic benefit (energy) of groundwater savings,
• comparing different energy supply options, now and in the future
• ..? (depending on future developments of the model)
DIALOGUE IN ALGIERS (2017): INTERSECTORAL ISSUES
Interlinkages discussed:
- trade-offs
- impacts

Outcome:
A series of intersectoral issues in the NWSAS

<table>
<thead>
<tr>
<th>Water</th>
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<th>Energy</th>
<th>Land/Agriculture</th>
<th>Ecosystem services</th>
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<td>*Energy (ENE) to Water (WAT) 1</td>
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MOVING FROM ISSUES TO SOLUTIONS:
WHAT HAS BEEN DONE

1. We have taken all issues identified in the 1st Transboundary workshop

2. We recognized that addressing all these issues will require achieving three objectives:
   - Slowing down depletion of the groundwater resource and rationalizing water use
   - Modernizing and increasing the value and viability of agriculture
   - Sustainable energy for water management and economic development

3. (We have further detailed the objectives (3X3))

4. (We have detailed many (53) solutions that combine in multi-sectoral packages (they combine so as to address tradeoffs and value synergies))

THIS IS WHAT YOU SEE IN THE (DRAFT) INFORMATION NOTE
MOVING FROM ISSUES TO SOLUTIONS: WHAT WE NEED TO DO

1. We want ONE feasible Package of Solutions, with 15 solutions max
2. We suggest 30 solutions of priority
3. We need you to discuss:
   - They need to bring high positive impact in the NWSAS
   - They need to be synergetic across sectors
   - They need to be feasible in the NWSAS and in your country (who, what, how?)

THIS IS WHAT YOU WILL DISCUSS IN GROUPS
Thank you!
**Energy**

**Access to energy increases water extraction and transfers:**
- The availability of the modern drilling technologies and increasing water demand caused significantly increase in the number of wells in the NWSAS.
- The number of wells jumped from few wells in the 1960s to about 18000 wells in 2012.

**Water for Solar power plants:**
- A CSP plant requires water as the working fluid (for the steam cycle), as well as for cooling if a cooling tower is used.
- Water consumption can range from 98-295 m³/MWh for a dry type of cooling, to 2,975-3,785 m³/MWh for the tower type.
- Several projects are planned in the region. However there is uncertainty about these projects execution.
- PV technology is preferable due to its cost competitiveness if compare to CSP.

**Water for Enhanced Oil Recovery (EOR) systems:**
- Water is injected into the oil fields to increase pressure and increase oil recovery from existing reservoir.
- Many fields in the region uses this technology; i.e Haoud Berkiou which has a capacity of about 190 000 (bbl/d) and water injection capacity of 18000 m³/d.

**Water**

**Increased pumping demand:**
- This heavy exploitation has caused stress on the water resources and increased the risk of:
  - Reduced piezometric head;
  - Loss of artesian pressure;
  - Excessive pumping heights.
  - Depletion of ‘foggaras’ and springs
- In order to overcome this obstacle, people tend to dig deeper wells, which means higher pumping head and higher energy bill for pumping. Also the use of inefficient pumping systems increased energy losses.

**Brackish water demineralization:**
- In Algeria 2 demineralization plans are operational in the NWSAS. In Tunisia, as part of the National Program for Water Quality Improvement, more than 10 brackish water demineralization units to be installed in Tunisia, of which 6 are in progress (to be verified). Many are located within or close to the border of the NWSAS.
- The desalination/demineralization technology for the new plants will be either Reverse Osmosis (RO) or Reverse Electro Dialysis (RED). Average electricity consumption by brackish water RO plants is in the range of 0.5-2.5 kWh/m³

**Artesian water:**
- The hot water coming from artesian boreholes can be used for heating greenhouses.
- Research and pilot projects required to investigate the feasibility.
How do the Ecosystems and biodiversity affect the Water sector?

Water

New irrigated areas/expansion of irrigation
- The creation of new irrigated perimeters and modern oases (especially for market crops) lead to increase of water demand compared to the traditional oases ecosystems (food/sustenance crops).
- Salinization of soils occurs if the irrigation is not well managed and due to the lack of drainage.
- Saturation of superficial aquifers due to the groundwater table rising causes asphyxia of plants

Degradation of the biodiversity due to aquifer overexploitation:
- The overexploitation led to the degradation of water resources in the aquifer which affected severely the ecosystem and biodiversity.
- The NWSAS aquifer domain includes 19 groundwater dependent ecosystems (of which 11 are in Tunisia) and 7 Ramsar accredited wetlands. These ecosystems include Sebkhas, national parks, wadies, springs etc.
- Modification of biodiversity: appearance of new species adapted to the conditions and disappearance of those not favoured by the current conditions
- Impacts on ecotourism from degradation of ecosystems

Degradation of vegetation cover and loss of soil quality and fertility
- Leads to degradation of the physical and chemical properties, and to reduced infiltration of rainwater and recharge aquifers, reservoirs and wetlands

Impacts due to changes in water quality:
- Intrusion of seawater (in Djeffara) or saline water from chotts to the aquifers (chott Djerid)
- Pollution of drainage waters, by the use of fertilizers and pesticides may affect the fauna and flora
- Non-treated petroleum waste by companies active in the zone of hydrocarbon exploitation probably causes contamination of aquifers (In-Aménas, Hassi Messaoud)
- Polluted water may provoke health impacts such as allergies and asthma

Ecosystems and Biodiversity

Extrem phenomena
- It is expected that extreme climatic events such as droughts, heat waves and sirocco could increase both frequency and intensity in the coming years.
- Such extreme events will have serious consequences for water resources and likely increase the risks on different water uses and water demands in the region (i.e. drinking water and irrigation water).
- Degradation of ecosystems due to pressures from human activities affect water cycle processes and water availability (and ecosystem services)

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**Ecosystems and Biodiversity**

**Negative impacts**
- Reduced diversification in cultivation: monocultures, single varieties; the traditional 3-level structure lost at many oases (1 – palm trees; 2 – bushes; 3 – ground level)
- Vulnerability to climate change. Extreme climate phenomena (i.e. droughts) are predicted to have negative consequences on agriculture.
- Protection of biodiversity outside oases may limit agriculture
- Ill-adapted species get introduced for cultivation (not good productivity)
- Degradation of natural spring reduces the freshwater available water for irrigation.

**Positive effects**
- Healthy ecosystems and biodiversity improve resilience to climate change
- Co-existence of several plant species has positive impacts on production

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**Land / Agriculture**

**Agricultural and land use practices aggravate land degradation**
- Among the reasons: Lack of protection of oases, use of inappropriate irrigation techniques, and a lack of or inefficient functioning of drainage systems
- The changes in land use and negative impacts from agricultural practices result in a loss of soil fertility, degrade the vegetation cover. In some areas, the degradation can aggravate to desertification which has impacts on the biophysical, biogeochemical processes and the hydrological cycle of the aquifer area. Which area accordingly causing loss in habitat, alteration of ecosystem, reducing plant cover and carbon in the soil. Land silting reduces space for socio-economic activities
- Fragmentation of land and the oases as well as urbanization of the oases also occurs
- Inappropriate use of fertilizers causes pollution risks; a lack of proper integration of animal husbandry is a lost nutrient source opportunity

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**How does the Land Use affect the Ecosystem Services?**

**What impacts have the Ecosystems and biodiversity on the Land Use?**
How does the Land/Agriculture affect the Water sector?

**Degradation of water resources due to heavy exploitation:**
- The groundwater recharge is estimated to be 1.4 billion m³/year, however the use of the NWSAS increased significantly from 1 billion m³/year in 1980 to reach about 2.7 - 2.8 billion m³/year in 2012.
- The water use distribution as follows: Algeria with 2 Billion, Tunisia : 0.3 billion in Tunisia, and Libya 0.5 billion m³/year. The respective distribution of surface area: Algeria - 700 000 Km², Tunisia - 80 000 km², Libya 220 000 km².
- This heavy abstraction, mainly for agricultural activities, has caused stress on the water resources and increased the risk of drying up of outlets and depletion of natural springs as a results of lowering water tables.

**High water waste due to inefficient irrigation systems:**
- Irrigation of agricultural land in the NWSAS is a main source of wasting water due to in efficient irrigation systems.
- According to OSS (2012): the total irrigated area in the NWSAS aquifer is about 270,000 ha (202,000 ha in Algerian part- 30,000 ha in the Libyan part and 38,000 ha in the Tunisian part). Expected to grow to 40,000 ha by 2020.
- The average efficiency of irrigation system in the region is 42.4% and can go up to 60% at best in some parts of the region.
- In terms of volume, the estimated losses reach about 2500 m³/ha.

What impacts has the Water sector on the Land/Agriculture?

**Soil salinization due to low water quality and inappropriate irrigation techniques :**
- The salinization of irrigation water is increasing in the region deteriorating land quality.
- The estimate of soil resources loss reached the level of 4,300 ha per year over an area of 170,000 ha in Algeria, and 300 ha per year over an area of 40,000 ha in Tunisia.
- The population in the NWSAS region is highly dependent on agriculture, the increase in water salinity and soil degradation causes decline in agriculture yield and farmers revenues.
- Inefficient / Lack of drainage networks causes soils salinization and lands degradation.

**Low water quality impacts agriculture production:**
- Decrease of the yields due to the water quality
- Water with high degree of mineralization not well adapted some cultivation. Abandonment of certain crops
LESONS LEARNED FROM THE PROJECT

Challenging to engage relevant sectors and key actors (strong interests, lack of awareness/communication)

Process design and communication throughout the process is crucial

Appropriate institutional frameworks are key not only for carrying out the assessment but also for fostering follow-up actions

Many obstacles to implement solutions, first of all availability of resources

Need for fit-for-purpose analytical nexus tools and better availability of data

Potential of the nexus perspective to add value to other processes e.g. GEF projects merits further attention
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<tr>
<td>20,311 km²</td>
<td>11,700 km²</td>
<td>97,700 km²</td>
<td>410,000 km²</td>
<td>3,400 km²</td>
<td>20,320 km²</td>
<td>1,000,000 km²</td>
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<tr>
<td>River length</td>
<td>391 km</td>
<td>945 km</td>
<td>3,019 km</td>
<td>140 km</td>
<td>346 km</td>
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<tr>
<td>Countries sharing</td>
<td>Azerbaijan, Georgia</td>
<td>Bosnia and Herzegovina, Croatia, Montenegro, Serbia, Slovenia, (Albania)</td>
<td>Kazakhstan, Kyrgyzstan, Tajikistan, Uzbekistan</td>
<td>Italy, Slovenia</td>
<td>Bosnia and Herzegovina, Montenegro, Serbia, (Albania)</td>
<td>Algeria, Libya, Tunisia</td>
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<tr>
<td>Climate</td>
<td>Warm, temperate</td>
<td>Warm, temperate</td>
<td>Arid/semi-arid</td>
<td>Mediterranean-influenced, partly humid</td>
<td>Warm, temperate</td>
<td>Arid/hyper-arid</td>
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<td>Main nexus storylines</td>
<td>Lack of access to affordable energy aggravates deforestation, which increases the exposure to flash floods, erosion and landslides.</td>
<td>Energy production in the countries depends on water availability in the Sava River Basin.</td>
<td>Energy and food insecurity are drivers for conflicting seasonal water uses and make countries prioritize self-sufficiency over cooperation.</td>
<td>Diverse ecosystem services need protection.</td>
<td>Water-flow regulation for power generation is suboptimal and has impacts on flood and drought risks.</td>
<td>Heavy and unsustainable use of the aquifer.</td>
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<td>A poor state and inadequate maintenance of irrigation systems aggravates the impact of flash floods on the loss of fertile soil and damage to settlements.</td>
<td>Targets for renewables and climate mitigation push countries to develop more hydropower.</td>
<td>This aggravates the current situation of suboptimal use of resources.</td>
<td>Water-flow regulation for power generation is suboptimal and has impacts on flood and drought risks.</td>
<td>Hydropowering affects biodiversity and water availability for irrigation. Irrigation is reduced with water-efficient technology.</td>
<td>Heavy use of irrigation with high losses.</td>
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<td>There are environmental concerns about dam construction in environmentally sensitive areas.</td>
<td>Water-flow regulation for power generation is suboptimal and has impacts on flood and drought risks.</td>
<td>Groundwater abstraction for irrigation needs energy and may cause seawater intrusion.</td>
<td>Application of environmental flows is challenging.</td>
<td>Rural development is hampered by low agricultural productivity and a lack of infrastructure.</td>
<td>Water and soil salinization from irrigation and inadequate management of drainage.</td>
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<td>- Water-flow regulation for hydropower is suboptimal and has impact on floods and drought risks</td>
<td>- Heavy biomass use drives forest degradation and loss of forest ecosystems</td>
<td>- Developments of agriculture and trade need to be understood in relation to resource use.</td>
<td>- Water management (pumping from higher depth, treatment etc.) requires sustainable energy solutions.</td>
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<td>- Water quality is declining because pressures go unchecked (solid waste, wastewater).</td>
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