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التعاون في خزان الحجر الرملي النوبي

Nubian Sandstone Aquifer Cooperation

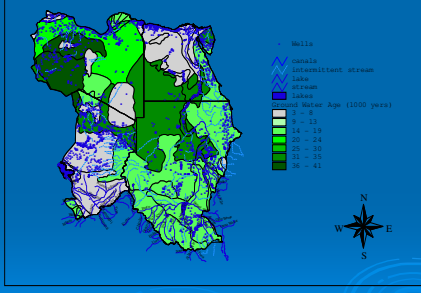
Cairo, Egypt, November 29, 2017

Khaled M. AbuZeid, PhD, PE.
 Regional Water Director, CEDARE
 أ.د. خالد محمود أبو زيد
 المدير الإقليمي لإدارة الموارد المائية بمنظمة سيداري

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The Nubian Sandstone Aquifer

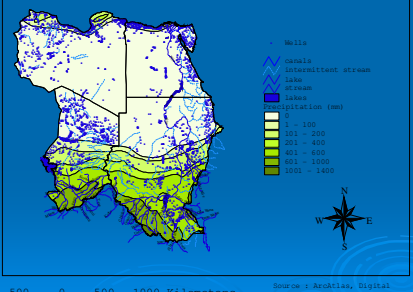


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Non-Renewable Groundwater

Petrified Trees = Old Water



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مشروع النهر الصناعي في ليبيا




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النهر الصناعي العظيم




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Sustaining Tourism & Recreation Swimming in Groundwater Springs in Egypt



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Sustaining Agriculture Siwa Oasis in the Western Desert of Egypt



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Sustaining Ecosystems



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Regional Strategy for the Utilization of the Nubian Sandstone Groundwater Aquifer



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DEVELOPMENT OF A REGIONAL STRATEGY

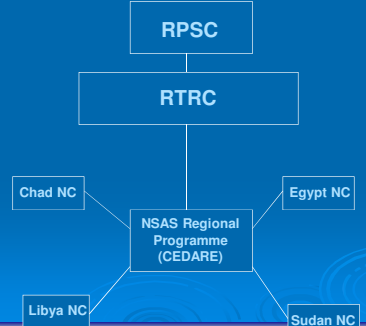
Environmentally and socially sustainable utilization and management of a vast common property resource by:

- creating an **enabling environment**
- **capacity-building** of national institutions in 4 countries
- formulating a **regional groundwater development plan**
- integrating **socio-economic dimensions**

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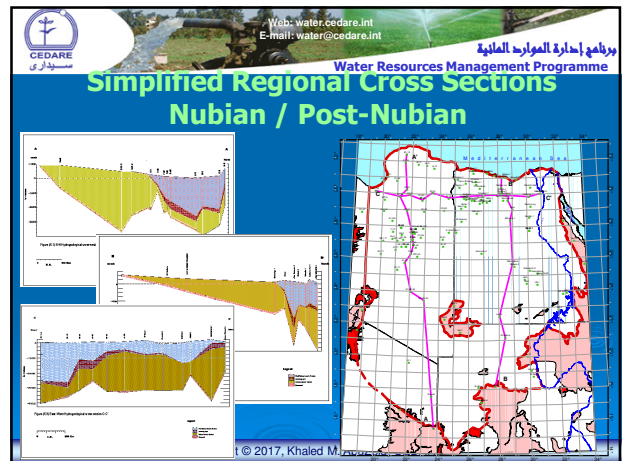
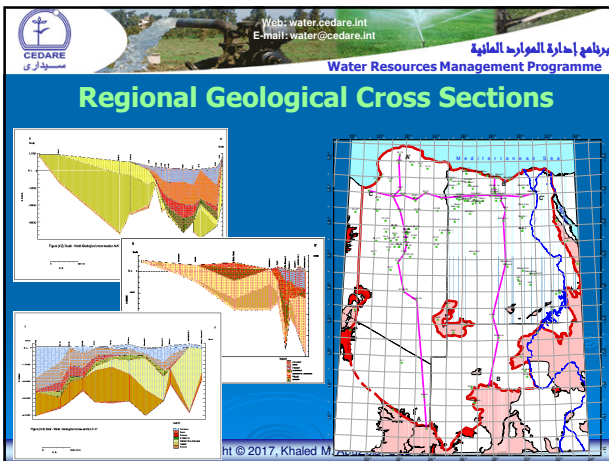
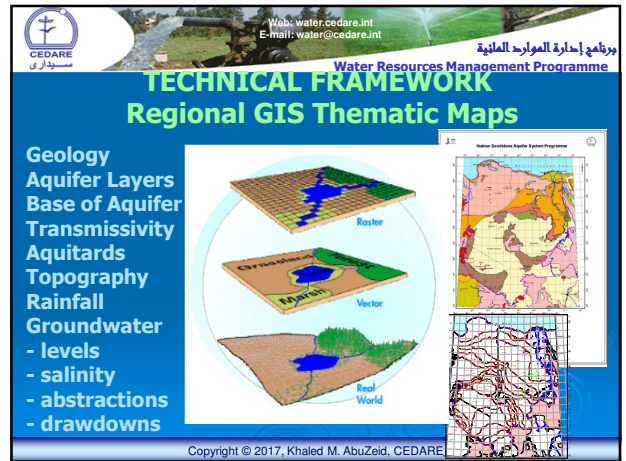
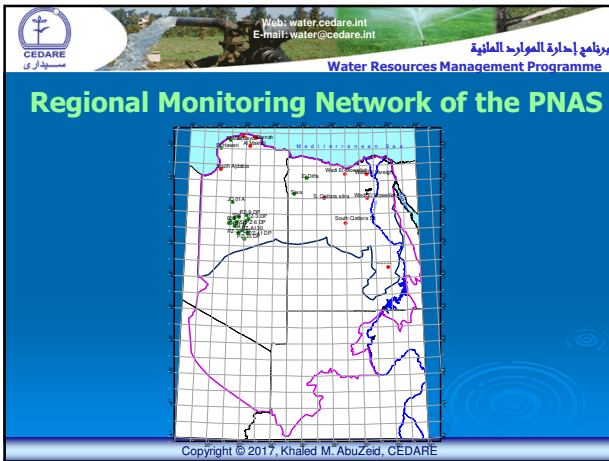
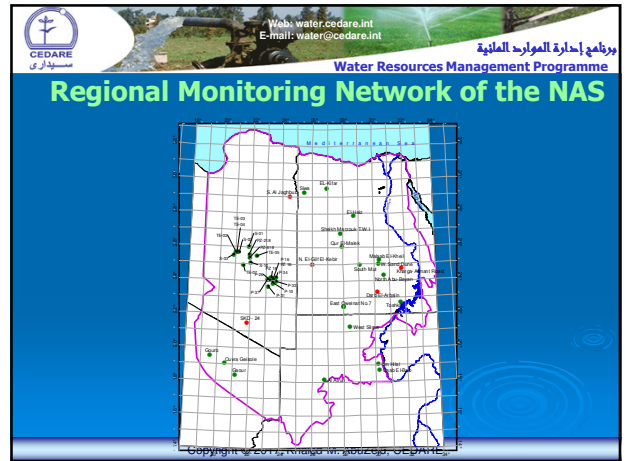
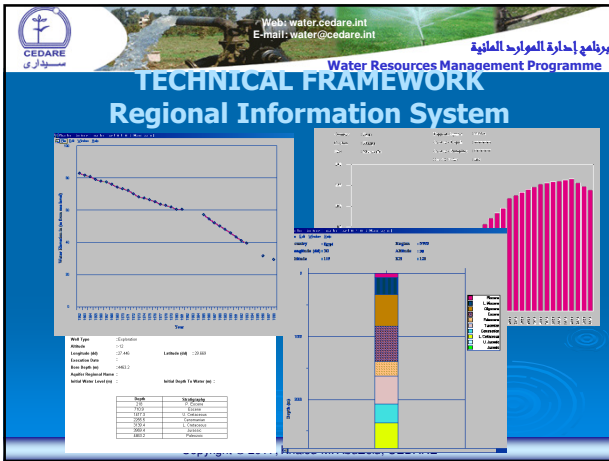
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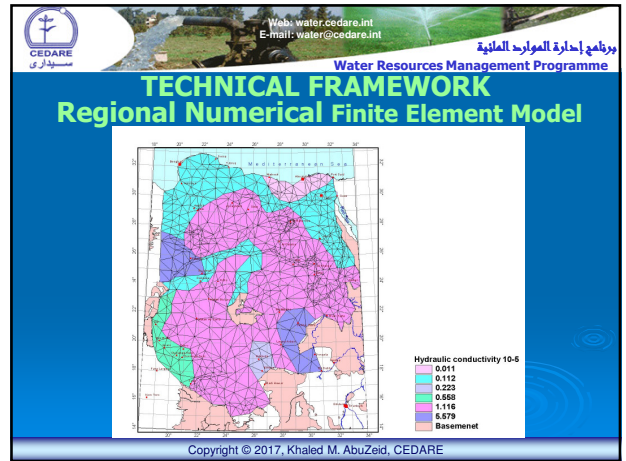
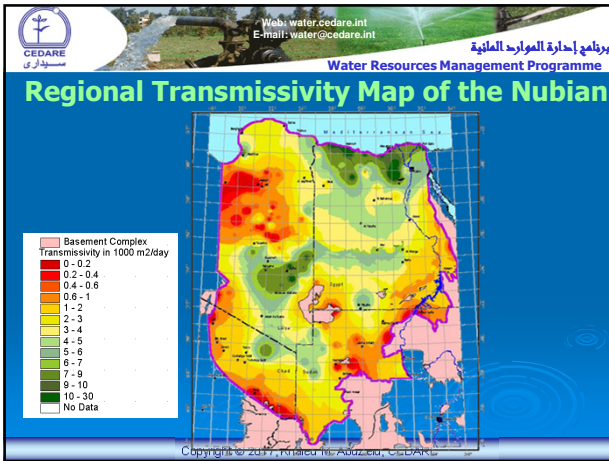



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    graph TD
      RPSC[RPSC] --> RTRC[RTRC]
      RTRC --> NSAS[NSAS Regional Programme (CEDARE)]
      NSAS --> ChadNC[Chad NC]
      NSAS --> EgyptNC[Egypt NC]
      NSAS --> LibyaNC[Libya NC]
      NSAS --> SudanNC[Sudan NC]
  
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- ## USE OF AQUIFER NUMERICAL MODEL
- assess current regional impacts
 - assess impacts of future expansion
 - recommend strategies to minimise negative impacts (transboundary conflicts, optimize yields and drawdowns, protect groundwater quality)
 - provide boundary conditions for local models
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- ## REGIONAL COOPERATION AGREEMENT
- regular monitoring of Nubian Aquifer through a regional network including:
 - annual abstraction for all production sites
 - EC measurements for each abstraction site (with complete chemical analysis after major changes)
 - aquifer water-level measurements at specified locations
 - international sharing of data generated by the monitoring programme
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- Storing and documenting the different data, covering all fields relevant to the Nubian Sandstone Aquifer System.
- Processing, analysis and display of basic data
- Preparing the input parameters which are needed for the modeling at different scales, and calibration of the groundwater model and comparison of the results of modeling with other data for planning and decision making.
- Provide an easy link between the participating countries through a system ensuring the exchange and flow of information.


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CEDARE Nubian Agreement 2



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- Yearly extraction in every extraction site, specifying geographical location and number of producing wells and springs in each site.
- Representative Electrical Conductivity measurements (EC), taken once a year in each extraction site, followed by a complete chemical analysis if drastic changes in salinity is observed.
- Water level measurements taken twice a year in the locations shown in the attached maps and tables. The proposed monitoring network is subject to changes upon the feedback of the National Coordinators of the concerned countries.

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Nubian SAP Agreement





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The Vision for the NSAS

- To assure rational and equitable management of the NSAS for sustainable socio-economic development and the protection of biodiversity and land resources whilst ensuring no detrimental effects on the shared aquifer countries.

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- Section 2: Description and importance of the NSAS- presents a brief summary of the natural and human resources of the region and summarises the socio-economic pressures on the NSAS.
- Section 3: Approach adopted to SADA/SAP preparation- the preparation of the SADA and SAP has followed the GEF best practices in identifying and prioritising the key transboundary issues and their causes, leading to a common vision for the future use and protection of the NSAS.
- Section 4: Strategy for protecting the water resources and ecosystem of the NSAS- presents the agreed management principles for managing the shared aquifer and defines water resources and ecosystem objectives that though the defined management actions will ensure that the Joint Authority and national institutions are better resourced (human capacity and facilities) to address the transboundary issues.

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- Section 5: Legal and institutional framework for SAP implementation- provides an analysis on the Joint Authority's agreements and assesses the compatibility of these to implement the SAP
- Section 6: Monitoring and evaluation of SAP implementation- following best practices identified in GEF projects, process, stress reduction and ecosystem/socio-economic indicators are identified that could be utilised by the Joint Authority (and National agencies) to monitor the progress of SAP implementation.
- Section 7: Next steps- this SAP provides an overview of actions that are needed at the regional level or are shared by the NSAS countries. However there is a future need to develop detailed National Action Plans to implement national actions. In addition more details and full cost-benefit assessments are required on the Management Actions (Annex 1) to assess the efficacy of the various options and to identify sources and level of finances required.

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Nubian Aquifer State of the Water (SOW) Reports



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Aquifer SOW Indicators


Whole Aquifer Indicators	Units
Water & Availability	
Internal Renewable Groundwater (IRG)	BCM/Year
Total Exploitable Non-Renewable Ground Water Resources	BCM/Year
Country Area Under the Aquifer	km ² (Mapped)
Potential Volume for Each Country	BCM
Inflow to Each Country	BCM/Year
Outflow from Each Country	BCM/Year
Piezometric Water Head	Meters (Mapped)
Depth from water to Basement/ Confining Layer (Unconfined Aquifer)	Meters (Mapped)
Depth to Water Table (Unconfined Aquifer)	Meters (Mapped)
Depth to Piezometric Surface (Confined Aquifer)	Meters (Mapped)
Depth to the bottom of confined layer (Confined aquifer)	Meters (Mapped)
Water & Uses	
Withdrawals from Blue Greenwater	BCM/Year
Annual Withdrawals from Exploitable Non-Renewable Groundwater	BCM/Year
Accumulative Withdrawals from Exploitable Non-Renewable Groundwater	BCM/Year
Extraction Zones of The Aquifer	Numbers/ Mapped
Annually Observed Drawdown (Average & Mapped)	Meters
Water & Land Use Change	
Total Irrigated Agricultural Land	ha
Total Rainfed Agricultural Land	ha
Total Pasture Area	ha
Total Forests Area	ha
Urban Encroachment on Agricultural Land	ha/Year
The Decrease in Groundwater Recharge caused by Urban Encroachment	BCM/Year

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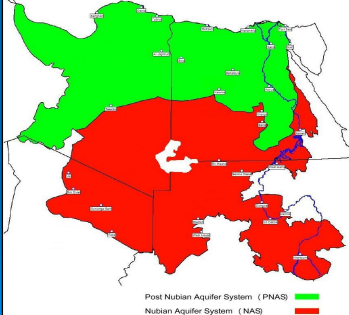

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Whole Aquifer Indicators	Units
Water & Population	
Total Aquifer bound and dependent population	Number
Internal Renewable Water Resources Per Capita	CM/Capita
Renewable Water Resources Per Capita	CM/Capita
Renewable Water Resources per Capita (for the whole country population)	CM/Capita
Water & Quality	
Concentration of Chloride in The Aquifers Domain	PPM/ Mapped
Nitrate Concentration	PPM/ Mapped
Sulfate Concentration	PPM/ Mapped
Total Dissolved Solids	PPM/ Mapped
Fluoride Concentration	PPM/ Mapped
Water & Ecosystems	
Number of Greenwater Based Ecosystems	Number
Number of RAMSAR Wetlands in The Aquifer Domain	Number
Number of Endangered Species	Number
Number of Invasive Species	Number
Water & Governance	
Well Pans (Yes/No)	Yes/No
Well Permits to date	CM/Capita
Volume of Groundwater Rights	BCM/Year
Unauthorized Groundwater Abstractions	BCM/Year
Water & Politics	
Dependency Ratio of Each Riparian Country	%
Bilateral / Multilateral Agreements & Cooperation Protocol or MOUs between Riparians	Number
Presence of Other Transboundary Bodies in Riparian Countries	Number
Presence of other Water Resources	BCM/Year

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Geographical Extent of NAS & PNAS



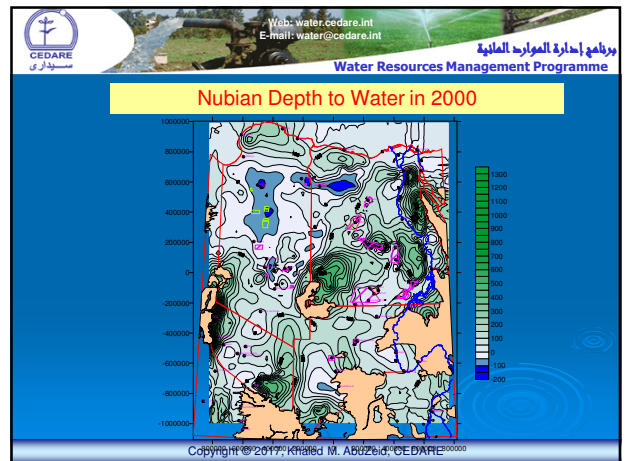
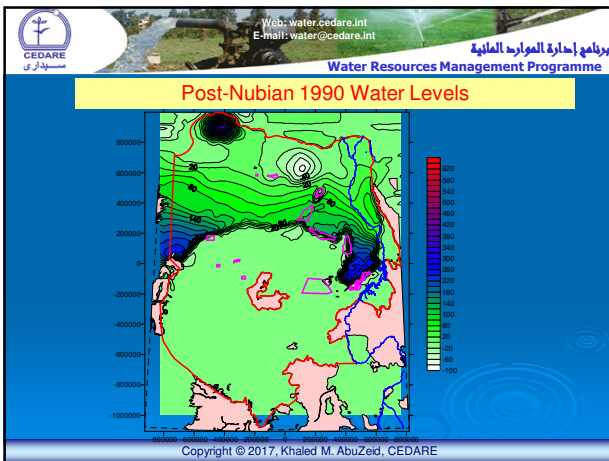
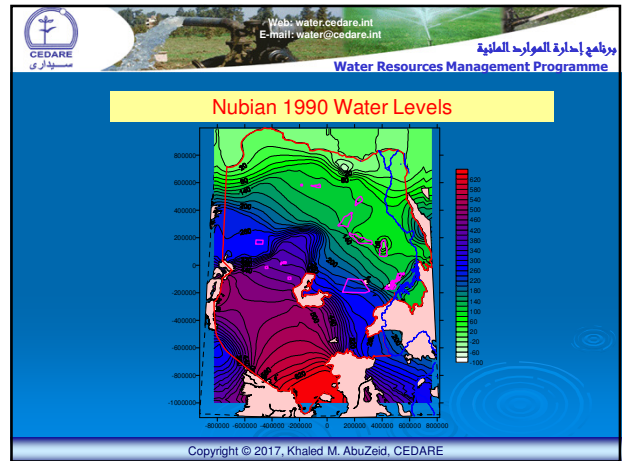
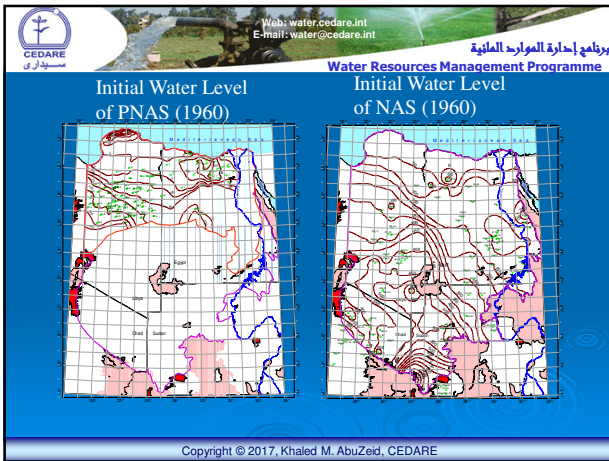
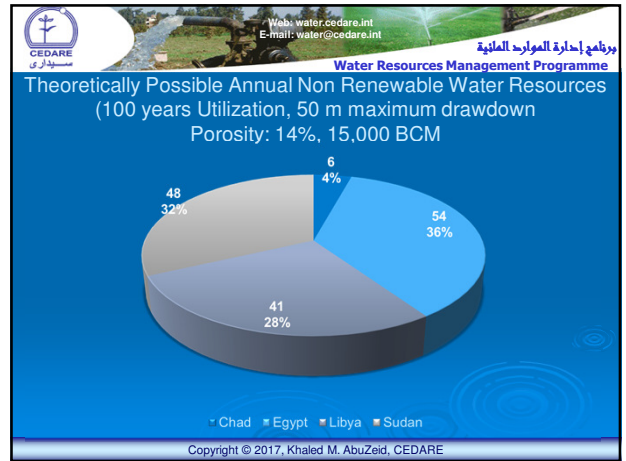
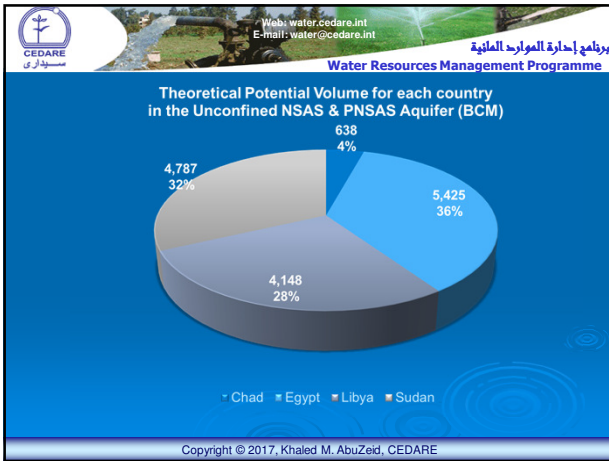
Post Nubian Aquifer System (PNAS) ■
 Nubian Aquifer System (NAS) ■

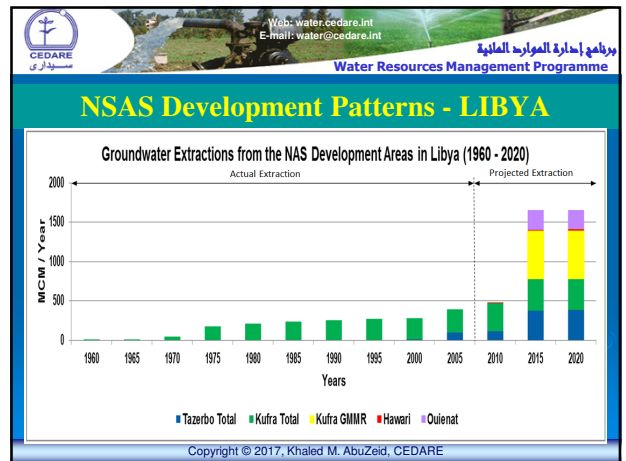
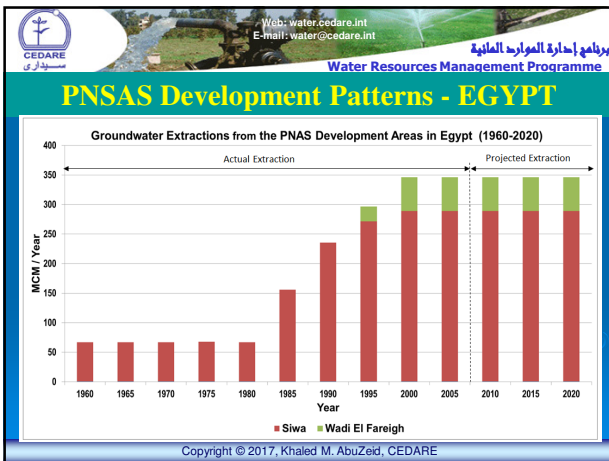
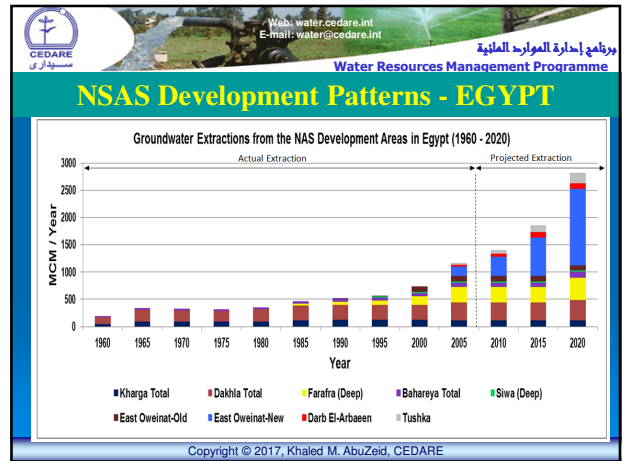
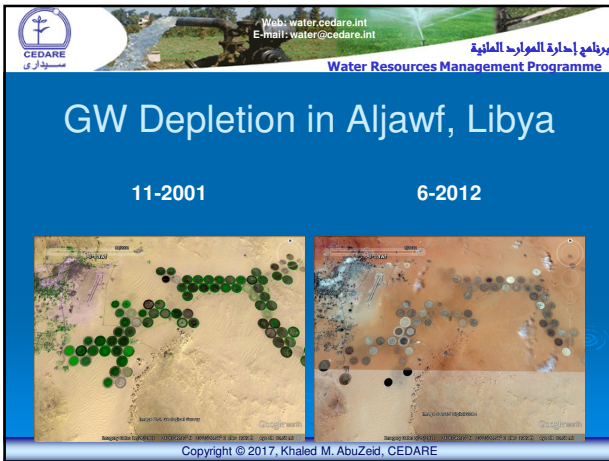
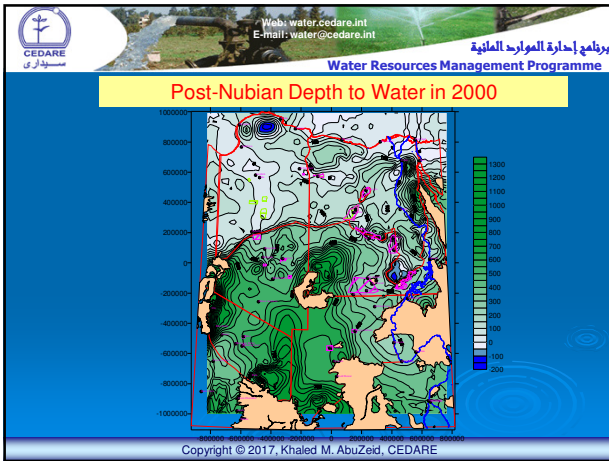
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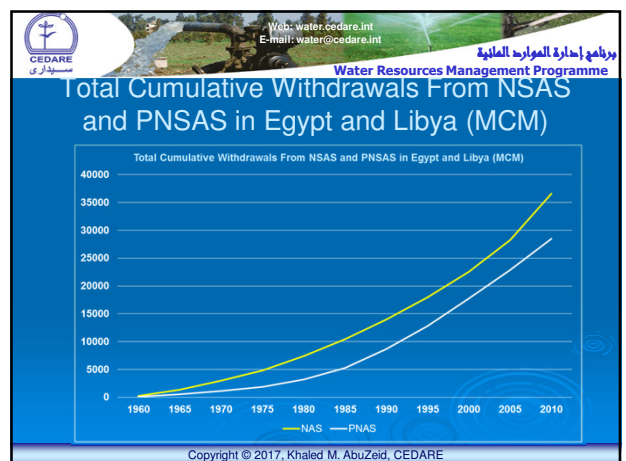
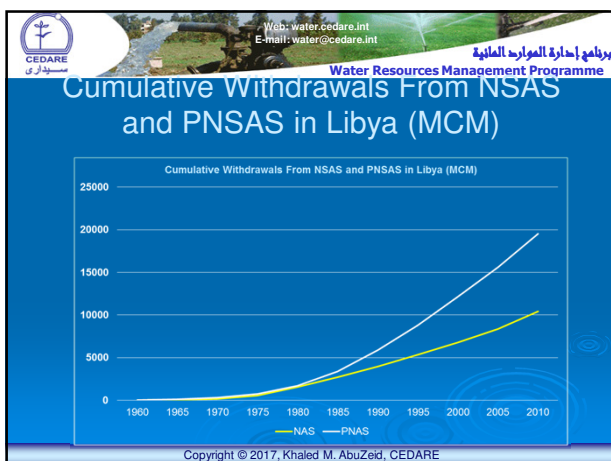
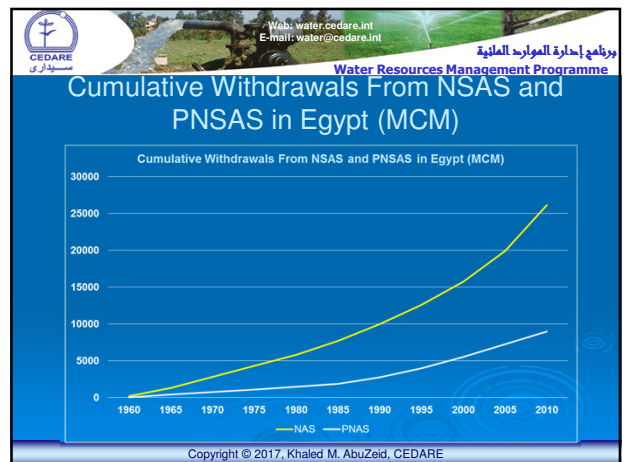
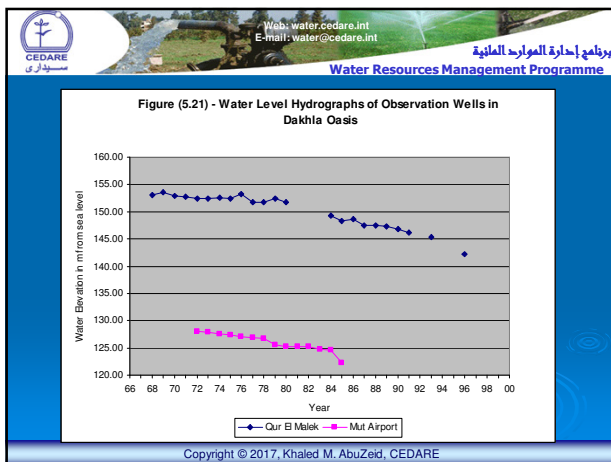
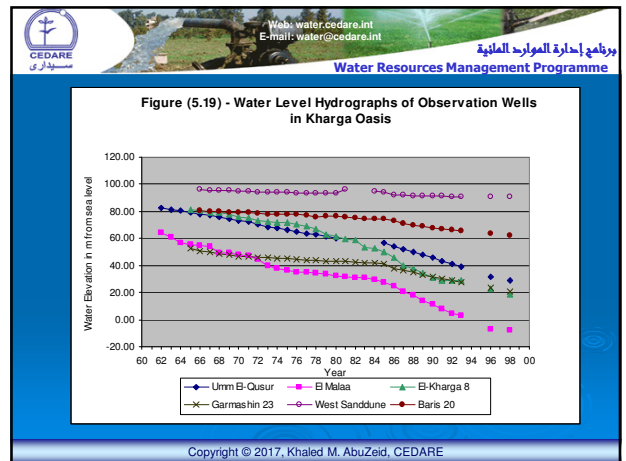
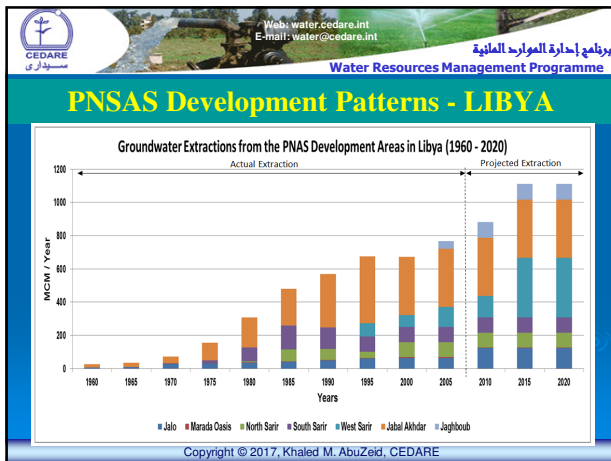

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1. WATER & AVAILABILITY

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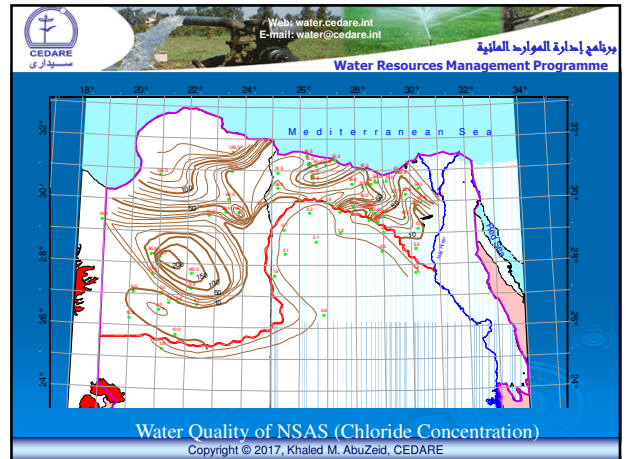





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WATER & QUALITY

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WATER & ECOSYSTEMS

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SDG 6.5.2 Alternative

- **I-15-5- Ratio of Riparian Countries with Agreements to Riparian Countries:** The number of riparian countries, with water Benefit Sharing and/or Water Cooperation bilateral and/or multilateral agreements with the concerned country, as a percentage of the number of countries that are riparians to existing transboundary aquifers or river basins shared with that country. (riparian countries may be recounted as many times as the number of different transboundary aquifer/river basins they may be sharing with the concerned country)

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