Adapting to climate change and reducing the risk of exposure to natural disasters

Ihab Jnad

المركز العربي لدراسات المناطق الجافه و الأراضي القاحلة (ACSAD)
RICCAR Partnerships

Implementing Partners

- United Nations ESCWA
- UN Environment
- WMO
- The League of Arab States
- LAS
- Collaborating Research Institutes
  - Center of Excellence for Climate Change Research/ King Abdulaziz University (CECCR/KAU) - KSA
  - King Abdullah University of Science and Technology (KAUST) - KSA
  - Climate Services Center 2.0 (CS2.0) – Germany
  - CORDEX/MENA housed at The Cyprus Institute
Mean change in temperature

RCP 4.5

1986-2005

2046-2065

2081-2100

RCP 8.5

1986-2005

2046-2065

2081-2100

Mean change in temperature:
- RCP 4.5:
  - 1986-2005: +1.5 °C
  - 2046-2065: +4 °C
  - 2081-2100: +4 °C
- RCP 8.5:
  - 1986-2005: +2 °C
  - 2046-2065: +4 °C
  - 2081-2100: +4 °C
Mean change in precipitation
## Extreme events indices

<table>
<thead>
<tr>
<th>Extreme temperature indices</th>
<th>Extreme precipitation indices</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Index</strong></td>
<td><strong>Full name</strong></td>
</tr>
<tr>
<td>SU</td>
<td>Number of summer days</td>
</tr>
<tr>
<td>SU35</td>
<td>Number of hot days</td>
</tr>
<tr>
<td>SU40</td>
<td>Number of very hot days</td>
</tr>
<tr>
<td></td>
<td>Number of tropical nights</td>
</tr>
<tr>
<td>TR</td>
<td>Simple precipitation intensity index</td>
</tr>
<tr>
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</tr>
</tbody>
</table>
Temperature – “Hot” days (>35°C)
Intense Rainfall – SDII
Mean change in annual runoff

RICCAR

Regional Initiative for the Assessment of Climate Change impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region

RCP 8.5

HYPE MODEL

1986-2005

2046-2065

2081-2100

VIC MODEL

Local runoff [mm/month]

Local runoff, abs. diff. [mm/month]
Number of extreme flood exceed 90\textsuperscript{th} percentile of maximum daily value

Scenario RCP4.5  Scenario RCP8.5
Mean ensemble change values for 100-year return period flood

**Medjerda River Basin**

**Nahr el Kabir Al-Junoubi** basin

**Wadi Dayqah Basin**
Overall trend of predicted SPI

Drought indices

SPI (6 month) Values_Medjerda - RCP4.5

SPI (6 month) Values_Medjerda - RCP8.5
<table>
<thead>
<tr>
<th>SECTORS</th>
<th>SUBSECTORS</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water</td>
<td>Water availability</td>
</tr>
</tbody>
</table>
| Biodiversity and Ecosystems | Area covered by forests  
| | Area covered by wetlands |
| Agriculture | Water available for crops  
| | Water available for livestock |
| Infrastructure and Human Settlements | Inland flooding area |
| People | Water available for drinking  
| | Health conditions due to heat stress  
| | Employment rate for the agricultural sector |
**Scenario**

<table>
<thead>
<tr>
<th>Scenario</th>
<th>Vulnerability (% of study area)</th>
</tr>
</thead>
<tbody>
<tr>
<td>RCP 4.5 Mid-century</td>
<td>Low 0%  Moderate 57%  High 43%</td>
</tr>
<tr>
<td>RCP 8.5 Mid-century</td>
<td>Low 0%  Moderate 48%  High 52%</td>
</tr>
<tr>
<td>RCP 4.5 End-century</td>
<td>Low 0%  Moderate 52%  High 48%</td>
</tr>
<tr>
<td>RCP 8.5 End-century</td>
<td>Low 0%  Moderate 43%  High 57%</td>
</tr>
</tbody>
</table>

**Areas with highest vulnerability:**
- Upper Nile Valley
- SW Arabian Peninsula
- Northern Horn of Africa

**Areas with lowest vulnerability:**
- Tigris-Euphrates Basin
- Lower Nile Valley and Delta

**Water Availability Vulnerability**
(RCP8.5 End-century)
Areas with highest vulnerability:
- Sub-Saharan Africa
- Horn of Africa
- SW Arabian Peninsula

Areas with lowest vulnerability:
- Mediterranean coast of the Magreb
- Selected areas Levant
- Tigris-Euphrates basin
- Central eastern Arabian Desert
Areas with highest vulnerability:
- Sub-Saharan Africa
- Levant
- Upper Tigris-Euphrates Basin
- Al Hajar Mountains
- Horn of Africa
- SW Arabian Peninsula

Areas with lowest vulnerability:
- Atlas Mountains and Plains
- Central Arabian Desert

### Water Available for Livestock Vulnerability (RCP8.5 End-century)

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<thead>
<tr>
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<th>Vulnerability (% of study area)</th>
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</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
</tr>
<tr>
<td>RCP 4.5 Mid-century</td>
<td>0%</td>
</tr>
<tr>
<td>RCP 8.5 Mid-century</td>
<td>0%</td>
</tr>
<tr>
<td>RCP 4.5 End-century</td>
<td>0%</td>
</tr>
<tr>
<td>RCP 8.5 End-century</td>
<td>0%</td>
</tr>
</tbody>
</table>
**Scenario**

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</thead>
<tbody>
<tr>
<td></td>
<td>Low</td>
<td>Moderate</td>
<td>High</td>
</tr>
<tr>
<td>RCP 4.5 Mid-century</td>
<td>2%</td>
<td>94%</td>
<td>4%</td>
</tr>
<tr>
<td>RCP 8.5 Mid-century</td>
<td>3%</td>
<td>93%</td>
<td>4%</td>
</tr>
<tr>
<td>RCP 4.5 End-century</td>
<td>2%</td>
<td>94%</td>
<td>4%</td>
</tr>
<tr>
<td>RCP 8.5 End-century</td>
<td>4%</td>
<td>89%</td>
<td>7%</td>
</tr>
</tbody>
</table>

**Areas with highest vulnerability:**
- All coastal areas

**Areas with lowest vulnerability:**
- Sub-Saharan Africa

**Inland Flooding Area Vulnerability**
(RCP8.5 End-century)
Proposed adaptation measures
Using rainwater harvesting measures for flood management

Al-Qaa- Lebanon
Water harvesting for supplementary irrigation and animal drinking

عين البنية - بعلبك - لبنان

بطموش - اللاذقيه - سوريا

اهمج - جبيل - لبنان

الشيحة - حماه - سوريا
Water harvesting for rangeland rehabilitation
New crop varieties

• use crop varieties better suited to new climate conditions (e.g. more resilient to heat and drought)
ACSAD developed wheat and barely varieties resilient to heat and drought.
Apply conservation agriculture:

- Minimum tillage + land cover + crop rotation

- CA increase soil moisture and OM content
تم تسجيل زيادة في إنتاج القمح بحوالي (30-10%) بتطبيق الزراعة الحافظة مقارنة مع الزراعة التقليدية، مع زيادة في كفاءة استعمال مياه الأمطار.

كفاءة استعمال مياه الأمطار (كم/مم) في إنتاج القمح في محافظة الحسكة

متوسط إنتاجية محصول القمح في محافظة الحسكة

**Series 1, الزراعة الحافظة:**
- كفاءة استعمال مياه الأمطار: 4.26
- متوسط إنتاجية القمح: 1580 كغ/هكتار

**Series 1, الزراعة التقليدية:**
- كفاءة استعمال مياه الأمطار: 3.14
- متوسط إنتاجية القمح: 1420 كغ/هكتار
Proposed adaptation measures

- adjust **sowing dates** according to temperature and rainfall patterns,
Proposed adaptation measures

• Apply supplementary irrigation
Figure 8. Impact of Supplemental Irrigation on Rainfed Wheat Yield

Yield (ton/hectare)

Total annual rainfall

- 234 mm: 183 mm Supplementary Irrigation, 50 mm Rainfall
- 316 mm: 120 mm Supplementary Irrigation, 200 mm Rainfall
- 504 mm: 75 mm Supplementary Irrigation, 429 mm Rainfall
Thanks