

Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR): Overview of RICCAR for Informing the water-energy interlinkages

Economic and Social Commission for Western Asia



**UNITED NATIONS** 



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EGM on Enhancing capacity building addressing water and energy interlinkages for sustainable development in the Arab Region (Beirut, 25-26 June 2019)



# Intergovernmental mandates calling for & supporting climate change assessment in the Arab Region







Objective: To assess the impact of climate change on freshwater resources in the Arab Region through a consultative and integrated regional initiative that seeks to identify the socio-economic and environmental vulnerability caused by climate change impacts on water resources based on regional specificities.

Purpose: To provide a <u>common platform for assessing, addressing</u> <u>and informing response</u> to climate change impacts on freshwater resources in the Arab region by serving as the basis for <u>dialogue</u>, <u>priority setting</u> and <u>policy formulation</u> on <u>climate change at the</u> <u>regional level</u>.





### **Partnerships**







Cairo Office









United Nations Educational, Scientific and Cultural Organization









SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY



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### **RICCAR: Four Pillars of Work**

#### **REGIONAL KNOWLEDGE HUB**



**AWARENESS RAISING & INFORMATION DISSEMINATION** 

### **Integrated Assessment**



GCM: Global Climate Modelling RCM: Regional Climate Modelling RHM: Regional Hydrological Modeling VA: Vulnerability Assessment IM: Integrated Mapping

### **MENA/Arab Domain**



## **IPCC regional domains**

nerability in the Arab Regio



From R.K Kolli, WMO RICCAR EGM #2 (Beirut, 2010)<sub>8</sub>



## **IPCC regional domains**



#### Figure AI.3: Overview of the SREX, ocean and polar regions used.

SREX: Special Report on Managing the Risks of Extreme Events and Disasters to Advance Climate Change Adaptation

IPCC Assessment Report 5 – WGI: Annex I Draft: 30 September 2013

### **MENA/Arab Domain**

ate Change Impacts on Water Re



#### **Representative Concentration Pathways (RCPs)** As first represented in IPCC AR5 Projections



Graph adapted from: Meinshausen et al.,2010

### Regional Climate Modeling & Hydrological Modeling





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#### ARAB CLIMATE CHANGE ASSESSMENT REPORT

**TECHNICAL ANNEX** 

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



### **RICCAR Publication Series**



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**TECHNICAL REPORTS** 

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# Temperature in the Arab region is increasing and is expected to continue to increase until the end of the century.

RCP 4.5



**RCP 8.5** 



2046-2065

2081-2100





Precipitation trends are largely decreasing across the Arab region until the end of the century, though limited areas expected to exhibit an increase in the intensity and volume of precipitation.

#### RCP 4.5



#### **RCP 8.5**















### **Extreme events indices**

Extreme temperature indices		Extreme precipitation indices		
Index	Full name	Index	Full name	
SU	Number of summer days	CDD	Maximum length of dry spell	
SU35	Number of hot days	CWD	Maximum length of wet spell	
SU40	Number of very hot days	R10	Annual count of 10 mm precipitation days	
TR	Number of tropical nights	R20	Annual count of 20 mm precipitation days	
Has important implications for Energy & Water Demand for cooling, water pumping, grid management, assessing flood risks		SDII	Simple precipitation intensity index	



### Maximum length of dry spell (CDD)





#### **RCP 8.5**





\* The "All storms" hazard includes, in order of descending frequency: snowstorms, electric storms, storms, hailstorms, windstorms and sandstorms.

Note: Figures 8,9 and 10 are based on Data provided by UNISDR, 2017a, based on Desinventar Consolidated Database, 2015



### **Regional Hydrological Modeling**



GCM and RCM outputs need to be **Bias Corrected** to be usable for Hydrological Modeling & as inputs for Agricultural Models, Drought & Flood Analysis



#### Case Studies draw on RHM outputs







Health

Green Sectors Extreme Events



**RCP 4.5** 

## Mean change in annual runoff

2 Models; 2 RCPs



VIC MODEL



Comparison between 2 hydrological models based on SMHI modeling outputs: Hydrological Predictions for the Environment (HYPE) and Variable Infiltration Capacity (VIC)



## Mean change in annual runoff

RCP 8.5



VIC MODEL





# Mean change in annual evapotranspiration

RCP 4.5



VIC MODEL





# Mean change in annual evapotranspiration

RCP 8.5

#### HYPE MODEL



VIC MODEL





### Locations of subdomains for hydrological analysis





# Mean change in runoff and evapotranspiration

### Moroccan Highlands (MH)





## **Vulnerability Assessment**

~	SECTORS	SUBSECTORS	
	Water	Water availability	
₽£3	Biodiversity and Ecosystems	Area covered by forests Area covered by wetlands	integrated Veterrability Assessment And Segmed Applications
-00	Agriculture	Water available for crops Water available for livestock	Plant. 🛞 🚆
	Infrastructure and Human Settlements	Inland flooding area	VA Methodological Note
	People	Water available for drinking Health conditions due to heat stress Employment rate for the agricultural sector	



# Vulnerability of Water Availability to Climate Change

### **Vulnerability Assessment**



Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region



### Impact chain of water availability sector

SENSITIVITY (0.50)

#### EXPOSURE (0.50)





RCM

RHM

Change in temperature (0.17)
Change in precipitation (0.17)

Change in runoff (0.17)
Change in evapotranspiration (0.17)



	Percentage of study area		y area
Scenario	Low Exposure	Moderate Exposure	High Exposure
RCP 4.5 Mid-century	5%	88%	7%
RCP 8.5 Mid-century	2%	64%	33%
RCP 4.5 End-century	5%	68%	27%
RCP 8.5 End-century	3%	39%	58%

32



### **Components of vulnerability**







# Adaptive capacity

Demonstrates the socio-economic dimensions affecting the ability to respond to climate change impacts

Least Developing Countries largely have least Adaptive Capacity (supports SDG13 call for targeted support for LDCs)

\* Scale is based on comparison across 21 Arab States







## Water Availability Vulnerability





		Pe	erce	entage of study	v area
Scenario	Low Moderate High Vulnerability Vulnerability	High Vulnerability			
RCP 4.5 Mid-century		0%		57%	43%
RCP 8.5 Mid-century		0%		48%	52%
RCP 4.5 End-century		0%		52%	48%
RCP 8.5 End-century		0%		43%	57%

#### No Areas with Low Vulnerability

### Areas with highest relative vulnerability:

- Upper Nile Valley
- Southwestern Arabian Peninsula
- Northern Horn of Africa
- Areas with lowest relative vulnerability:
- Tigris-Euphrates Basin
- Lower Nile Valley, including the Nile Delta



# Vulnerability of Water Available for Agriculture



### Crop Vulnerability

### Areas with highest vulnerability:

- Upper Nile Valley
- Southwestern Arabian Peninsula

## Areas with lowest vulnerability:

- Mediterranean coast of the Maghreb,
- Parts of the Levant,
- Parts of the Tigris-Euphrates Basin
- Parts of centraleastern Arabian Desert.

# ic Vulnerability in the Arab Regio

### Livestock Vulnerability – RCP 8.5 End-Century





		P	erce	ntage of study area	
Scenario	Vu	Low Ilnerabil	ity	Moderate Vulnerability	High Vulnerability
RCP 4.5 Mid-century		0%		67%	33%
RCP 8.5 Mid-century		0%		55%	45%
RCP 4.5 End-century		0%		58%	42%
RCP 8.5 End-century		0%		46%	54%

#### No Areas with Low Vulnerability

#### Areas with highest relative vulnerability:

- Sub-Saharan Africa •
- Levant •
- African Horn •

#### Areas with lowest relative vulnerability:

- Atlas Mountains and • Plains
- Central Arabian • Desert





Scenario	Vulnerability		lity (% of study area)		
occhario	Low	Moderate	High		
RCP 4.5 Mid-century	0%	39%	61%		
RCP 8.5 Mid-century	0%	28%	72%		
RCP 4.5 End-century	0%	36%	65%		
RCP 8.5 End-century	0%	23%	77%		

Employment Rate for the Agricultural Sector Vulnerability (RCP8.5 End-century)

### Areas with highest relative vulnerability:

- Selected areas near Gulf of Aden
- Central eastern Red Sea

### Areas with lowest relative vulnerability:

• Lower Nile Valley



# **Regional Knowledge Hub**

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### Welcome to the **RICCAR REGIONAL KNOWLEDGE HUB**

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ArabCOF

Water



Climate Negotiations Agriculture

Disaster Risk Reduction

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#### The League of Arab States and ESCWA jointly held the

Regional Consultation on Climate Change for the 2019 Arab Forum for Sustainable Development (AFSD) and the High-level Political Forum (HLPF)

(Beirut, 21-22 March 2019)



### 2019 Regional Consultation on Climate Change: Outcome Document

- The meeting was attended by more than 120 officials from Arab States and senior representatives from national, regional and international institutions and civil society organizations representing a range of sectors and stakeholders in the region.
- The meeting resulted in the development of an <u>outcome</u> <u>document</u> that consolidates <u>regional views on climate</u> <u>change priorities</u> based on the experiences at the national and regional levels to advance climate action within the context of the 2030 Agenda for Sustainable Development.
- The key messages in the <u>outcome document</u> will be conveyed to the 2019 sessions of the <u>Arab Forum for</u> <u>Sustainable Development and High-level Political Forum</u> <u>on Sustainable Development</u>.

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ESCWA	27 March 2019
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Conomic and Social Commission for Western Asia (	(ESCWA)
REGIONAL CONSULTATION ON C ARAB FORUM FOR SUSTAINABLE DEVELOPM BEIRUT, 21-22	LIMATE CHANGE FOR THE 2019 IENT AND HIGH-LEVEL POLITICAL FORUM MARCH 2019
OUTCOME D	OCUMENT
The Regional Consultation on Climate Change for AFSD) and the High-level Political Forum (HLPF) was forue in Beint. The meeting was jointy organised by fornomic and Social Commission for Wateram Asia (E) on Arab States and searce representatives from nati- ociety organizations representing a range of sectors and ociety organizations representing a range of sectors and	the 2019 Arab Forum for Sustainable Development hald on 21 and 22 March 2019 at the United Nations year Leagnes of Arab States and the United Nations SCWA) and was attended by more than 120 officials mail, regional and international institutions and civil Istakaholders in the region.
The meeting highlighted the importance of the bevelopment Goals (SDGs). It also highlighted the imp bevelopment in an indivisible, integrated and inclusive rater, energy and food security in light of climate chang	climate-related and climate-dependent Sustainable ortance of pursuing the 2030 Agenda for Sustainable manner through a rights-based approach to achieving p.
The outcome document consolidates regional views apperiences at the national and regional levels to advance or Sustainable Development. The meeting resulted in the be conveyed to the 2019 sessions of the Arab Forum i forum on Sustainable Development.	on climate change priorities through the exchange of climate action within the context of the 2030 Agenda he development of the following set of key messages for Sustainable Development and High-level Political
KEY MIS	SAGES
General m	sessages
Evidence shows that air and sea temperatures in a continue to increase through the end of the century an patterns in terms of intra- and inter-memal variable affecting the frequency and intensity of extreme were to face an increase in the number of hot days, very h	the Arab region are increasing and are expected to ad maybe beyond. This is negatively impacting rainfall iity, increasing water scarcity, mixing sea levels and that events. The region is show facing and is projected not days and longer dry periods. <sup>1</sup>
The Arab region is vulnerable to climate change import to high across the region. Areas with the highest vul Africa and the south-western Arabian Peninsula. The	acts, with predicted vulnerability assessed as moderate inerability in the region are in the Sahel, the Horn of a Nile Delta of Egypt, the Levant and coastal areas are
The average temperature in the Ando region is projected to increase	by 1.9°C by and-cantary compared to the reference period (1986- period under the moderate emissions scenario (2021 4.5) and he

### **2019 Arab Regional Climate Change Consultations**



www.unescwa.org/events/regional-consultation-climate-change-2019-arab-forum-sustainable-development-and-high-level

### 2019 Arab Regional Climate Change Consultation: Key messages

- Improving research and innovation in the Arab region to <u>adapt technologies to our</u> <u>challenges</u>.
- Enhancing research, development and innovation in <u>sustainable energy</u> and <u>environmental technologies and services</u>, and diversification of the Arab <u>region's energy</u> <u>mix</u>
- Dedicating public policies and providing incubation, financing and incentives for <u>entrepreneurs to scale up innovation</u>.
- Promoting regional cooperation and <u>public-private partnerships (PPP)</u> for investment and trade in <u>cleaner, more efficient technologies</u>, goods and services.
- Promoting <u>climate-resilient agriculture technologies</u> that can effectively reduce climate change and disaster risks through an integrated approach.
- Investing in information and communication technologies (ICTs) and frontier technologies (drones, GIS, artificial intelligence, remote sensing, etc.) to enhance climate resilience.
- <u>Transfer, adopt and localize green technology</u> in the fields of environmental protection, resource conservation and other socioeconomic areas for sustainable development.
- Harnessing the valuable heritage offered <u>by indigenous knowledge</u>, local practices and <u>technologies</u>.

Technological Innovation

### 2019 Arab Regional Climate Change Consultation: Key messages

- Design <u>capacity-building programmes as a long-term</u>, demand-driven process, with focus on engaging women and youth.
- Strengthen the capacity of <u>national decision makers and policymakers for</u> negotiations, access to climate finance and addressing interlinkages between climate-sensitive sectors.
- Develop the capacity of Arab institutions and professionals in <u>climate change assessments</u>, <u>adaptation resources and databases</u> available in the region, such as the RICCAR.
- Strengthening capacities in <u>national and regional multi-hazard early warning systems</u> and <u>disaster</u> <u>risk management</u>, through emergency preparedness plans that include <u>public participation</u>.
- Establishing Linkages between <u>national disaster loss databases</u> and the Sendai Framework <u>monitoring system</u> to enhance resilience efforts in the region.
- Arab meteorological, climatological and hydrological centres should facilitate the <u>free exchange of</u> <u>data</u> to support climate change analysis and research.
- Empower <u>national climate change committees</u>, including through on-the-job training.
- Indicators should be adapted to the systems of the future, including monitoring, evaluation and development of new indicators that reflect the interlinkages between water, food, energy and climate.
- Empower and <u>raise awareness</u> of civil society, NGOs, schools, universities and the media for climate action.

Capacity Building

### #ShowYourStripes



Graphics and lead scientist: **Ed Hawkins**, University of Reading; AR6 contributing author Data: **Berkeley Earth, NOAA, UK Met Office, MeteoSwiss, DWD**.

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## Thank you

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