



Vulnerability of people with respect to drinking water and heat waves

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ESCWA
Lebanon

Water available for drinking: Study area



People

Water available for drinking

Health conditions due to heat stress

Employment rate for the agricultural sector

Study area based on *population density*
indicator

Population density over 2 inhabitants/km²



EXPOSURE (0.50)

RCM

- Change in precipitation (0.25)

EXTREME EVENTS INDICES

- Change in number of hot days (0.25)
- Change in number of very hot days (0.25)

RHM

- Change in runoff (0.25)

4
Exposure
indicator
s

SENSITIVITY (0.50)

POPULATION (0.50)

- Population density (0.09)
- Share of children and elderly of the population (0.11)
- Total renewable water available per capita (0.50)
- Water consumption per capita (0.10)
- Share of water consumption in agriculture (0.08)
- Refugee population (0.08)
- Migrant population (0.08)

NATURAL (0.26)

- Livestock density (1.0)

MANMADE (0.24)

- Irrigated areas (0.48)
- Urban extent (0.52)

10
Sensitivity
indicator
s

ADAPTIVE CAPACITY (0.50)

KNOWLEDGE & AWARENESS (0.10)

- E-Government development (0.37)
- Tertiary enrollment (0.31)
- Adult literacy rate (0.32)

TECHNOLOGY (0.11)

- Number of scientific and technical journal articles (0.43)
- Information and communication technologies index (0.57)

INSTITUTIONS (0.10)

- Governance index (0.40)
- Areas under nature protection (0.27)
- Disaster risk reduction committees (0.33)

INFRASTRUCTURE (0.50)

WATER & SANITATION (0.50)

- Areas served by dams (0.20)
- Installed desalination capacity per capita (0.20)
- Fossil groundwater (0.20)
- Access to improved water (0.20)
- Access to improved sanitation (0.20)

ENVIRONMENT (0.14)

- Environment performance index (1.0)

HEALTH (0.11)

- Health index (1.0)

ENERGY (0.14)

- Access to electricity (0.50)
- Energy consumption (0.50)

TRANSPORT (0.12)

- Density of road network (1.0)

ECONOMIC RESOURCES (0.11)

- GDP per capita (0.28)
- Age dependency ratio (0.22)
- ODA (0.25)
- Food imports as % of merchandise exports (0.25)

EQUITY (0.08)

- Female-to-male unemployment rate (0.19)
- Female-to-male literacy ratio (0.24)
- Years lost due to disability (0.21)
- Migrants/refugees index (0.36)

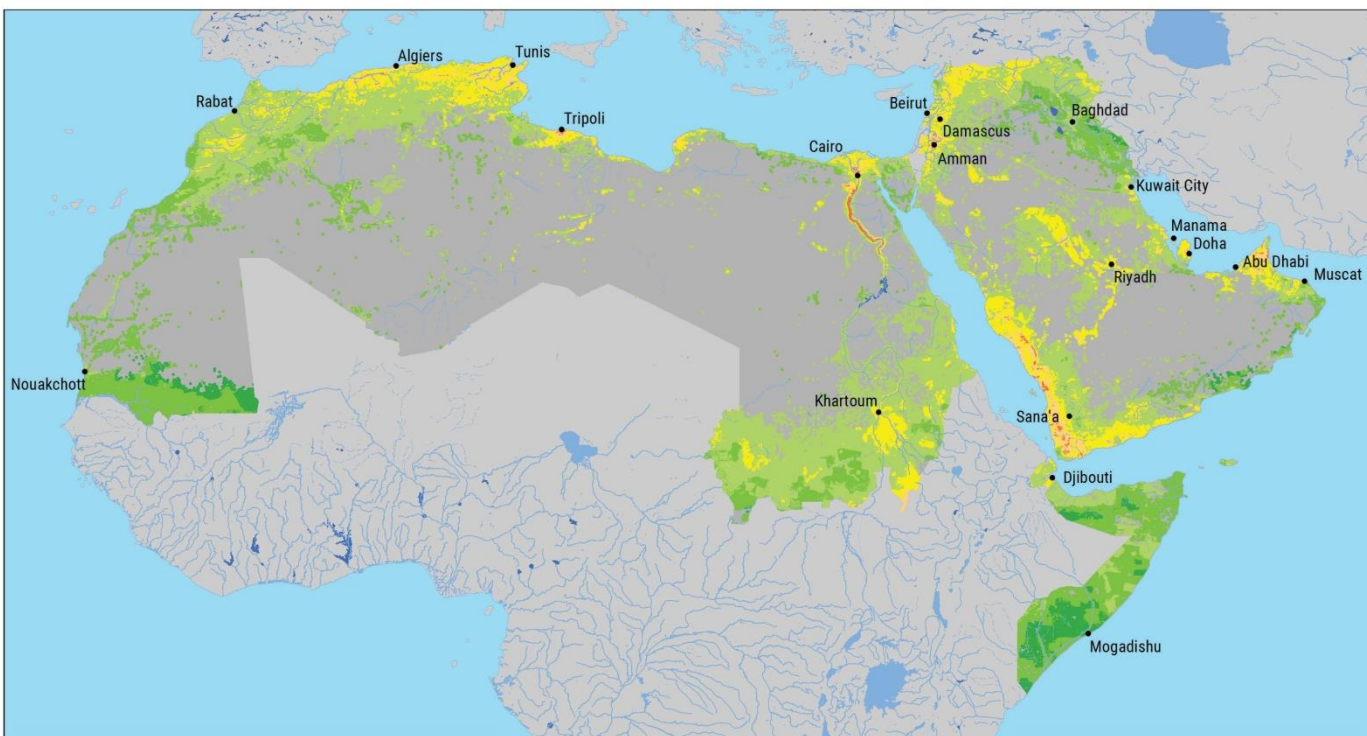
26
Adaptive
Capacity
indicator
s

POTENTIAL IMPACT
(0.50)

VULNERABILITY
ASSESSMENT



Impact chain:
Water
available for
drinking



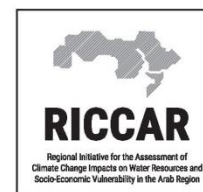
Areas with highest potential impact:

- Asir Mountains
- Lower Nile River
- Jabal Yibir region

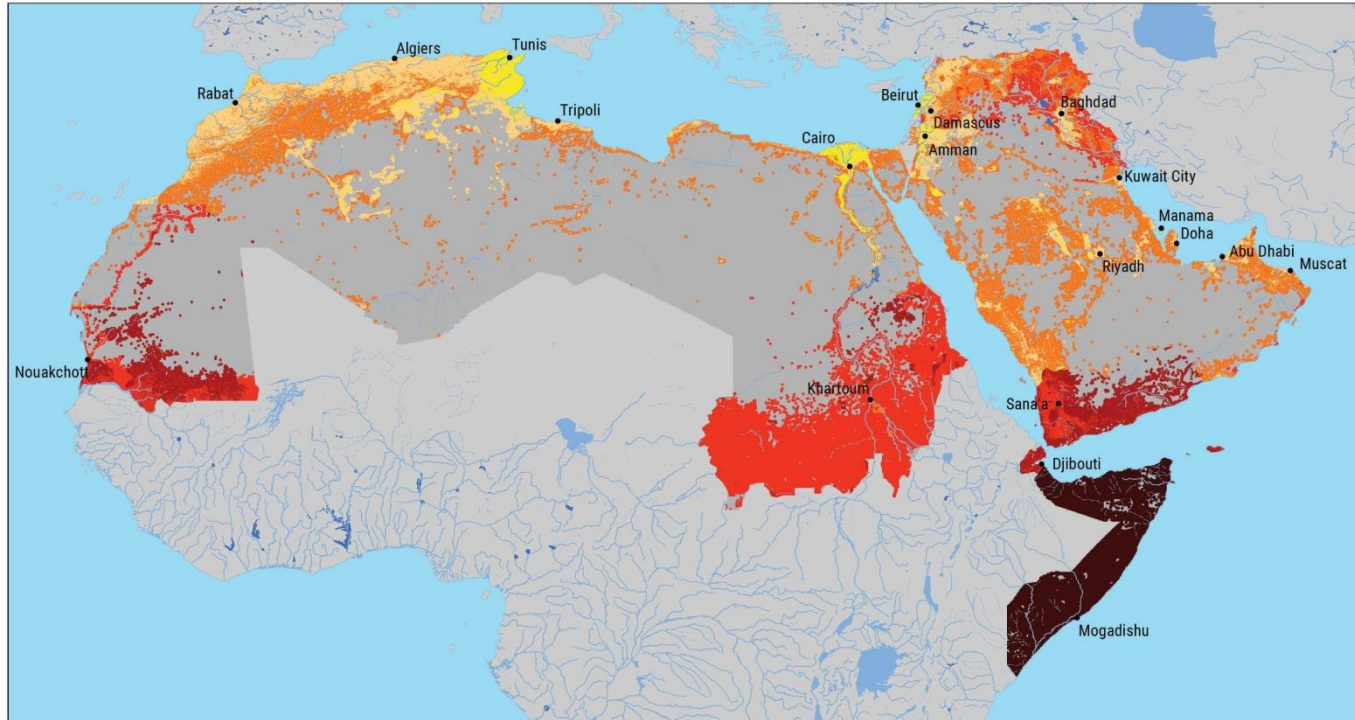
PEOPLE: WATER AVAILABLE FOR DRINKING

POTENTIAL IMPACT: RCP8.5 END-CENTURY (2081-2100)

Legend



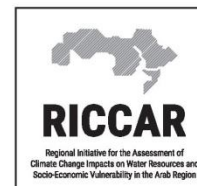
Scenario	Percentage of study area		
	Low PI	Moderate PI	High PI
RCP 4.5 Mid-century	59%	41%	0%
RCP 8.5 Mid-century	45%	54%	0%
RCP 4.5 End-century	53%	47%	0%
RCP 8.5 End-century	28%	72%	0%



PEOPLE: WATER AVAILABLE FOR DRINKING

ADAPTIVE CAPACITY

Legend



Areas with lowest adaptive capacity:

- Horn of Africa
- Western Sahel
- SW Arabian Peninsula

Scenario

Percentage of study area

Low AC

Moderate AC

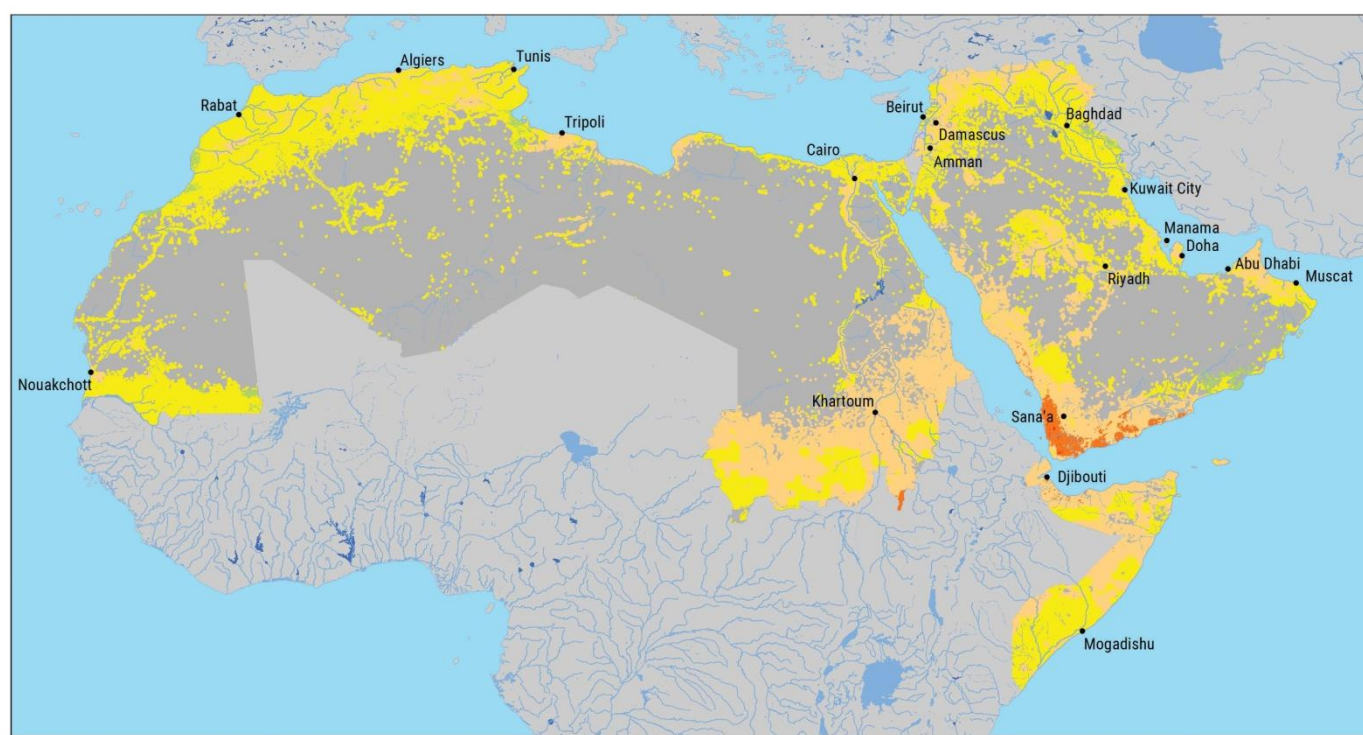
High AC

All climate scenarios

48%

52%

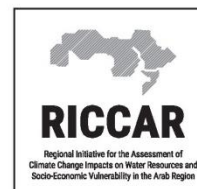
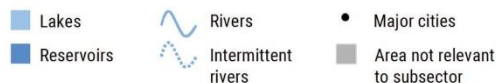
0%



PEOPLE: WATER AVAILABLE FOR DRINKING

VULNERABILITY: RCP8.5 END-CENTURY (2081-2100)

Legend



Areas with highest vulnerability:

- SW Arabian Peninsula

Areas with lowest vulnerability:

- Tigris-Euphrates Basin
- Gulf of Aden north central coastline
- Selected areas in Maghreb
- Lower Tindouf Basin/Taoudeni Basin

Scenario	Percentage of study area		
	Low Vul	Moderate Vul	High Vul
RCP 4.5 Mid-century	0%	98%	1%
RCP 8.5 Mid-century	0%	100%	0%
RCP 4.5 End-century	0%	99%	1%
RCP 8.5 End-century	0%	98%	2%

Vulnerability trends mid- to end-century

Water available for drinking

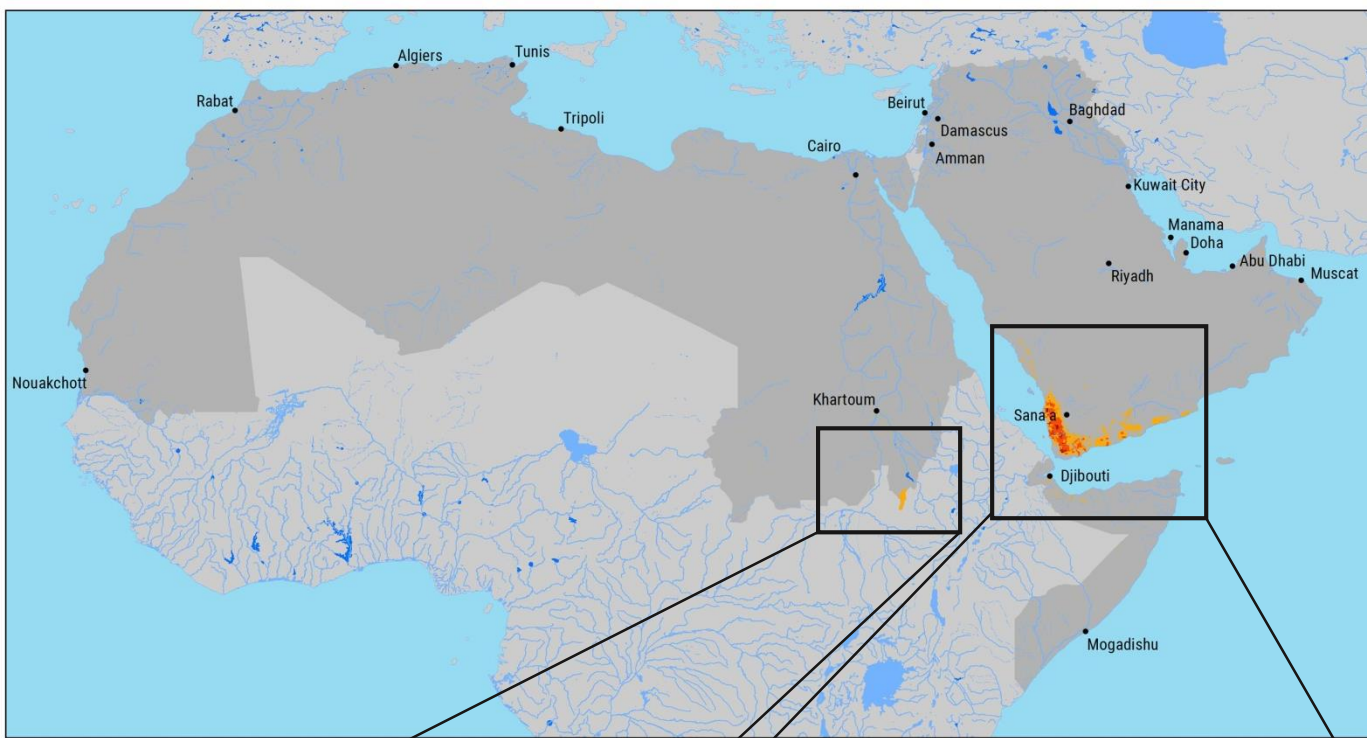


- Zagros Mountains
- Central western Red Sea
- Northern Maghreb
- Levant



- Oman Mountains (RCP4.5)
- Selected areas in Horn of Africa (RCP4.5)
- Grand Erg Oriental region (RCP4.5)
- Sahel (RCP8.5)

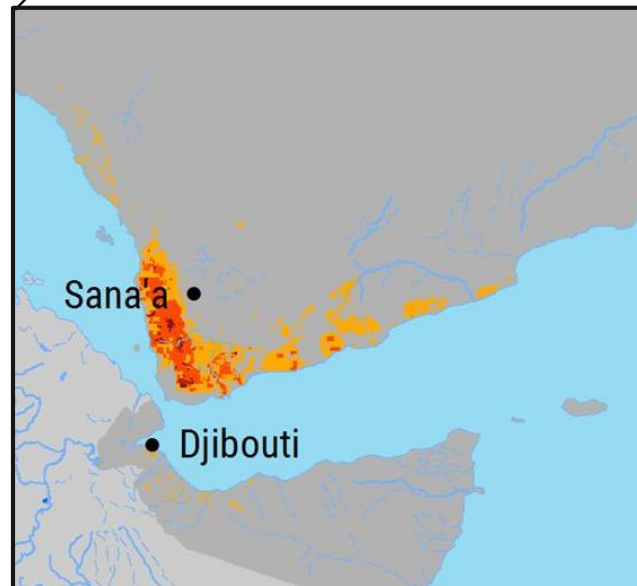
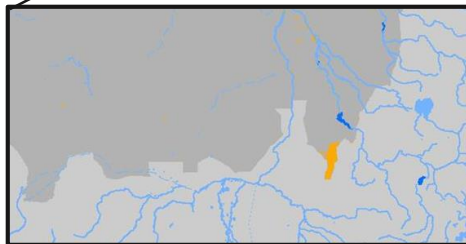




Vulnerability

hotspots:

- SW Arabian Peninsula near coast
- Northern coast of Horn of Africa
- White Nile-Blue Nile region



Health conditions due to heat stress: Study area



People

Water available for drinking

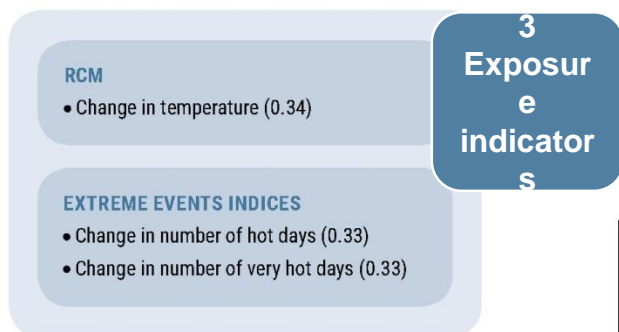
Health conditions due to heat stress

Employment rate for the agricultural sector

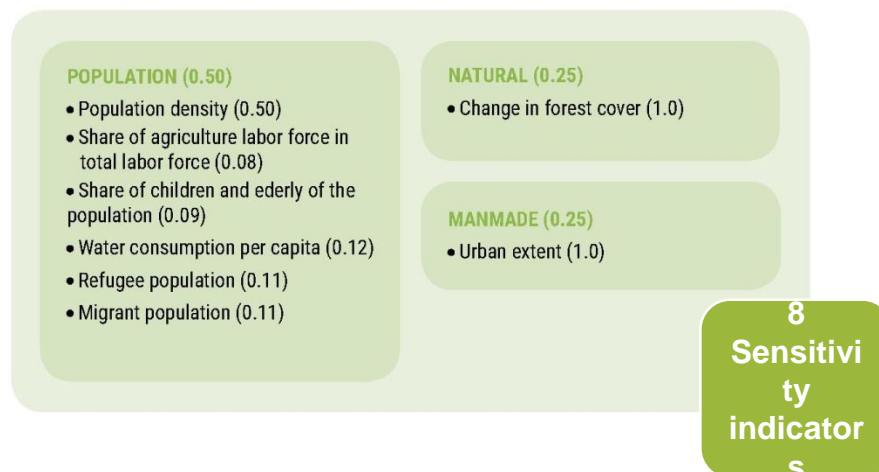
Study area based on *population density*
indicator

Population density over 2 inhabitants/km²

EXPOSURE (0.50)



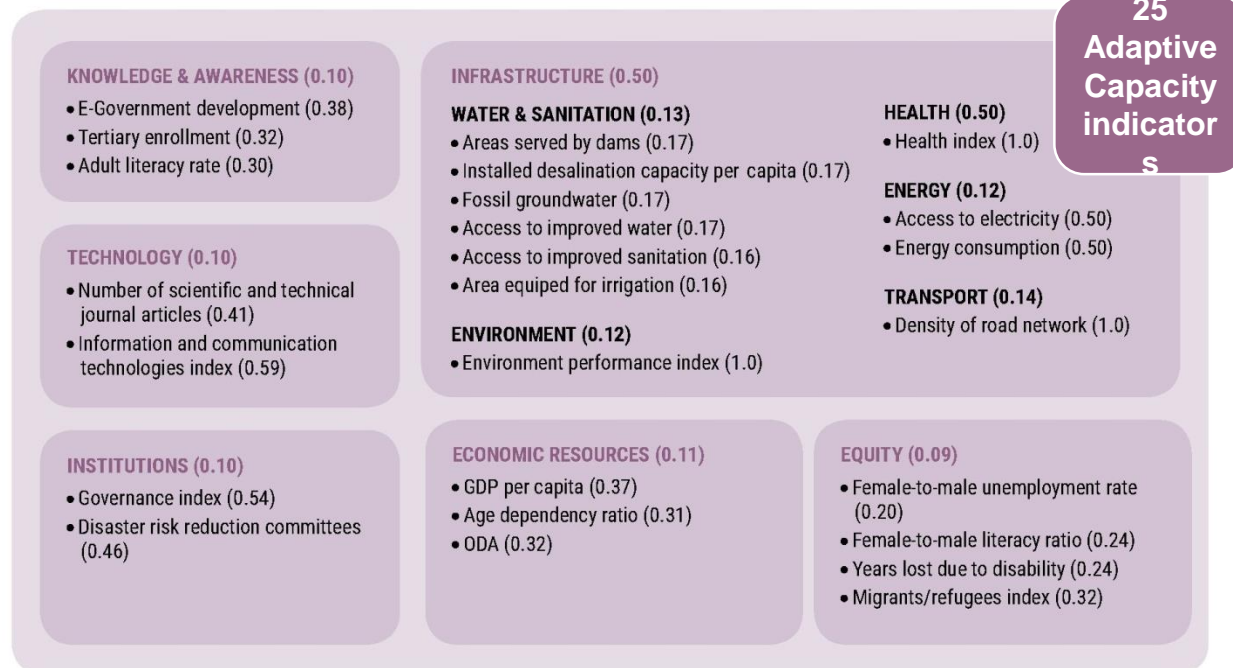
SENSITIVITY (0.50)



POTENTIAL IMPACT (0.50)

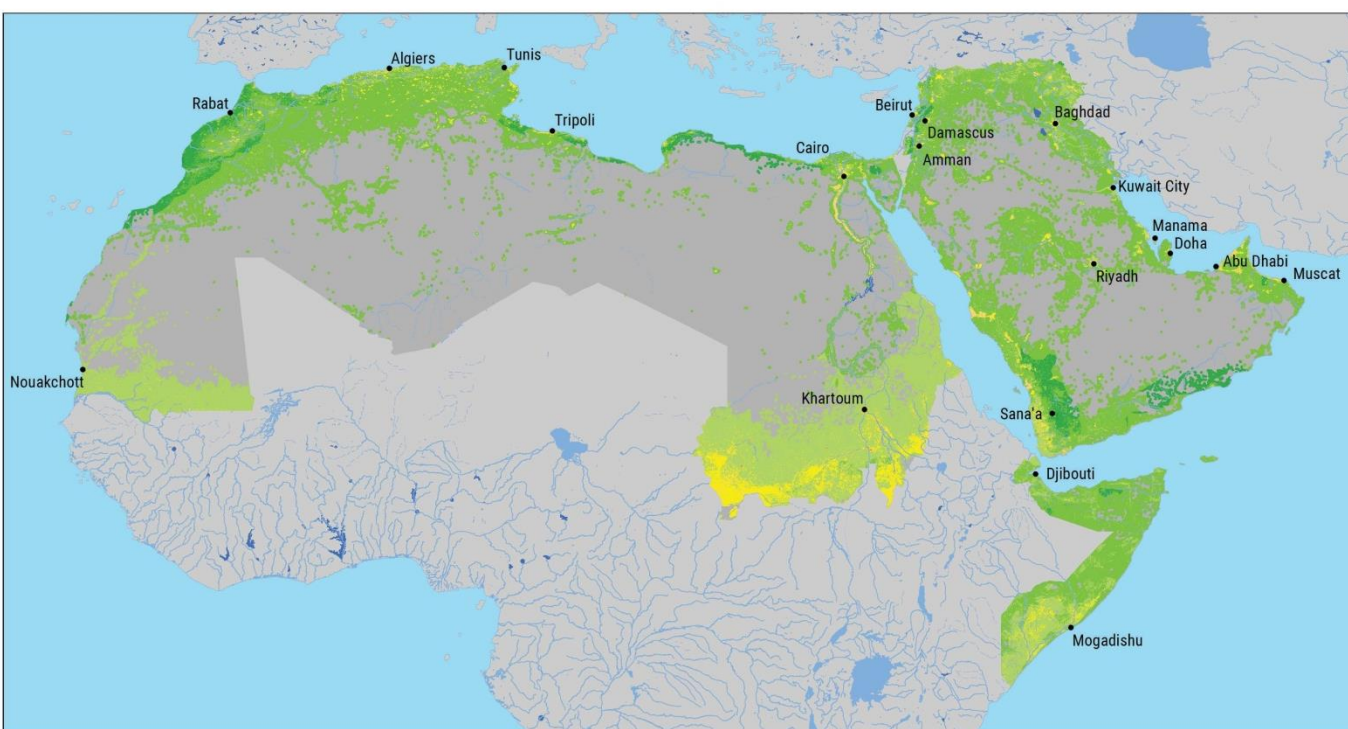
VULNERABILITY ASSESSMENT

ADAPTIVE CAPACITY (0.50)



Impact chain:
Health
conditions
due to heat
stress





Areas with highest potential impact:

- Red Sea coastal area
- Eastern Sahel

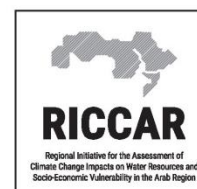
PEOPLE: HEALTH CONDITIONS DUE TO HEAT STRESS

POTENTIAL IMPACT: RCP8.5 END-CENTURY (2081-2100)

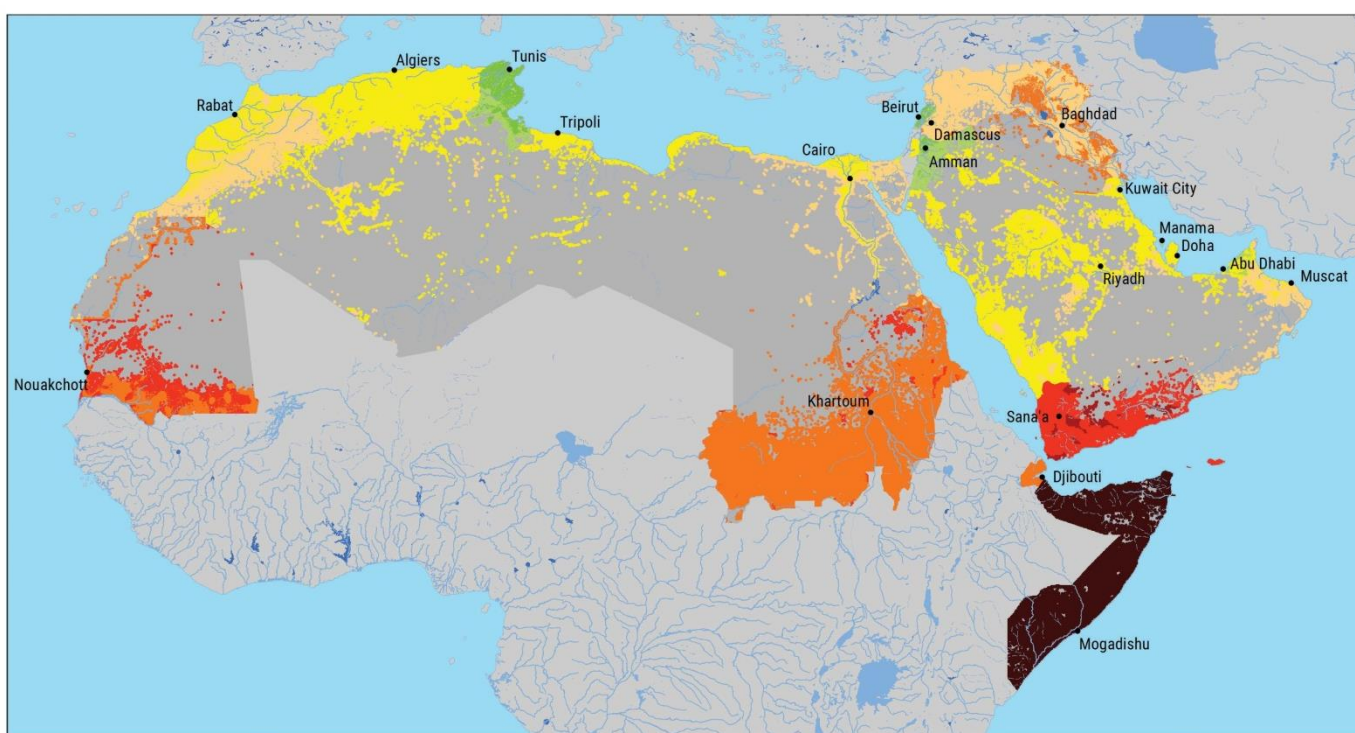
Legend

- Major cities
- Area not relevant to subsector
- Lakes
- Reservoirs
- Rivers
- Intermittent rivers

Low Potential Impact High Potential Impact



Scenario	Percentage of study area		
	Low PI	Moderate PI	High PI
RCP 4.5 Mid-century	97%	3%	0%
RCP 8.5 Mid-century	89%	11%	0%
RCP 4.5 End-century	90%	10%	0%
RCP 8.5 End-century	63%	37%	0%

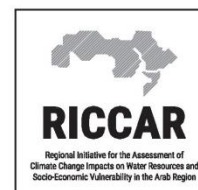
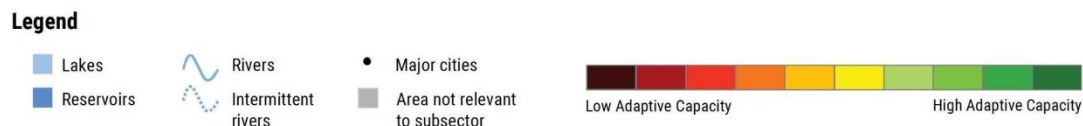


Areas with lowest adaptive capacity:

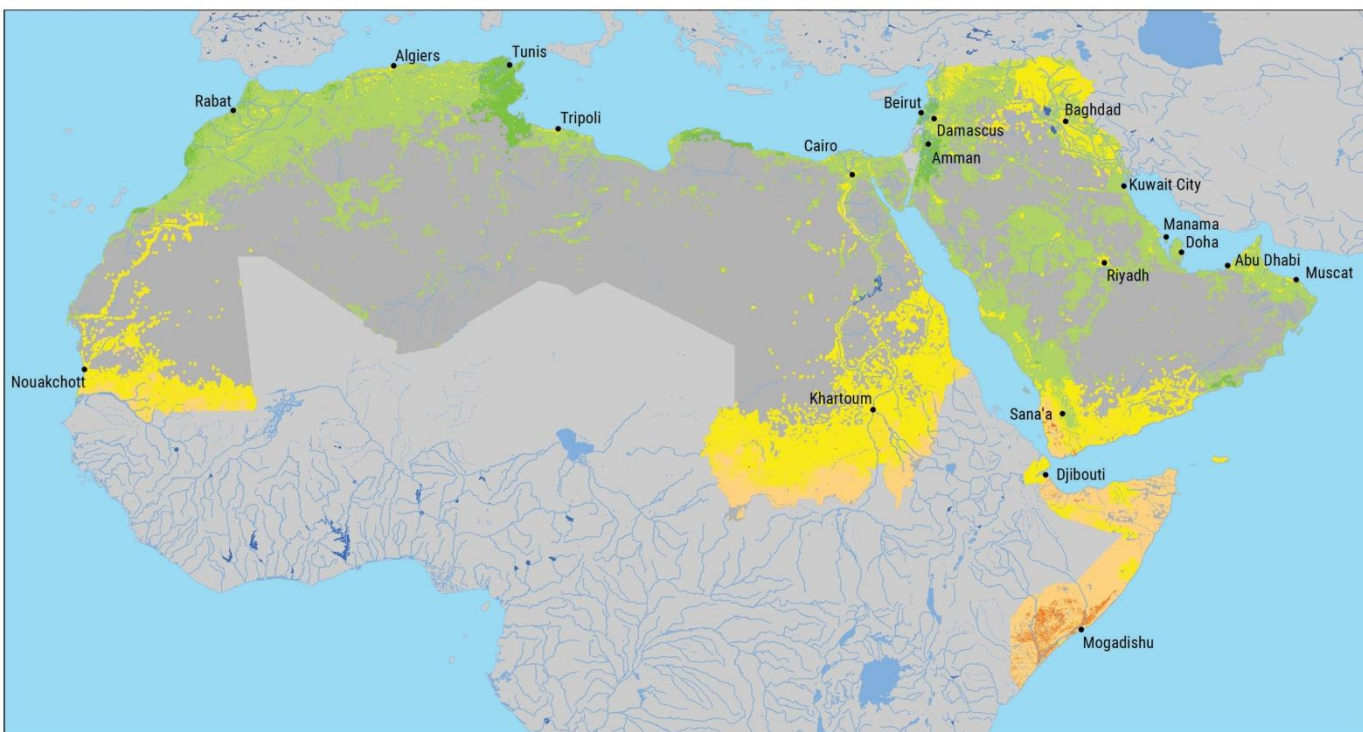
- Horn of Africa
- Selected areas in SW Arabian Peninsula

PEOPLE: HEALTH CONDITIONS DUE TO HEAT STRESS

ADAPTIVE CAPACITY



Scenario	Percentage of study area		
	Low AC	Moderate AC	High AC
All climate scenarios	21%	75%	4%



Areas with highest vulnerability:

- Sahel
- Northern coast of Horn of Africa
- Jubba River Valley (Horn of Africa)
- Isolated areas of Tigris-Euphrates Basin

Areas with lowest vulnerability:

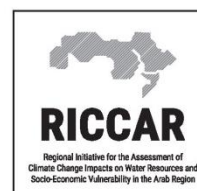
- Atlas Mountains
- Levant

PEOPLE: HEALTH CONDITIONS DUE TO HEAT STRESS

VULNERABILITY: RCP8.5 END-CENTURY (2081-2100)

Legend

- Major cities
- Area not relevant to subsector
- Lakes
- Reservoirs
- Rivers
- Intermittent rivers



Scenario	Percentage of study area		
	Low Vul	Moderate Vul	High Vul
RCP 4.5 Mid-century	45%	55%	0%
RCP 8.5 Mid-century	30%	70%	0%
RCP 4.5 End-century	37%	63%	0%
RCP 8.5 End-century	4%	95%	1%

Change in temperature related climate parameters

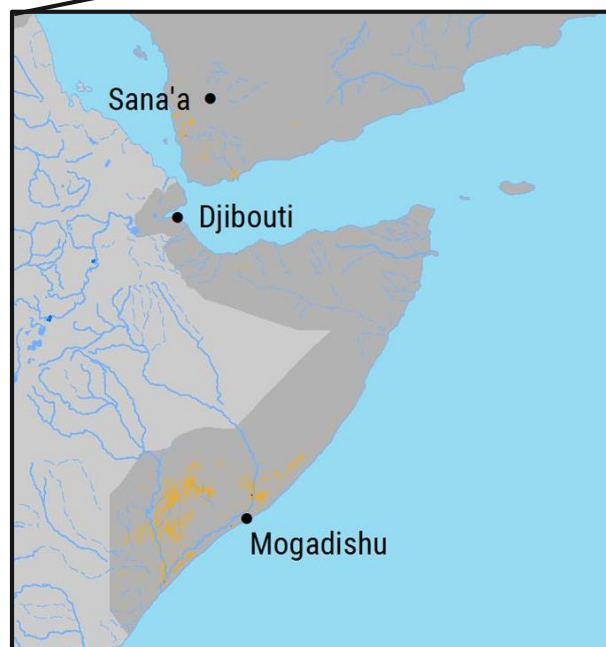
Exposure indicator	Units	Climate scenario	Average indicator value by vulnerability classification for subsector		Average indicator value for Arab region
			Low	Moderate	
Change in temperature (compared to reference period)	°C	Mid-Century RCP 4.5	+1.4	+1.5	+1.5
		Mid-Century RCP 8.5	+2.1	+2.1	+2.1
		End-Century RCP 4.5	+1.8	+1.9	+1.9
		End-Century RCP 8.5	+3.5	+4.0	+4.0
Change in number of hot days (SU35) (compared to reference period)	days/year	Mid-Century RCP 4.5	+22	+46	+30
		Mid-Century RCP 8.5	+30	+55	+41
		End-Century RCP 4.5	+27	+54	+38
		End-Century RCP 8.5	+54	+84	+74
Change in number of very hot days (SU40) (compared to reference period)	days/year	Mid-Century RCP 4.5	+15	+38	+28
		Mid-Century RCP 8.5	+16	+48	+39
		End-Century RCP 4.5	+18	+46	+36
		End-Century RCP 8.5	+26	+77	+76



Vulnerability

hotspots:

- Southern Horn of Africa
- SW Arabian Peninsula





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

Thank you



People

Water available for drinking
Health conditions due to heat stress
Employment rate for the agricultural sector

