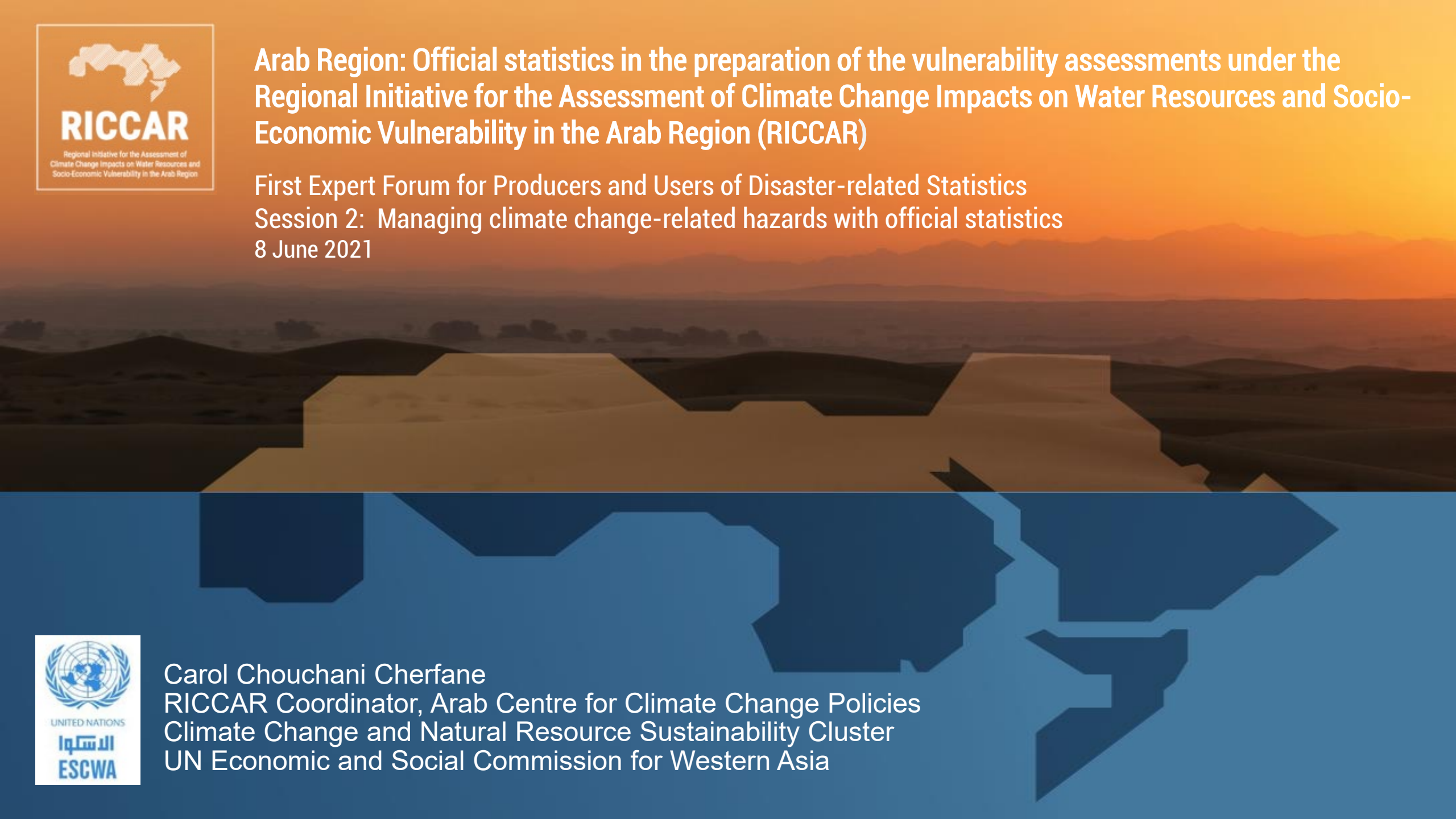
Arab Region: Official statistics in the preparation of the vulnerability assessments under the Regional Initiative for the Assessment of Climate Change Impacts on Water Resources and Socio-Economic Vulnerability in the Arab Region (RICCAR)

First Expert Forum for Producers and Users of Disaster-related Statistics
Session 2: Managing climate change-related hazards with official statistics
8 June 2021



Carol Chouchani Cherfane
RICCAR Coordinator, Arab Centre for Climate Change Policies
Climate Change and Natural Resource Sustainability Cluster
UN Economic and Social Commission for Western Asia

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.

RICCAR aims to provide a common platform for assessing, addressing and informing response to climate change impacts on freshwater resources in the Arab region by serving as the basis for dialogue, priority setting and policy formulation on climate change at the regional level

Assessment | **Adaptation** | **DRR** | **Mitigation** | **Negotiations**

RICCAR Partnerships - since 2010

UNITED NATIONS
الاسكوا
ESCWA

UN environment

WMO

THE LEAGUE OF ARAB STATES
THE ARAB CENTER FOR THE STUDIES OF ARID ZONES AND DRY LANDS
ACSAD 1968
ACSAD

جامعة الدول العربية
LAS

SMHI

UNESCO
United Nations Educational, Scientific and Cultural Organization
منظمة الأمم المتحدة للتربية والعلم والثقافة
Cairo Office
مكتب القاهرة

UNDRR
UN Office for Disaster Risk Reduction

FAO
FIAT PANIS

Sweden
Sverige
SWEDISH INTERNATIONAL DEVELOPMENT COOPERATION AGENCY

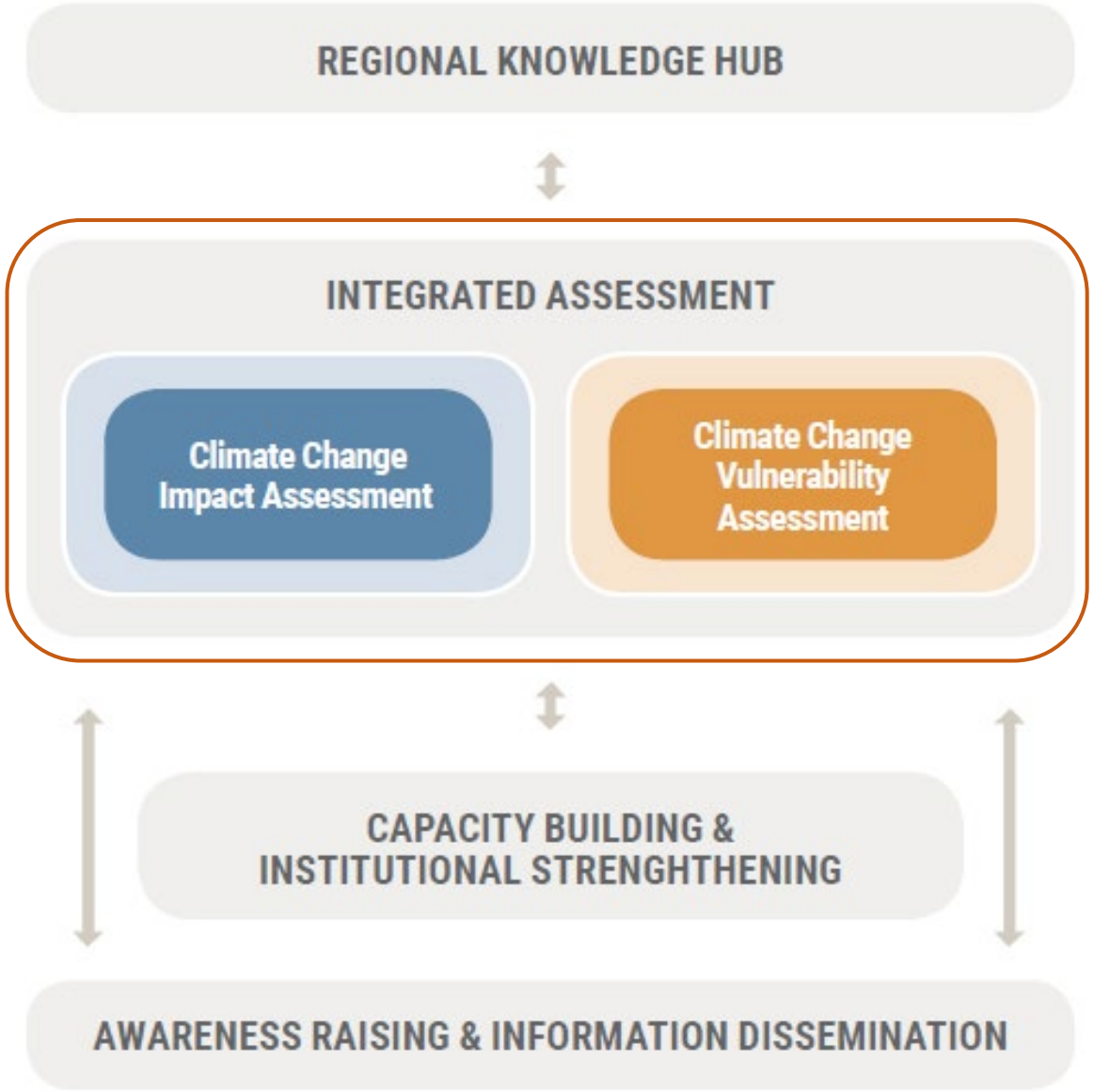
german cooperation
DEUTSCHE ZUSAMMENARBEIT

giz
ACCWaM

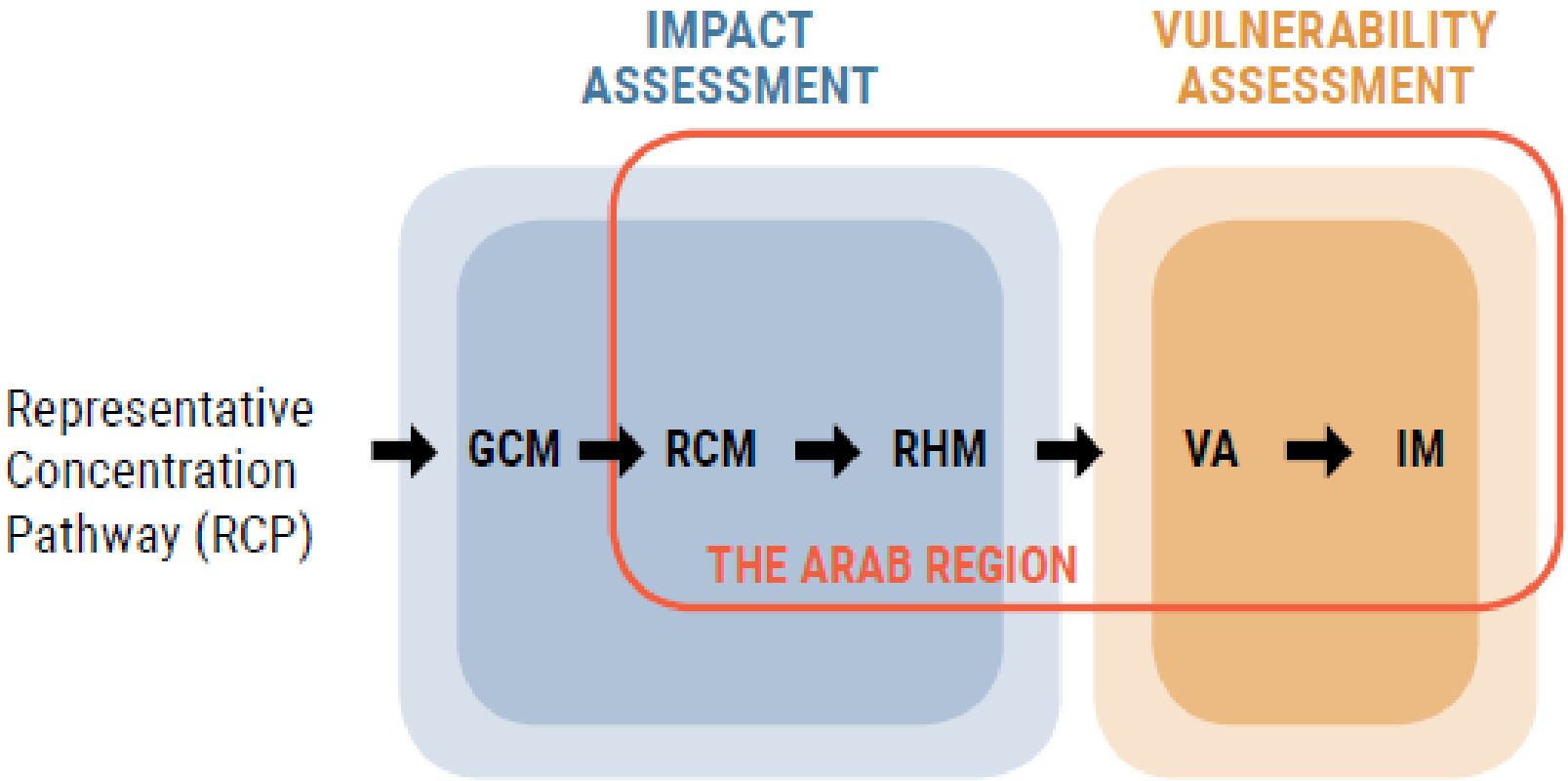
UNITED NATIONS UNIVERSITY
UNU-INWEH
Institute for Water, Environment and Health

CORDEX-MENA Domain hosted by The Cyprus Institute

Pillars of Work



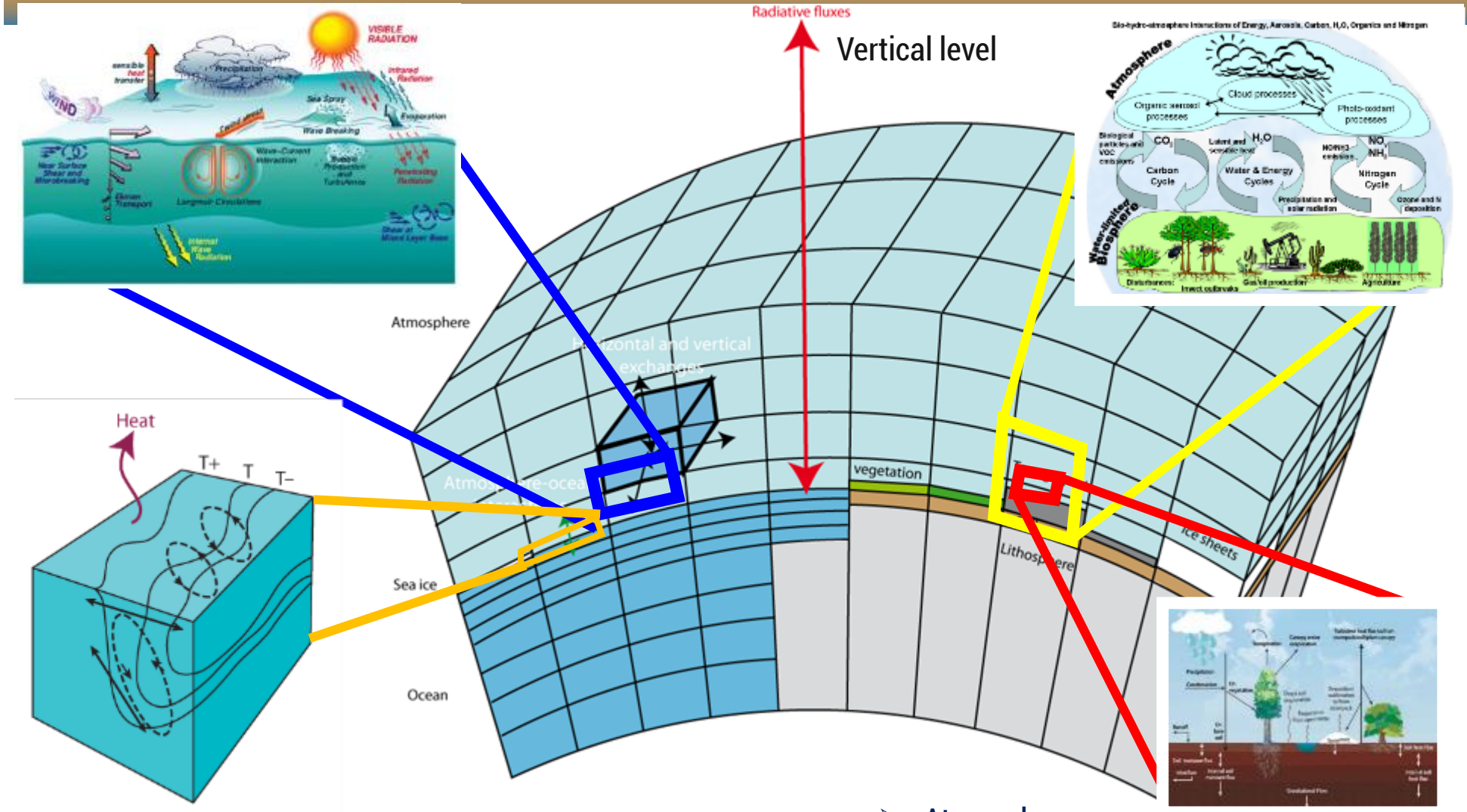
Integrated Assessment



GCM: Global Climate Modelling
RCM: Regional Climate Modelling
RHM: Regional Hydrological Modelling

VA: Vulnerability Assessment
IM: Integrated Mapping

Computing Climate Variables



REF: http://stratus.astr.ucl.ac.be/textbook/chapter3_node8.html
http://www.nesl.ucar.edu/LAR/2007/strategic-priorities/sp2/index.php

- Atmosphere
- Oceans
- Terrestrial

Essential Climate Variables:
Generated per Grid Box

Atmosphere

Surface

- Precipitation
- Pressure
- Radiation budget
- Temperature
- Water vapour
- Wind speed and direction

Upper-air

- Earth radiation budget
- Lightning
- Temperature
- Water vapor
- Wind speed and direction

Atmospheric Composition

- Aerosols
- Carbon dioxide, methane and other greenhouse gases
- Clouds
- Ozone
- Precursors for aerosols and ozone

Land

Hydrosphere

- Groundwater
- Lakes
- River discharge

Cryosphere

- Glaciers
- Ice sheets and ice shelves
- Permafrost
- Snow

Biosphere

- Above-ground biomass
- Albedo
- Evaporation from land
- Fire
- Fraction of absorbed photosynthetically active radiation (FAPAR)
- Land cover
- Land surface temperature
- Leaf area index
- Soil carbon
- Soil moisture

Anthroposphere

- Anthropogenic Greenhouse gas fluxes
- Anthropogenic water use

Ocean

Physical

- Ocean surface heat flux
- Sea ice
- Sea level
- Sea state
- Sea surface currents
- Sea surface salinity
- Sea surface stress
- Sea surface temperature
- Subsurface currents
- Subsurface salinity
- Subsurface temperature

Biogeochemical

- Inorganic carbon
- Nitrous oxide
- Nutrients
- Ocean colour
- Oxygen
- Transient tracers

Biological/ecosystems

- Marine habitats
- Plankton

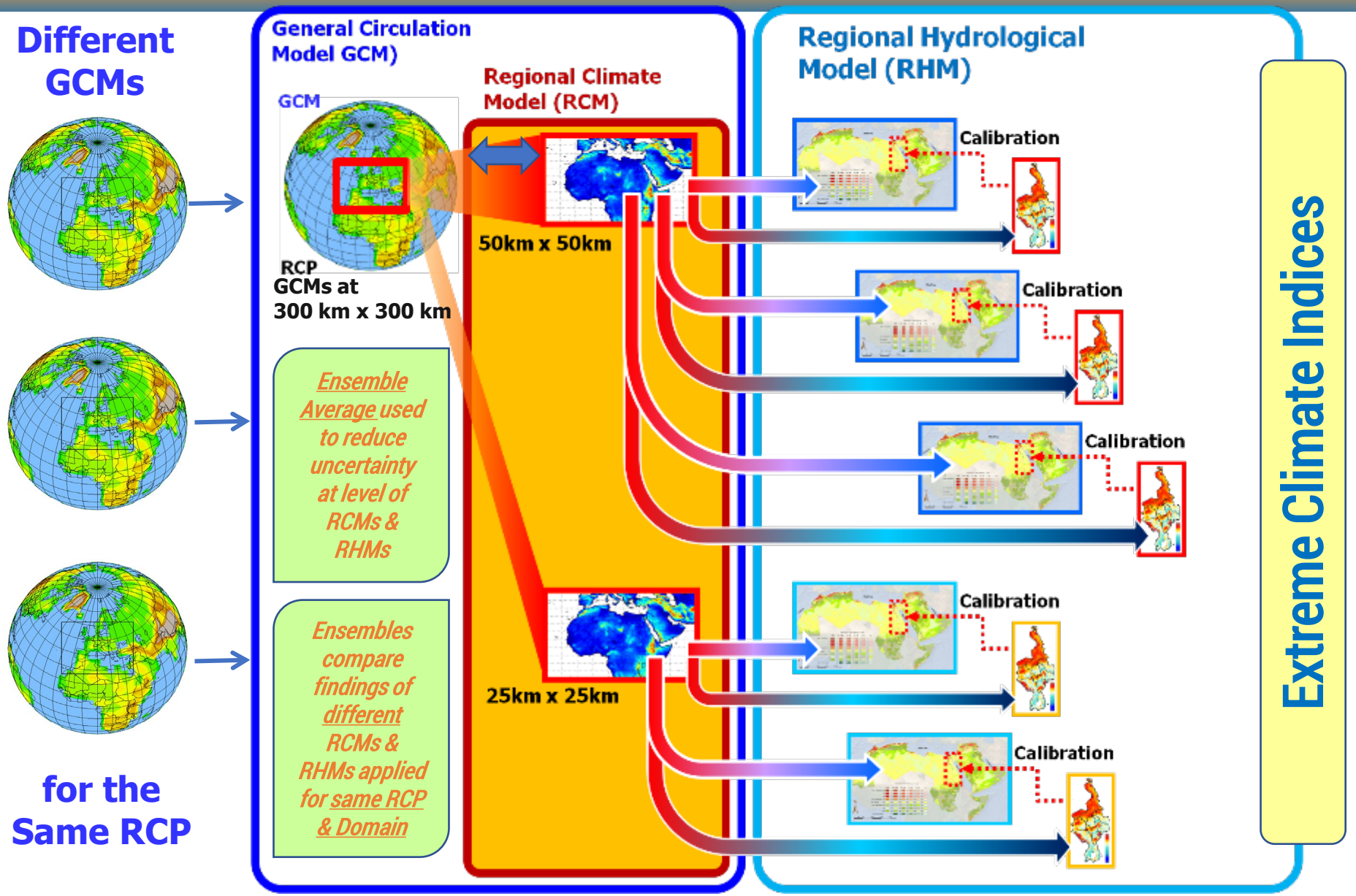
Essential Climate Variables (ECV) datasets provide the empirical evidence needed to understand and predict the evolution of climate

Is observed data that informs official statistics

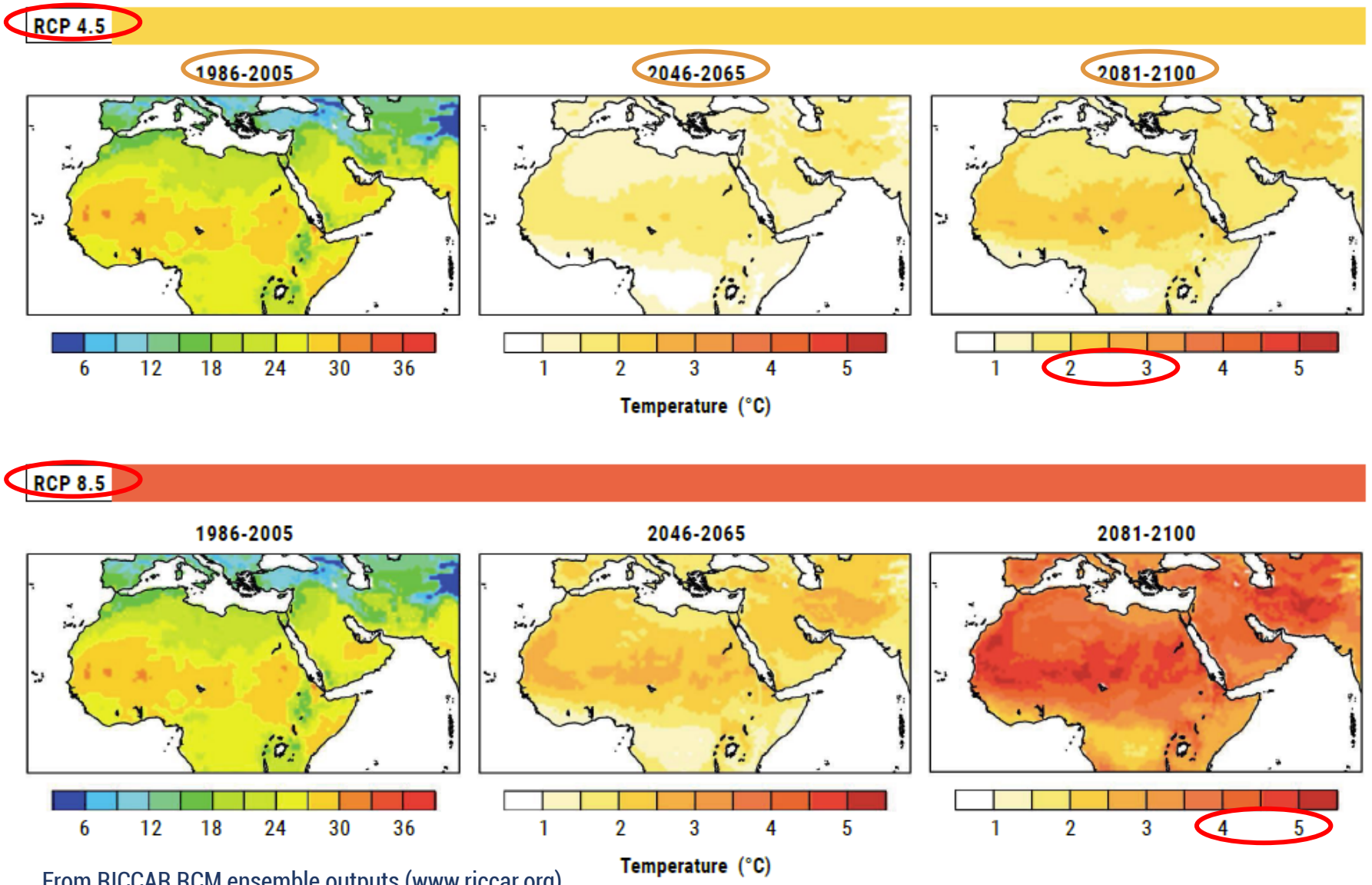
RICCAR RCMs are land-based models and do not generate Oceanic Variables

https://gcos.wmo.int/en/essential-climate-variables/table

Moving from Regional Climate Models to Hydrological Models



Change in Mean Temperature Ensemble Output: mean versus extreme climate events needed for DRR



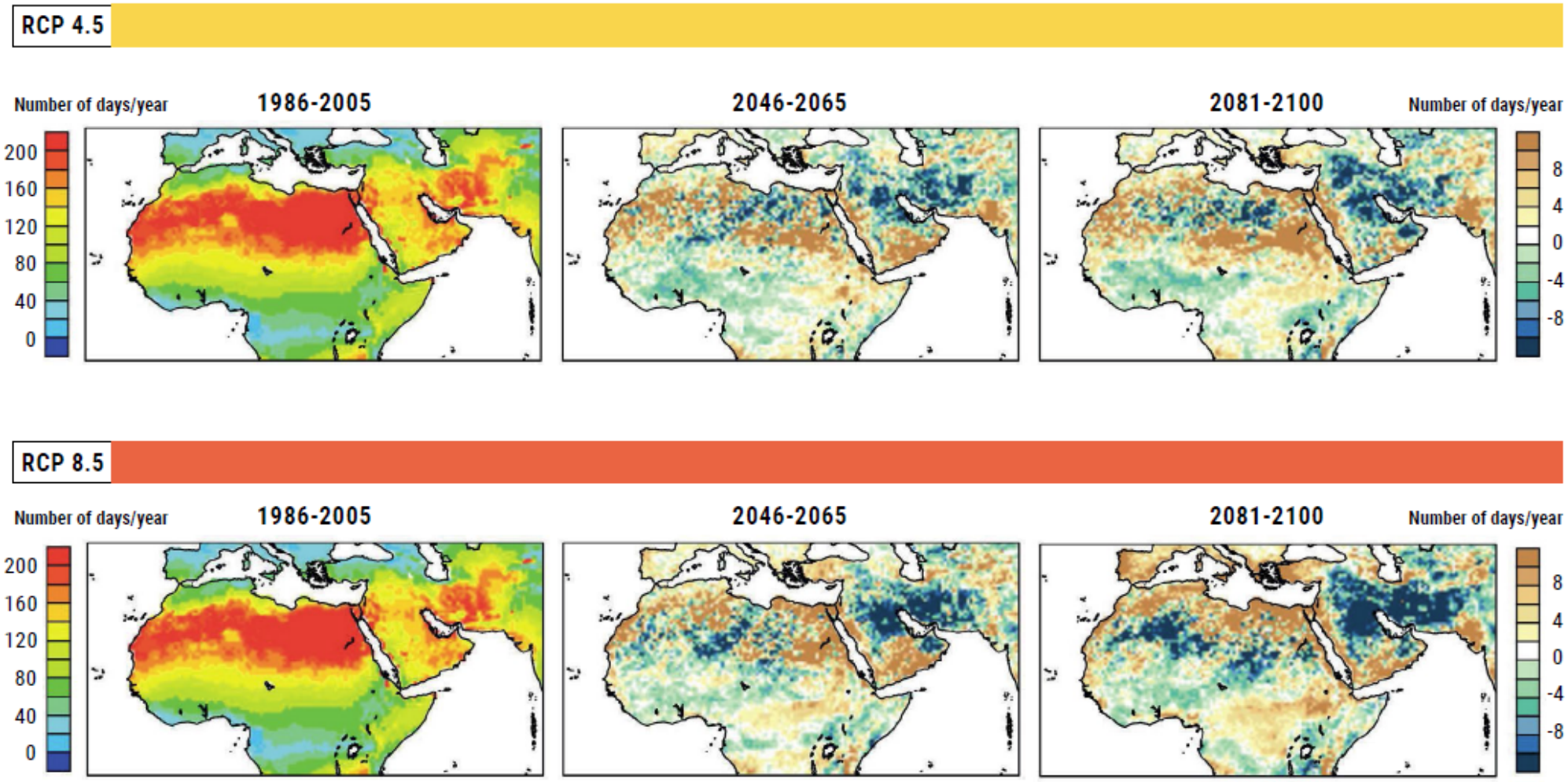
From RICCAR RCM ensemble outputs (www.riccar.org)

Extreme Climate Indices to inform DRR

Consider Appropriate Thresholds & 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
		SDII	Simple precipitation intensity index

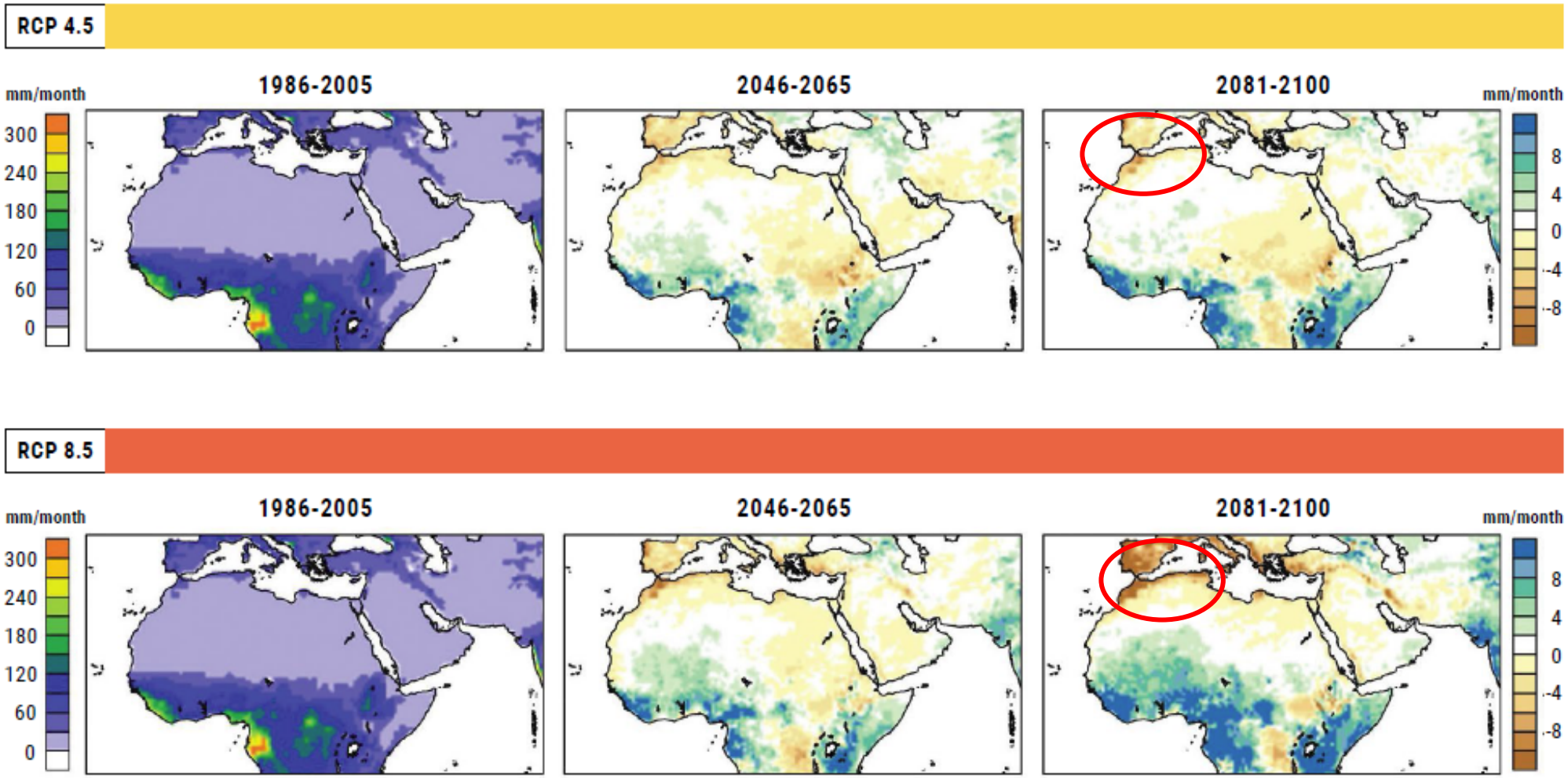
Maximum length of dry spell (CDD)



From RICCAR RCM ensemble outputs (www.riccar.org)

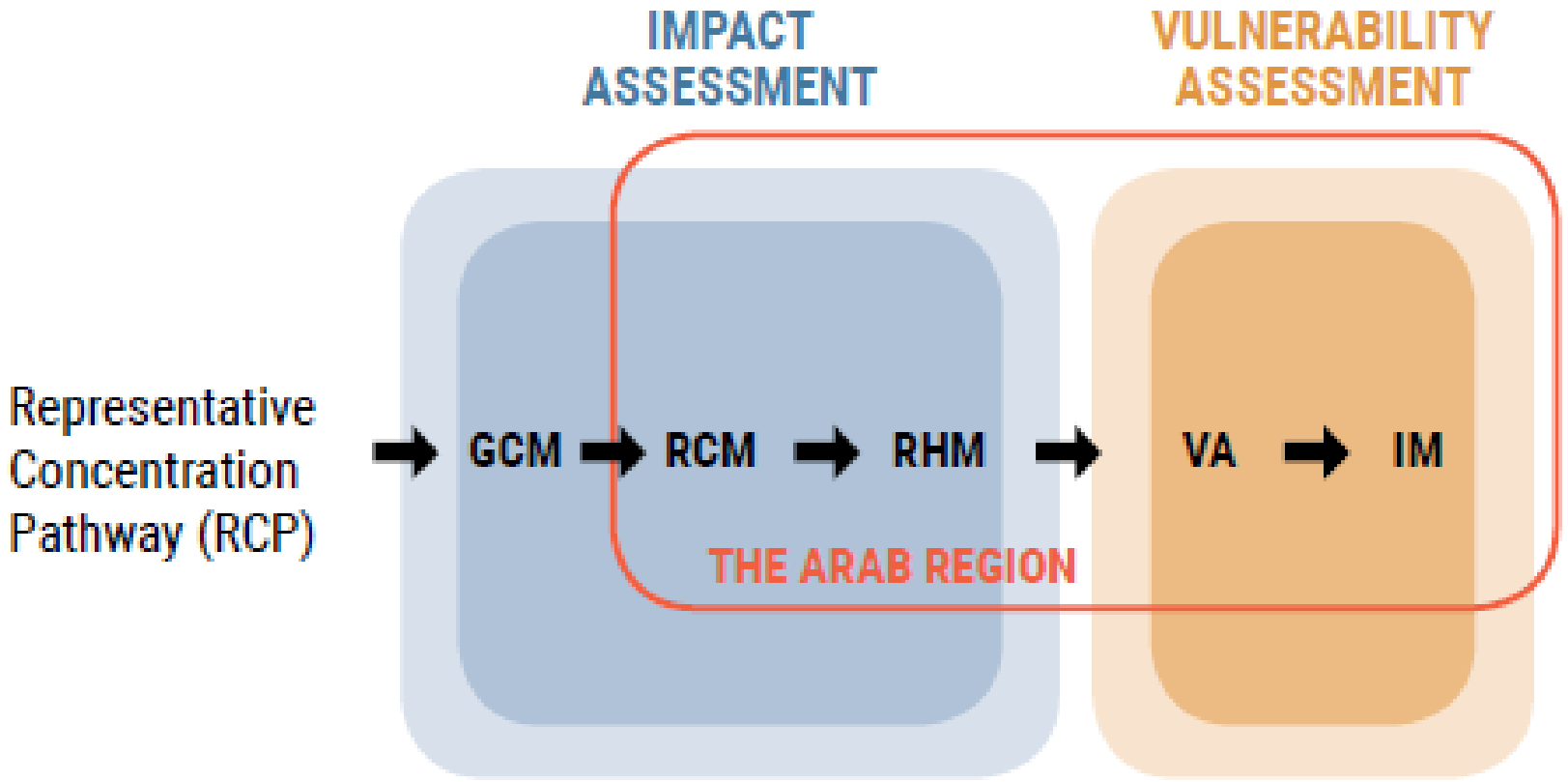
Precipitation:
On average, P is largely decreasing across the region until the end of the century, though limited areas expected to exhibit an increase in the intensity & volume of precipitation

Need to consider units that are user-friendly



From RICCAR RCM ensemble outputs (www.riccar.org)

Integrated Vulnerability Assessment



GCM: Global Climate Modelling
RCM: Regional Climate Modelling
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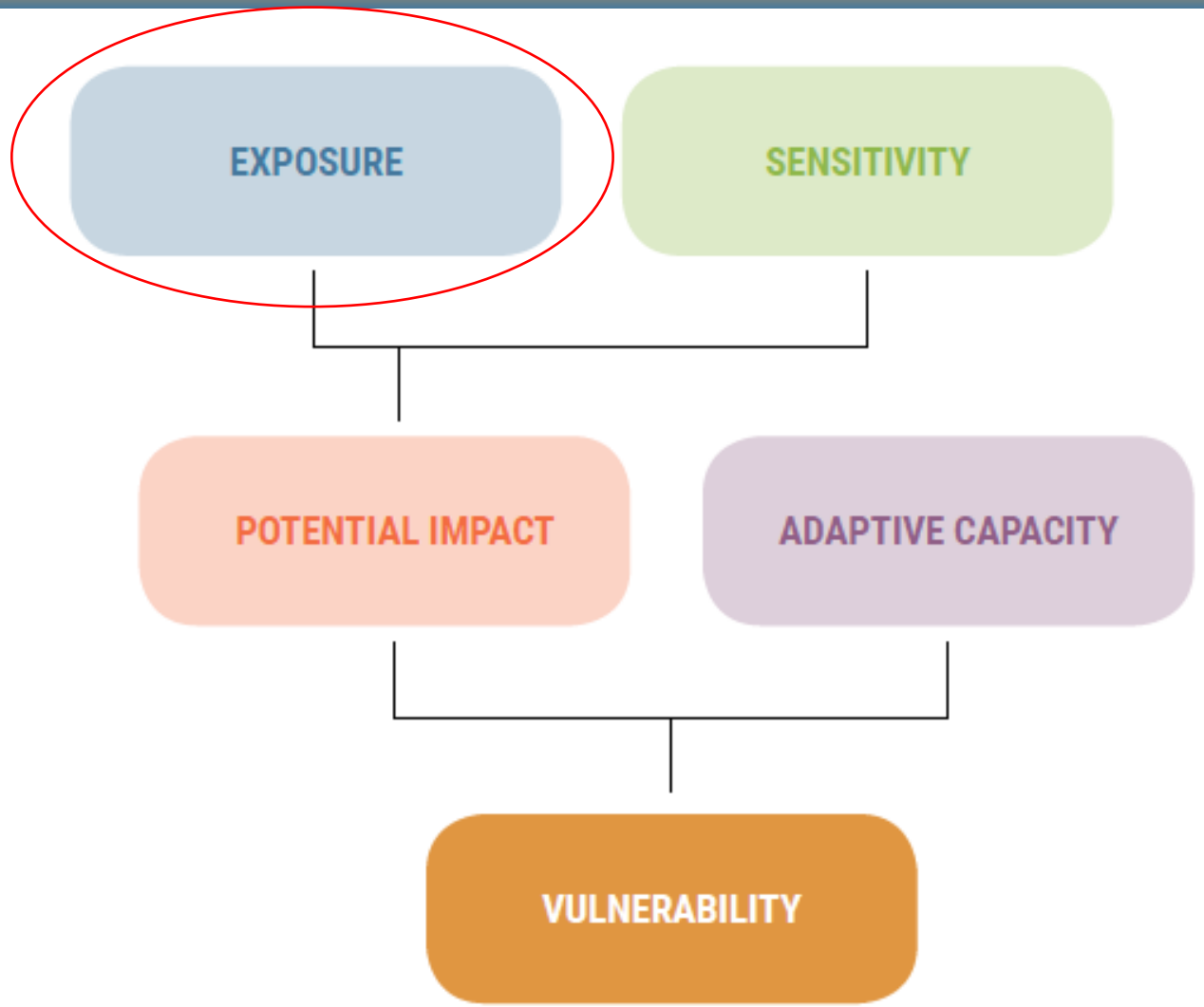
IM: Integrated Mapping

Vulnerability Assessment

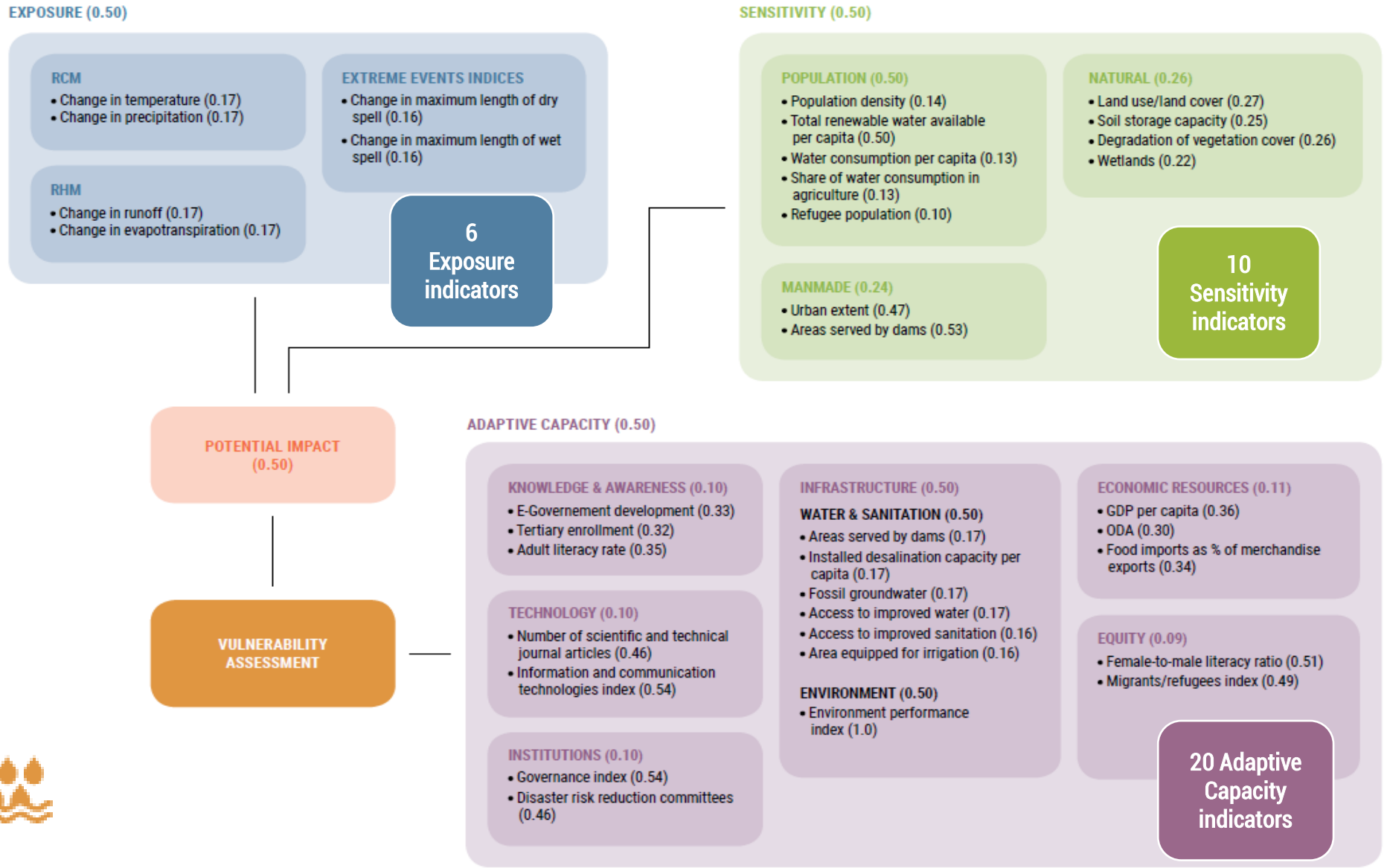
SECTORS	SUBSECTORS
Water	Water availability
Biodiversity and Ecosystems	Area covered by forests Area covered by wetlands
Agriculture	Water available for crops Water available for livestock
Infrastructure and Human Settlements	Inland flooding area
People	Water available for drinking Health conditions due to heat stress Employment rate for the agricultural sector

Vulnerability Assessment



Source: Based on IPCC, 2007

Impact chain of water availability sector



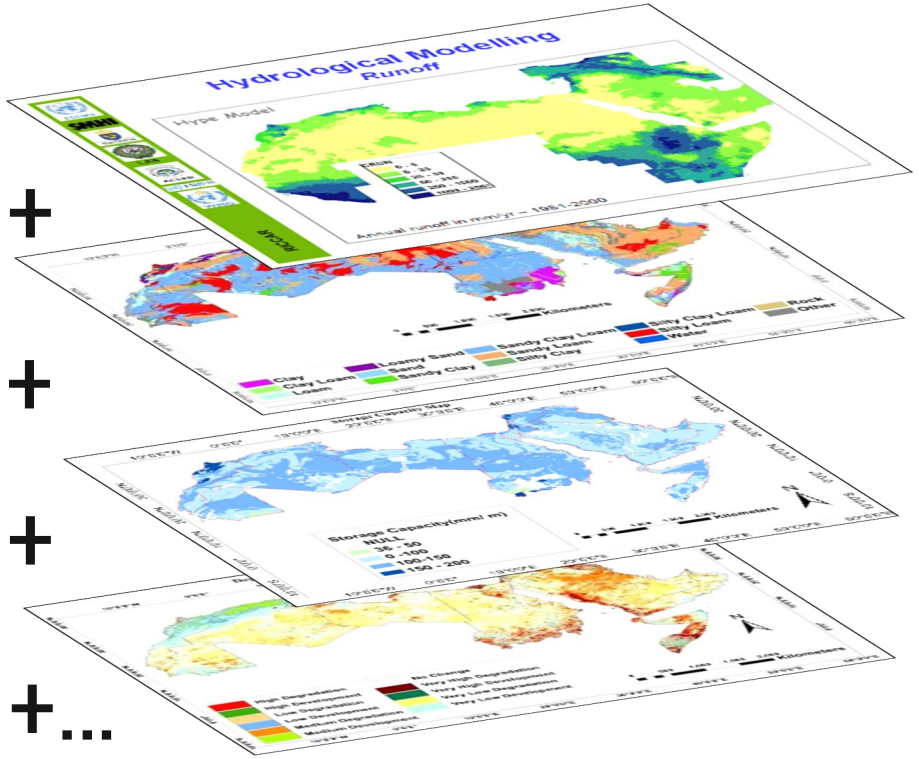
Official statistics & Global Databases central to analysis of Sensitivity and AC

Overall Vulnerability

Preparation of a Vulnerability Index:

- Per Sector
  - Contains all indicators identified to assess a given sectors
  - Attribution of weights for each indicator dependent on impact chains and expert judgment
  - Indicators classified to be comparable geospatially
  - As sector level, aggregated by component: Exposure, Sensitivity, Adaptive Capacity

- Overall Vulnerability
  - Aggregates vulnerability of each sub-sector or sector to generate an Overall VA
  - Supports identification of VA Hotspots



Slide graphics: adelphi
Source of maps: ACSAD, SMHI

Exposure

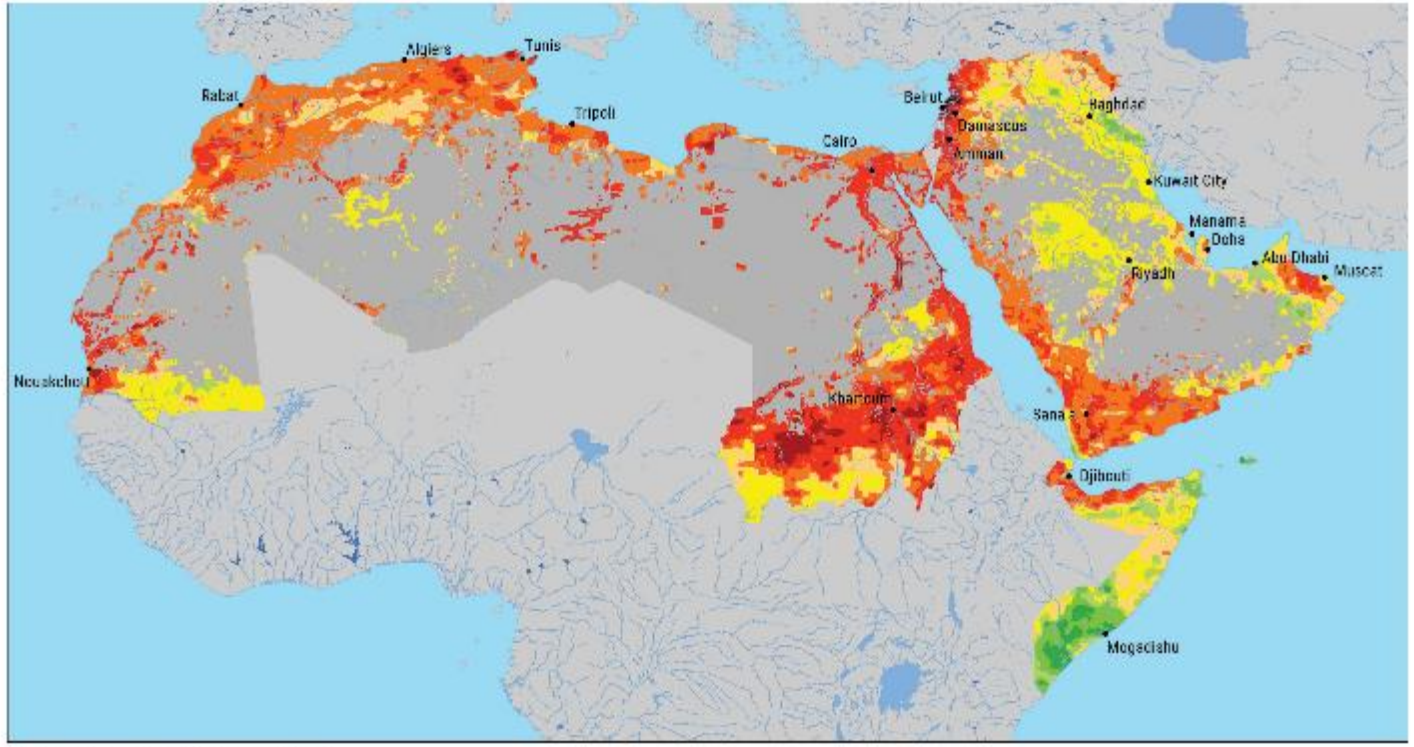
EXPOSURE (0.50)

RCM
- Change in temperature (0.17)
- Change in precipitation (0.17)

RHM
- Change in runoff (0.17)
- Change in evapotranspiration (0.17)

EXTREME EVENTS INDICES
- Change in maximum length of dry spell (0.16)
- Change in maximum length of wet spell (0.16)

Scenario	Percentage of study area		
	Low EX	Moderate EX	High EX
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%



Sensitivity

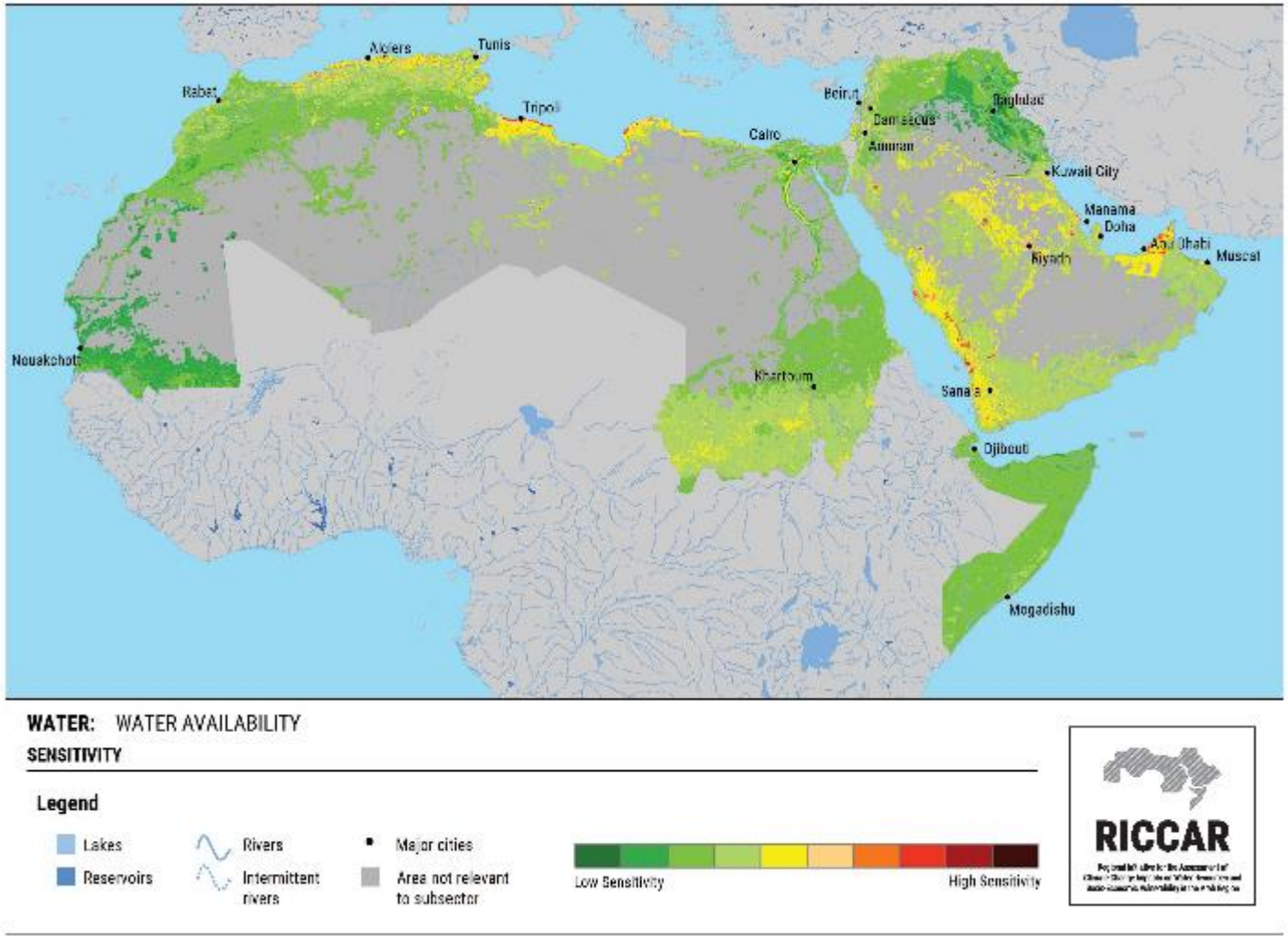
SENSITIVITY (0.50)

POPULATION (0.50)
- Population density (0.12)
- Share of agricultural labor force in total labor (0.12)
- Total renewable water available per capita (0.13)
- Share of water consumption in agriculture (0.50)
- Share of agriculture in GDP (0.13)

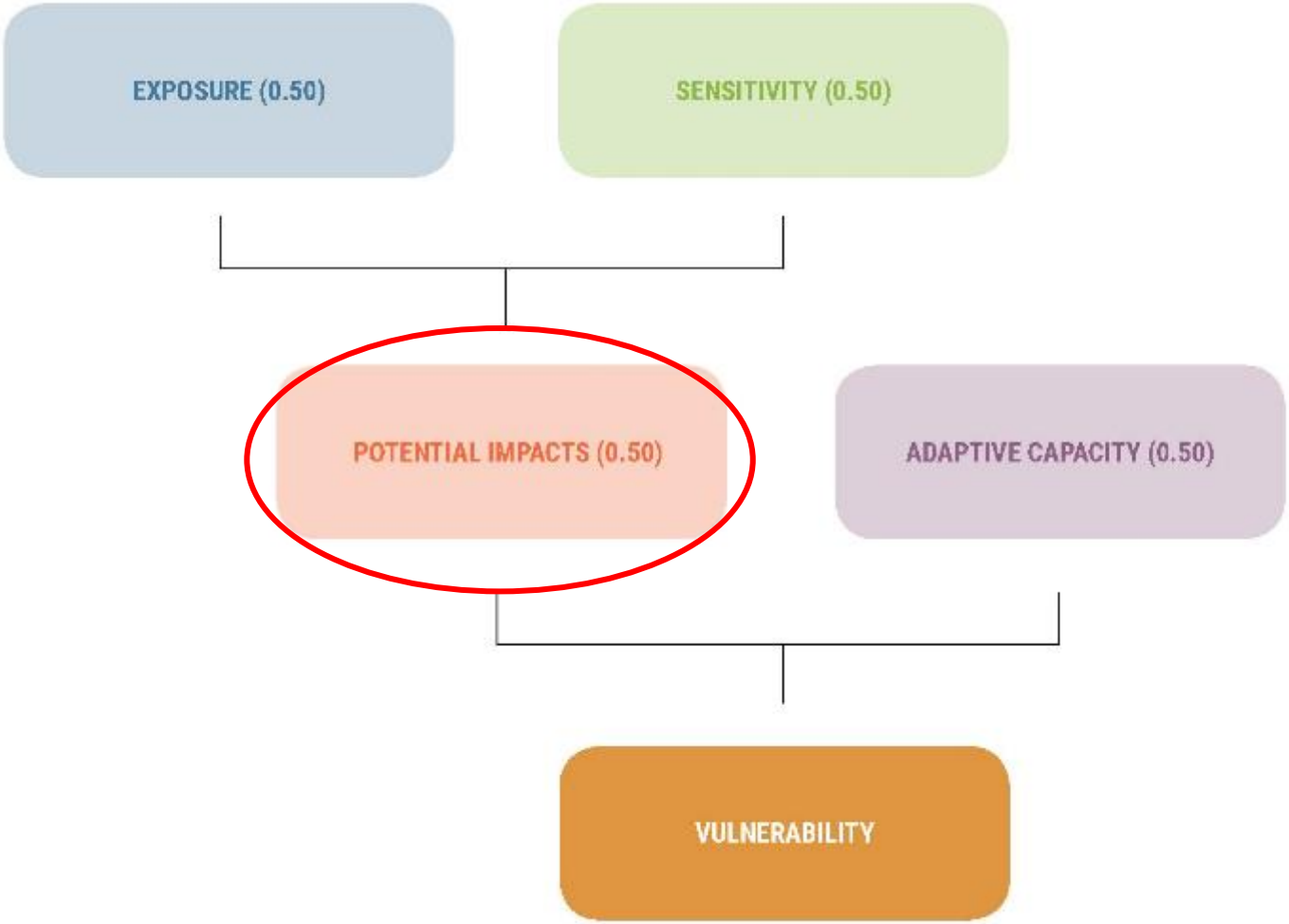
NATURAL (0.26)
- Soil storage capacity (0.34)
- Degradation of vegetation cover (0.32)
- Rainfed areas (0.34)

MANMADE (0.24)
- Floodprone areas (0.46)
- Irrigated areas (0.54)

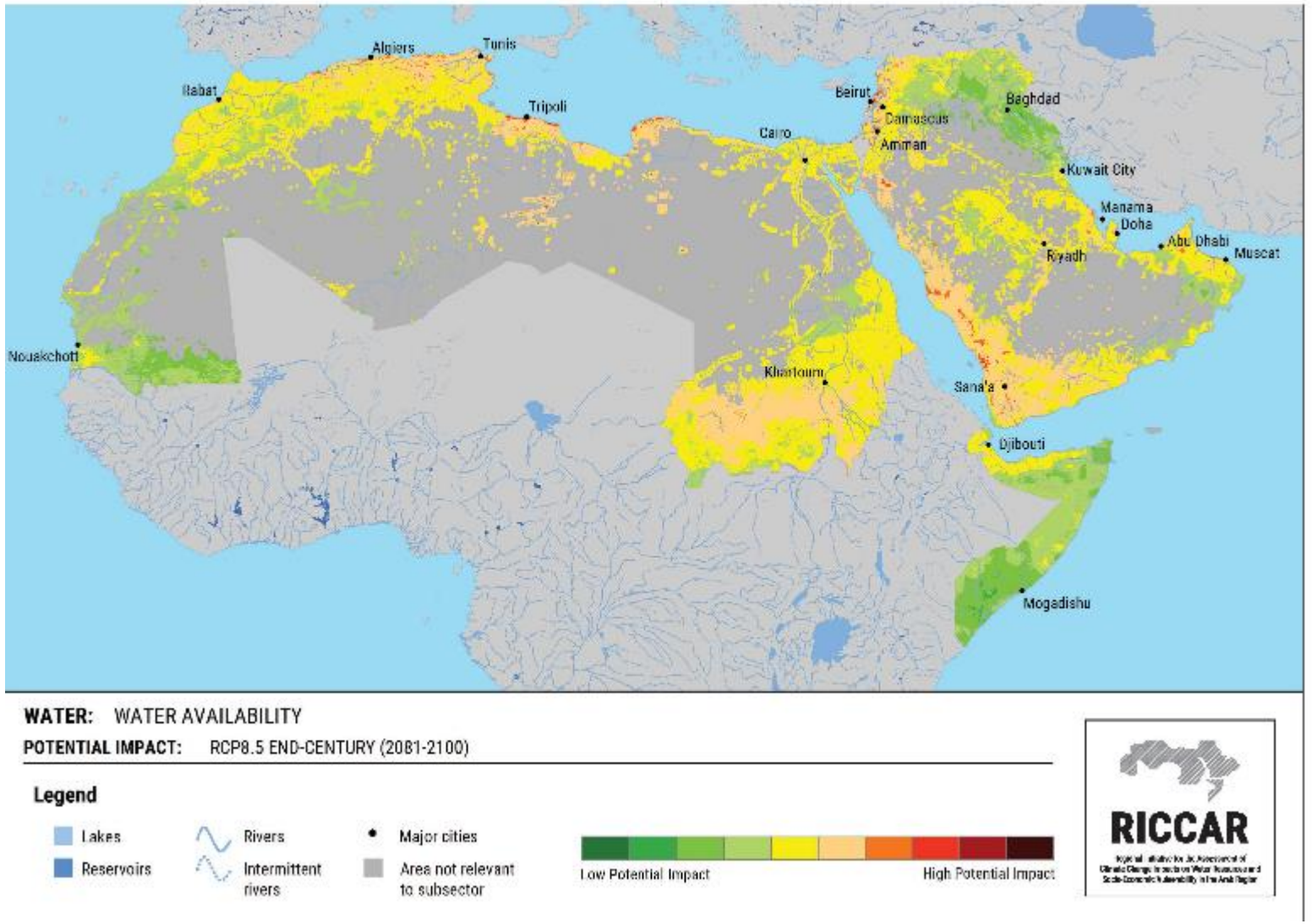
Scenario	Percentage of study area		
	Low SE	Moderate SE	High SE
All climate scenarios	43%	52%	4%



Components of vulnerability



Potential Impact



Areas with highest potential impact:

- Asir Mountains,
- Green Mountains
- Eastern Jafara Plain Basin.

Areas with lowest potential impact

- Southern Horn of Africa
- Central Tigris-Euphrates Basin

Adaptive capacity

ADAPTIVE CAPACITY (0.50)

KNOWLEDGE & AWARENESS (0.10)
- E-Governement development (0.33)
- Tertiary enrollment (0.32)
- Adult literacy rate (0.35)

TECHNOLOGY (0.10)
- Number of scientific and technical journal articles (0.46)
- Information and communication technologies index (0.54)

INSTITUTIONS (0.10)
- Governance index (0.54)
- Disaster risk reduction committees (0.46)

INFRASTRUCTURE (0.50)

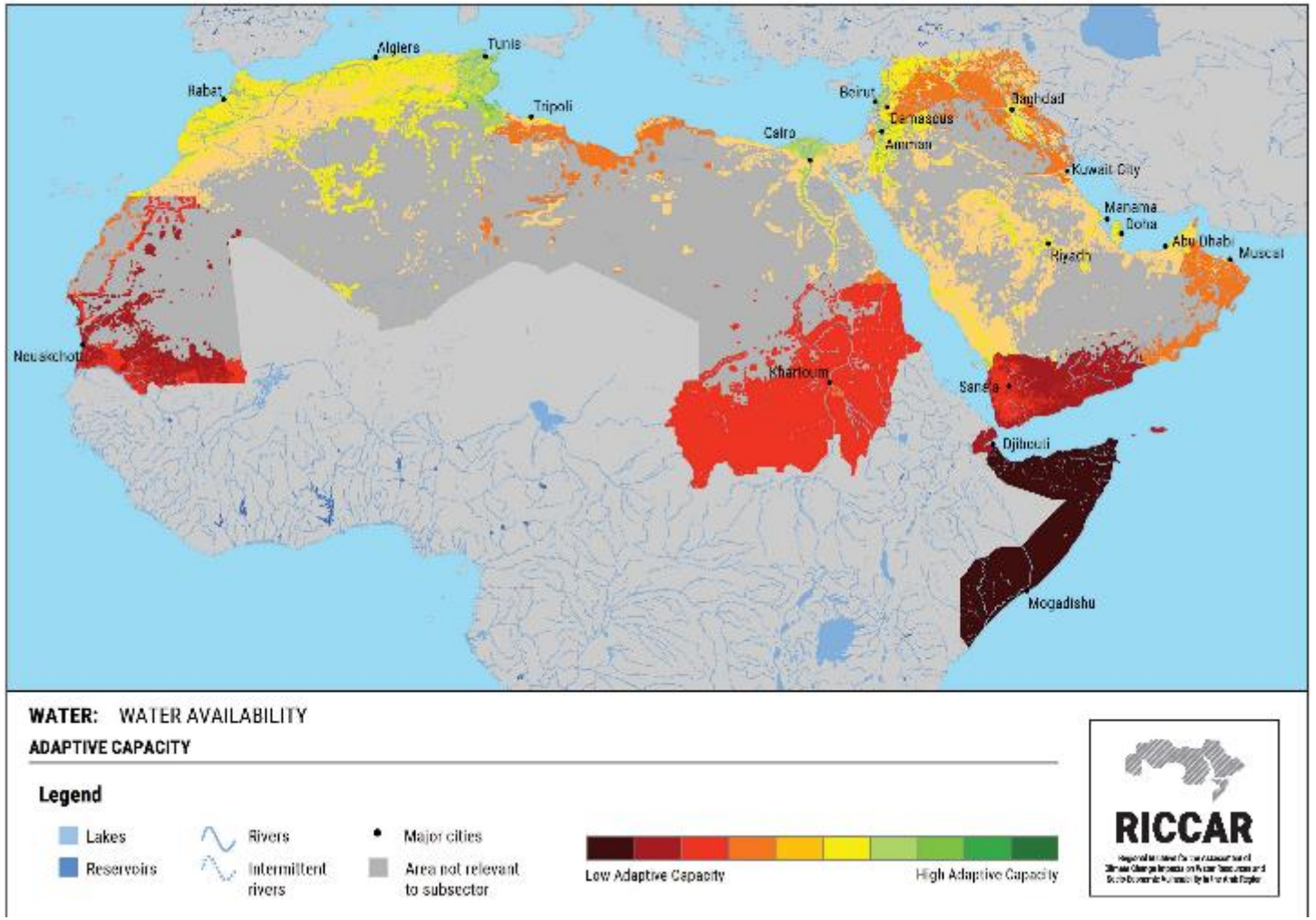
WATER & SANITATION (0.50)
- Areas served by dams (0.17)
- Installed desalination capacity per capita (0.17)
- Fossil groundwater (0.17)
- Access to improved water (0.17)
- Access to improved sanitation (0.16)
- Area equipped for irrigation (0.16)

ENVIRONMENT (0.50)
- Environment performance index (1.0)

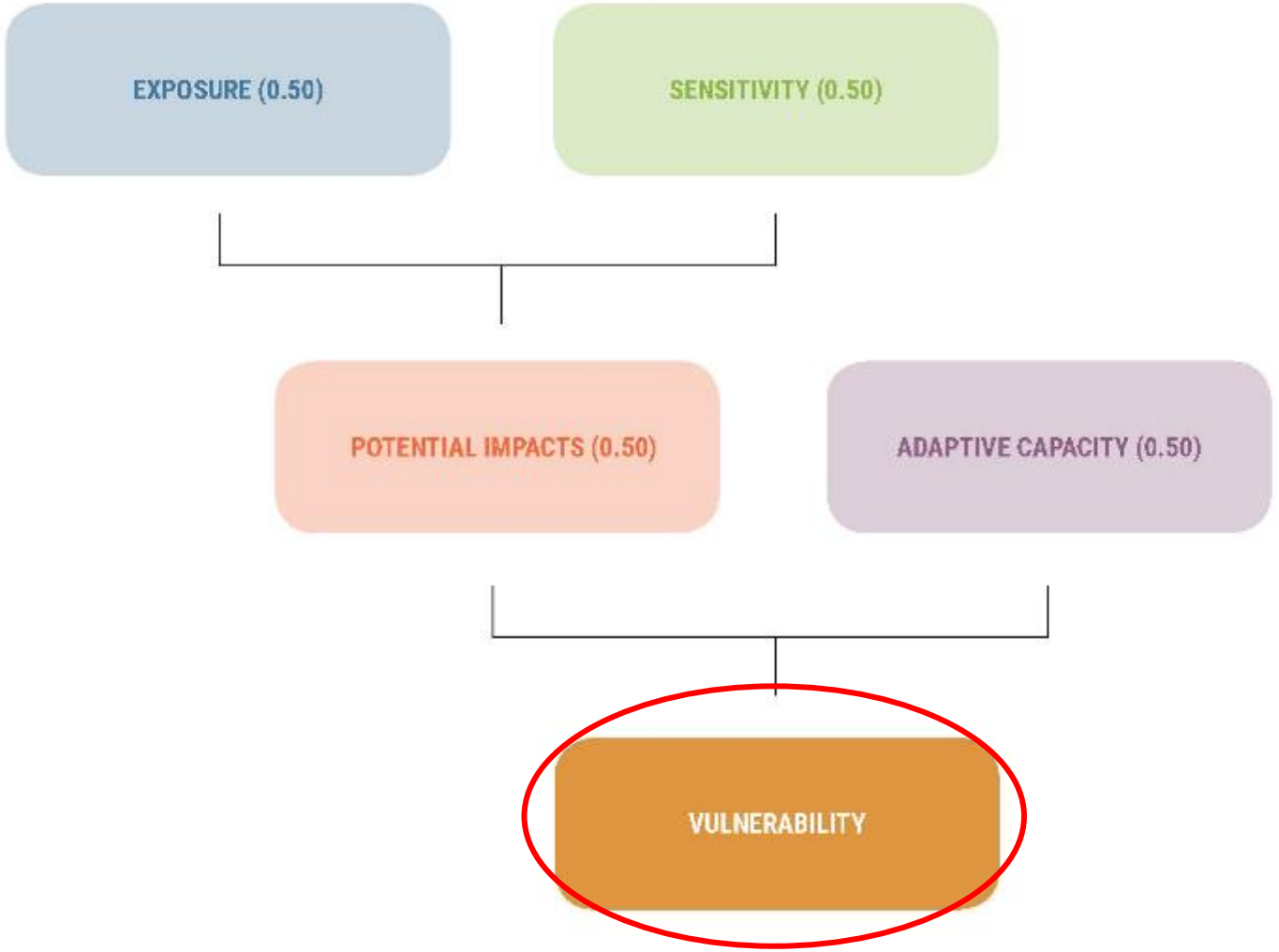
ECONOMIC RESOURCES (0.11)
- GDP per capita (0.36)
- ODA (0.30)
- Food imports as % of merchandise exports (0.34)

EQUITY (0.09)
- Female-to-male literacy ratio (0.51)
- Migrants/refugees index (0.49)

Scenario	Percentage of study area		
	Low AC	Moderate AC	High AC
All climate scenarios	43%	52%	4%

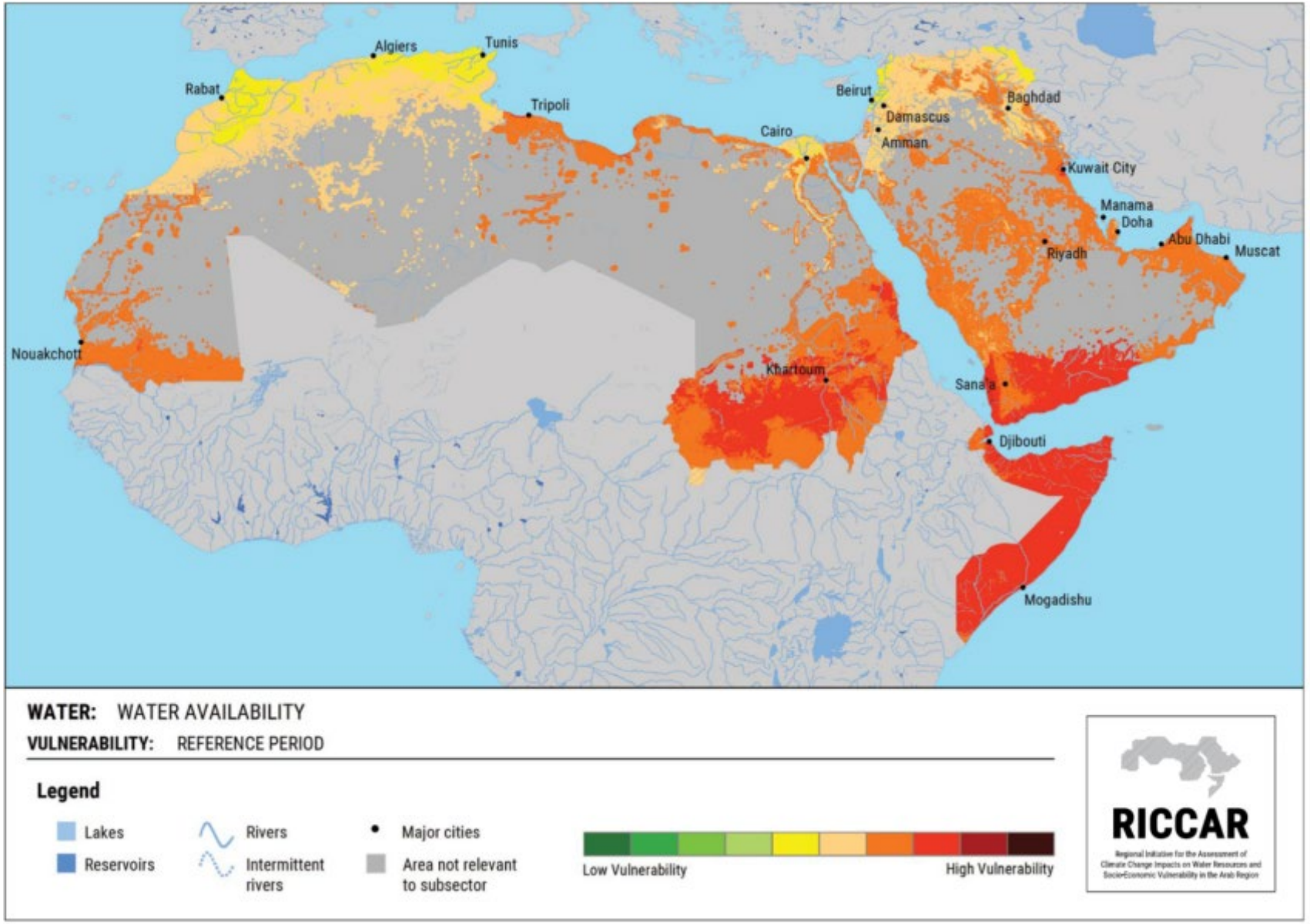


Components of vulnerability



Water Availability Vulnerability

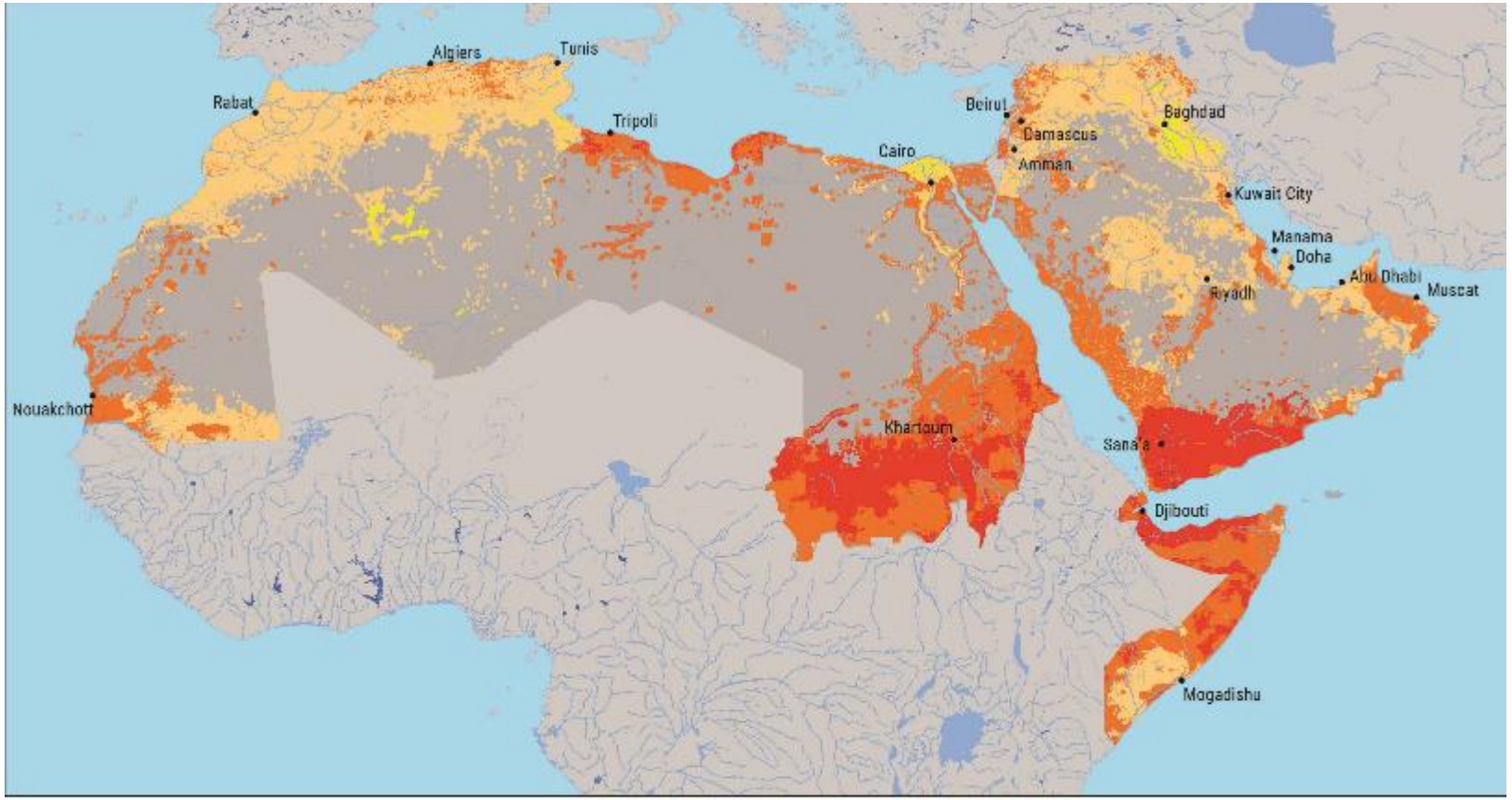
Reference Period (1986-2005)



Water Availability Vulnerability - modelled to end-century

Relative to Arab States as region of study

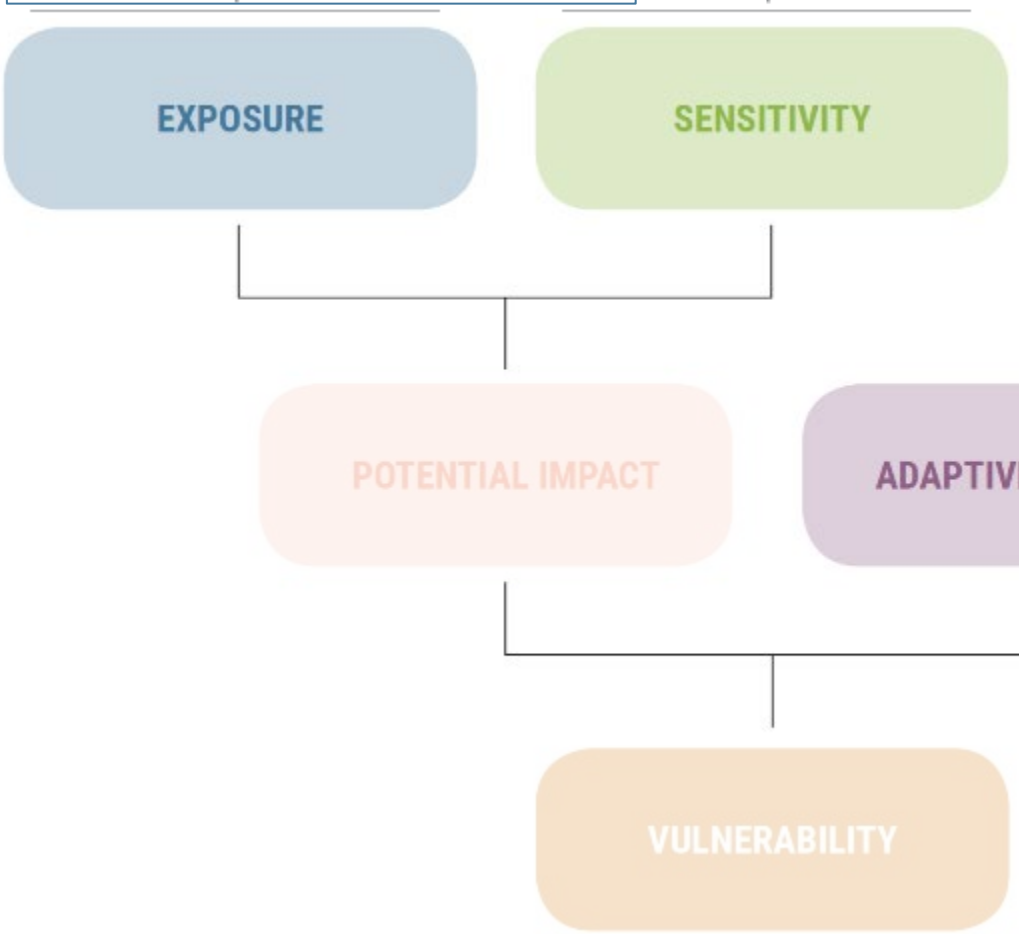
Scenario	Percentage of study area		
	Low Vul	Moderate Vul	High Vul
RCP 4.5 Mid-century	0%	57%	43%
RCP 8.5 Mid-century	0%	48%	52%
RCP 4.5 End-century	0%	52%	48%
RCP 8.5 End-century	0%	43%	57%



File formats for each indicator

- Netcdf (daily data, ensembles)
- Raster actual/ classified
- Map actual/classified
- Factsheet
- Excel file

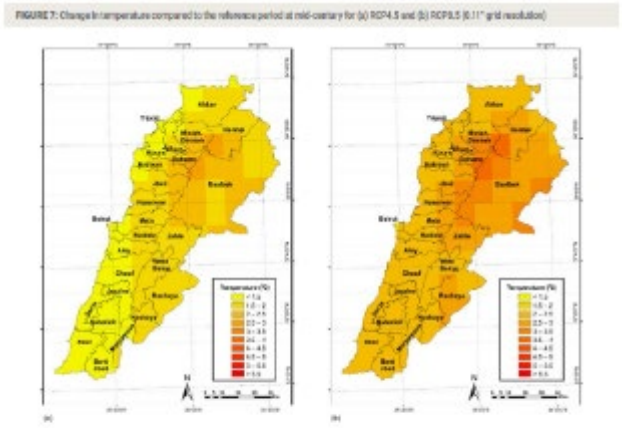
- Raster actual/ classified
- Map actual/classified
- Factsheet
- Excel file

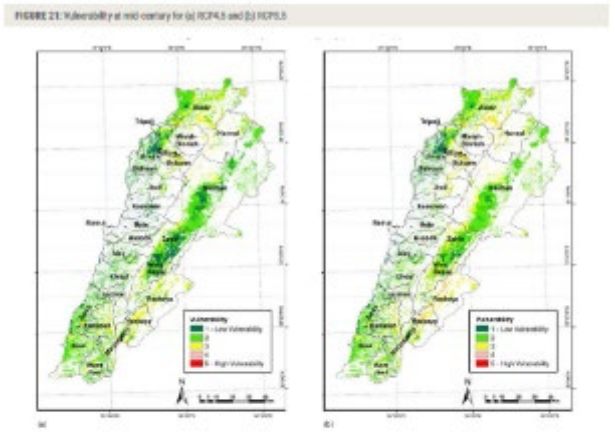


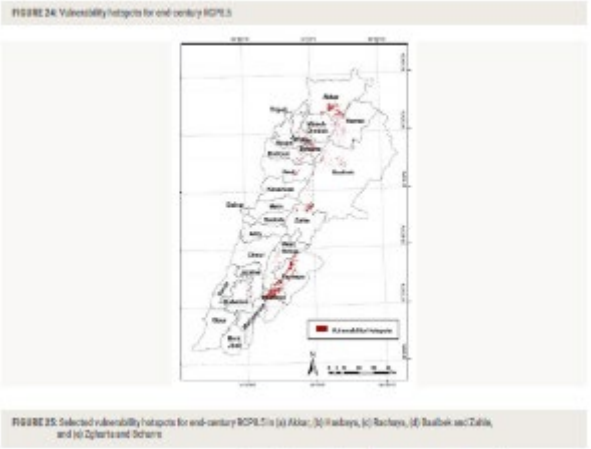
6 different file formats for each indicator

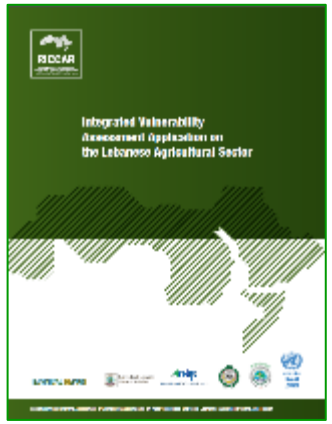
- Raster actual/ classified
- Map actual/classified
- Factsheet
- Excel file

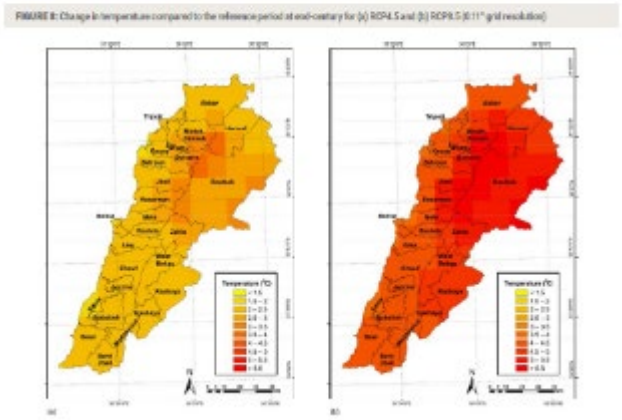
Lebanese Agricultural Sector Vulnerability Assessment

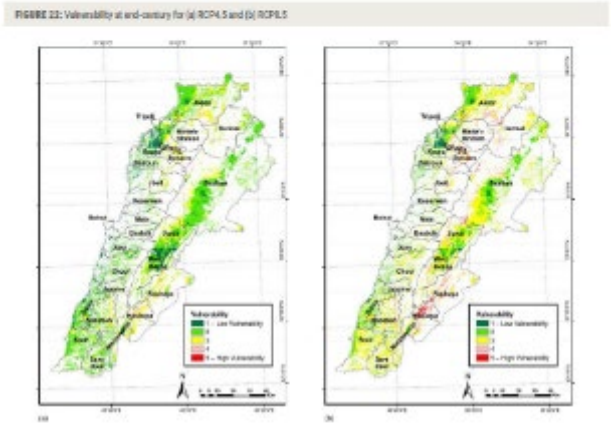


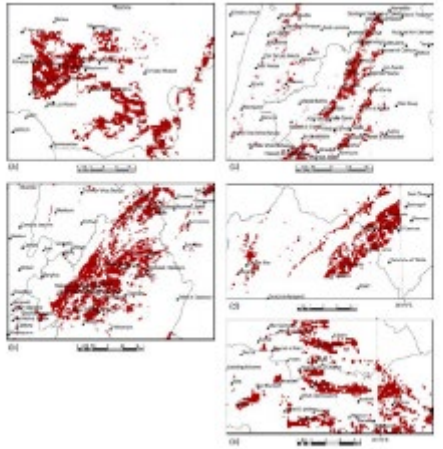




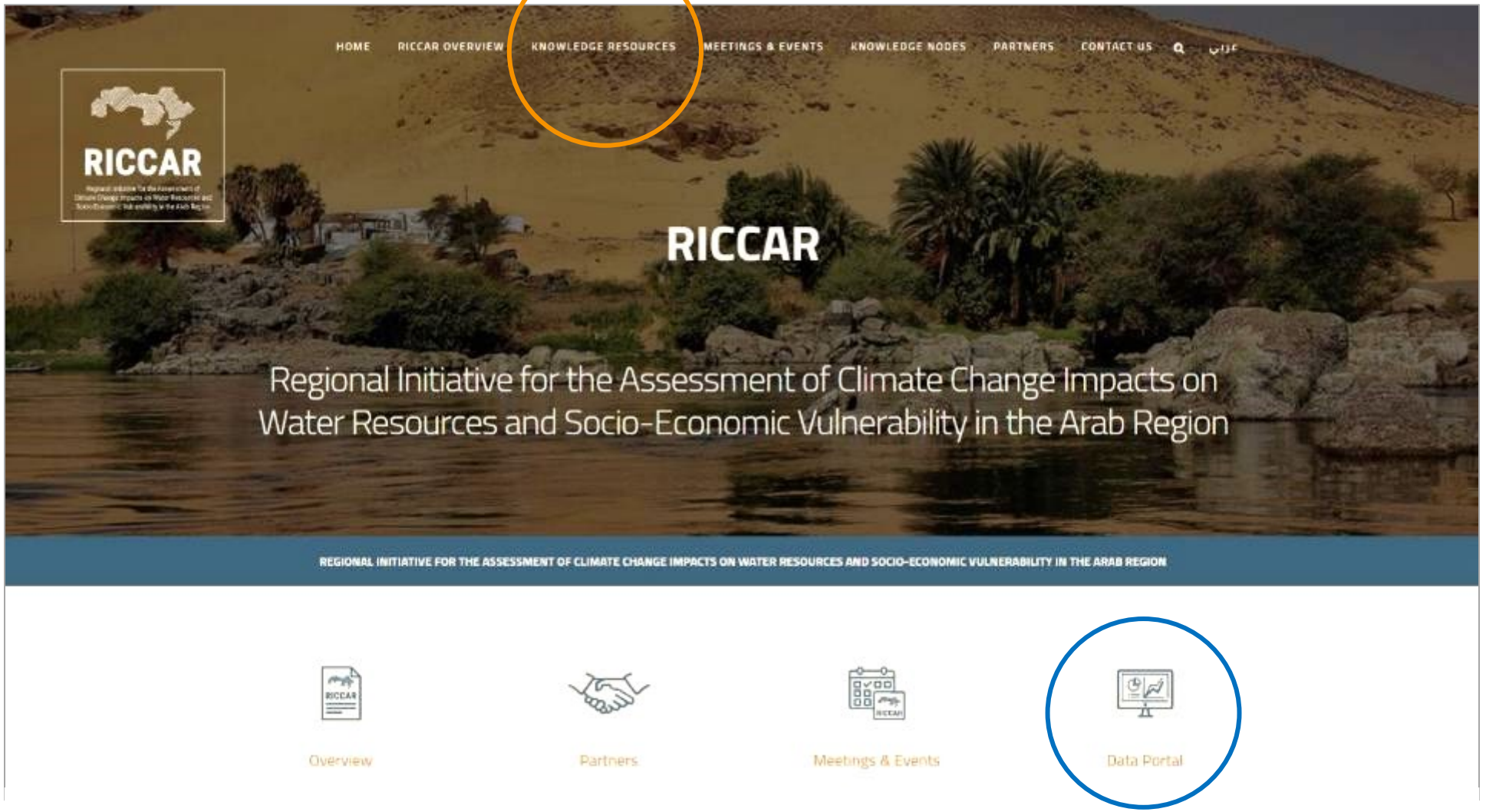






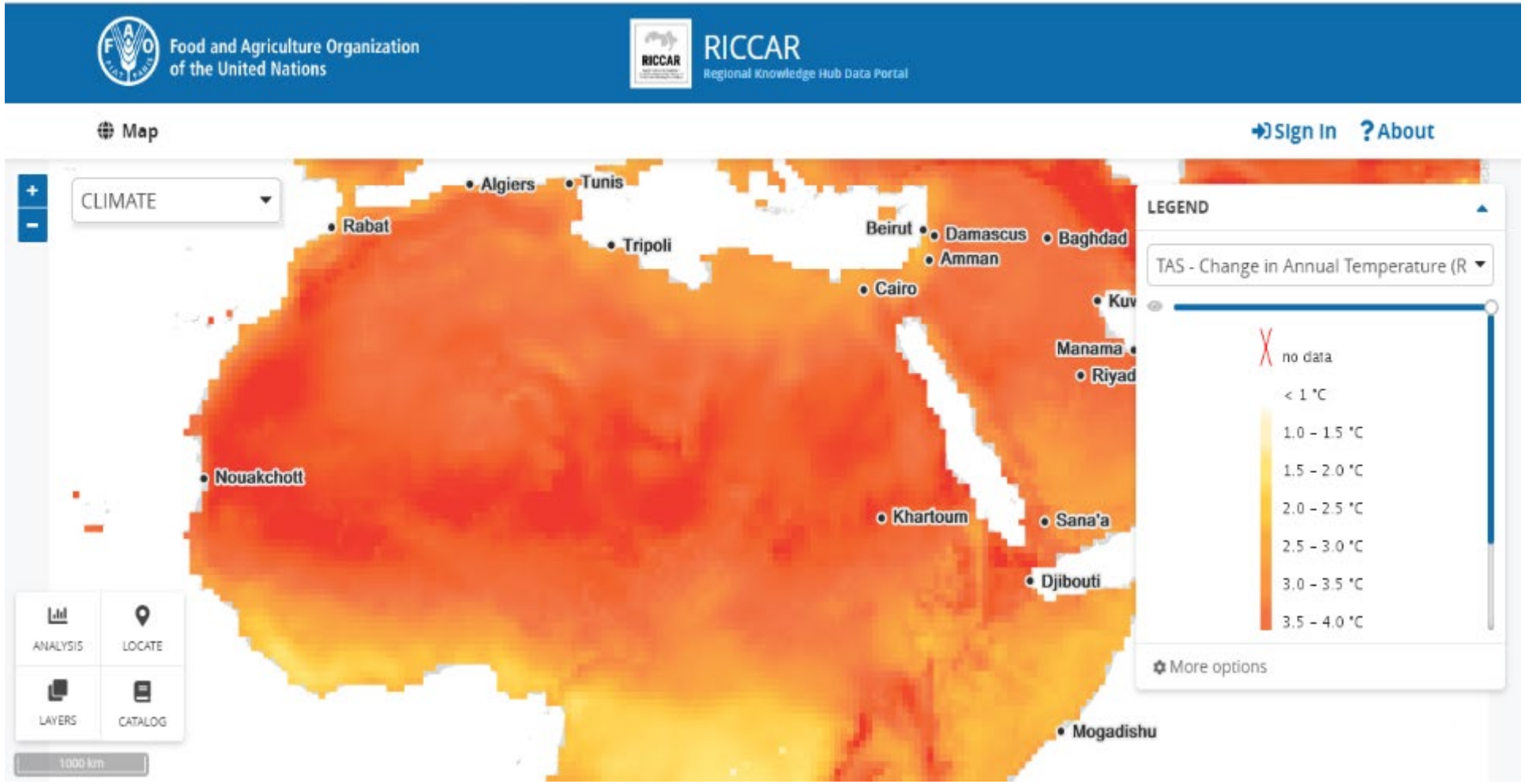


Regional Knowledge Hub



www.riccar.org

Regional Knowledge Hub - Data Portal



https://rkh.apps.fao.org/

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Thank You

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

ريـــكار
المبادرة الإقليمية لتقييم أثر تغيُّر المناخ على الموارد المائية وقابلية تأثُّر القطاعات الاجتماعية والاقتصادية في المنطقة العربية

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www.riccar.org

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الاسكوا
ESCWA

Shared Prosperity Dignified Life