Climate science and vulnerability and risk assessments to guide decision-making in adaptation

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Presentation outline

- Introduction
- Lessons from Zimbabwe on CC data
- Lessons from Zimbabwe on Vulnerability Assessment
- Challenges
- Conclusions

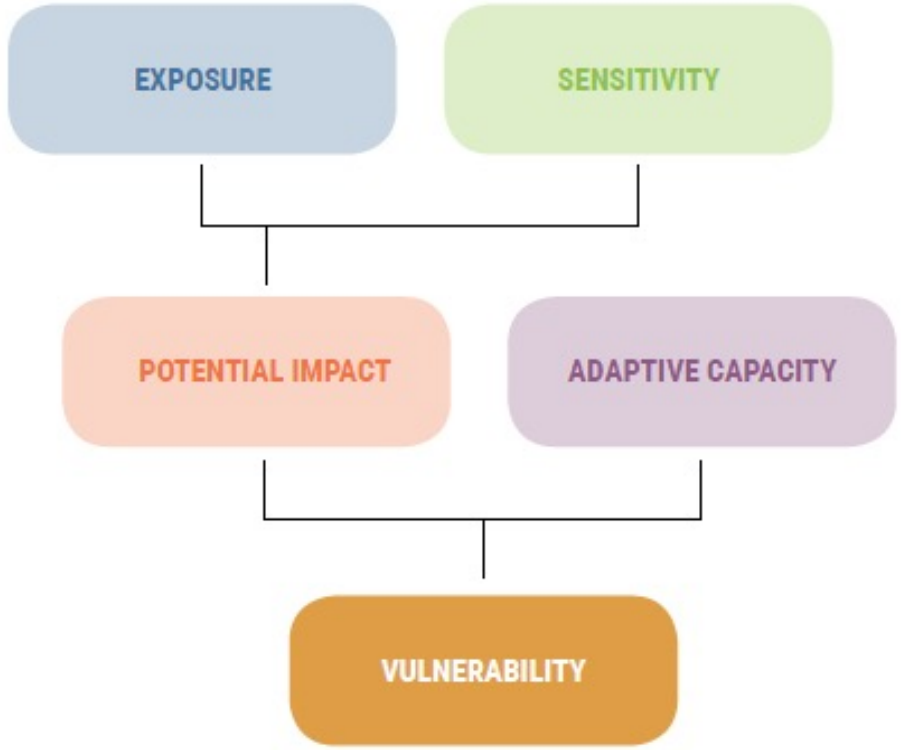
Introduction

- Climate variability and change affect virtually all socio-economic sectors.
- Extreme events (drought or floods) will also have considerable impact on economies particularly in developing countries with limited adaptive capacity.
- How climatic parameters (precipitation and temperature) changed in the past and how they will change in future have implications for adaptation and sustainable development.
- In planning for adaptation and resilience we are often faced with three questions:

- What are the climate risks (present and future)?
- What are the possible impacts and how vulnerable are we?
- How can we adapt?

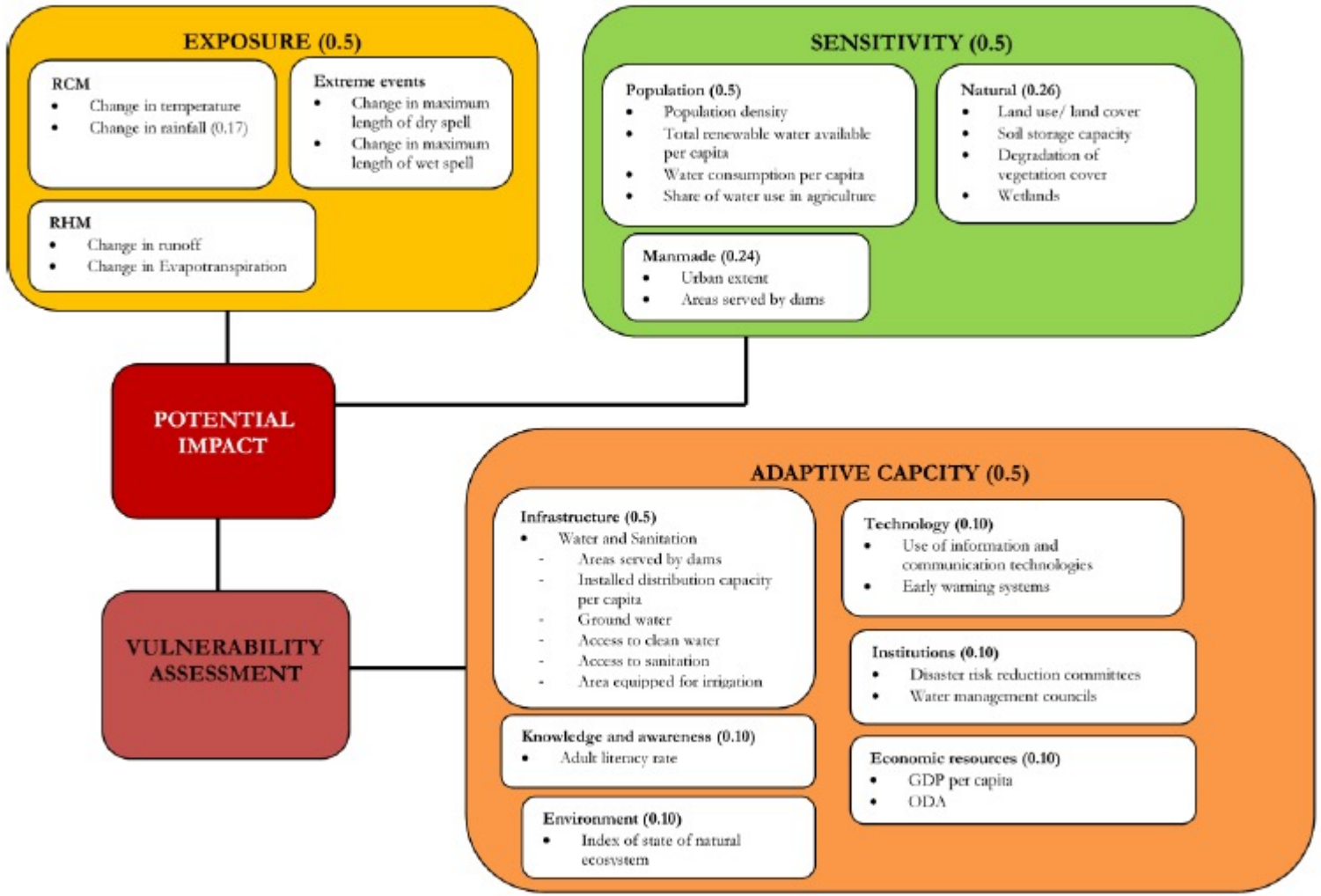
SECTORS	SUBSECTORS
Water	Water availability
Biodiversity and Ecosystems	Area covered by forests Area covered by wetlands
Agriculture	Water available for crops Water available for livestock
Infrastructure and Human Settlements	Inland flooding area
People	Water available for drinking Health conditions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

Using Climate Science to inform vulnerability Assessment



Source: Based on IPCC, 2007

Unpacking the Vulnerability Framework – with a focus on Exposure – Using water as an example



The Challenge

- In most developing countries both historic and future climate data or information is not readily available.
- When available the data/information may not be packaged at appropriate spatial and temporal scales for application.
- When available, the data may not be an easy-to-use format
- In some cases, potential user do not simply know where to get the data (especially Downscaled CC data).
- Also a common challenge is lack of skills to post-process available downscaled CC data.

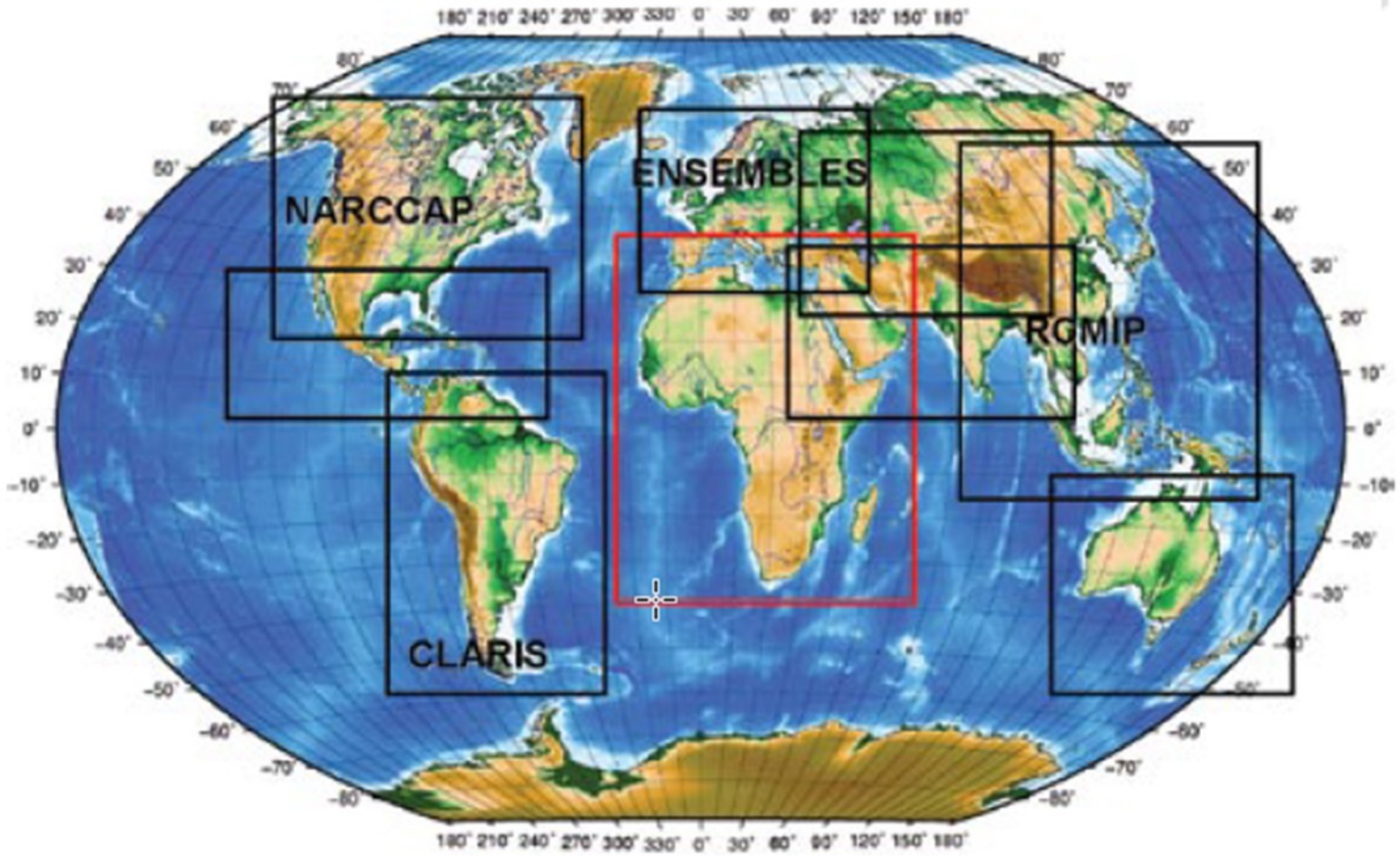
Lessons from Zimbabwe on CC data

- For Historical Climate trends- The University of East Anglia Climate Research Unit data can be very useful if complimented with data from the local Met Services.

- For Downscaled future climate change scenarios, the CORDEX data is very handy. CORDEX Data: https://cordex.org/data-access/cordex-data-on-esgf/.

- CORDEX is based on GCMs:RCMs from several modeling groups. Same data used in AR5 (CMIP5) now CMIP6. Data available on daily, monthly, seasonal, annual time scales.
- Regional Climate Models (RCMs) applied over a limited area and driven by GCMs can provide information on much smaller scales supporting more detailed impact and adaptation assessment and planning.

CORDEX Domains



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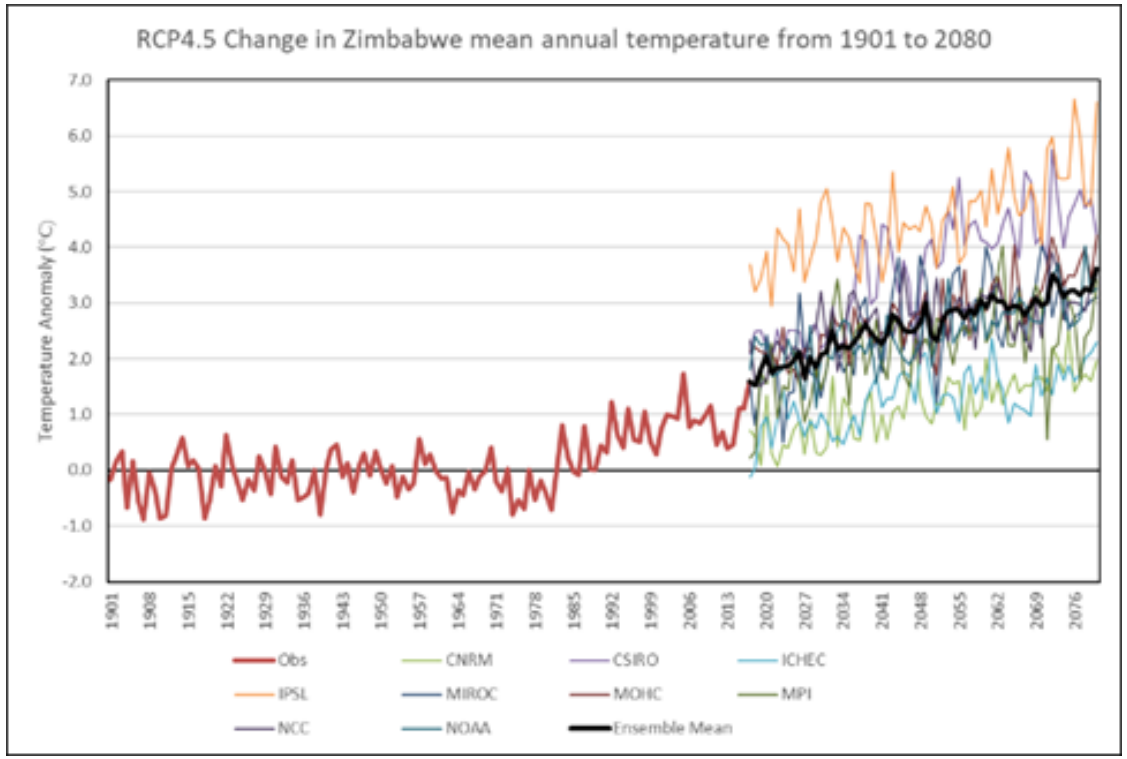
CORDEX Data
Used

- 10 GCMs
- 7 RCMs

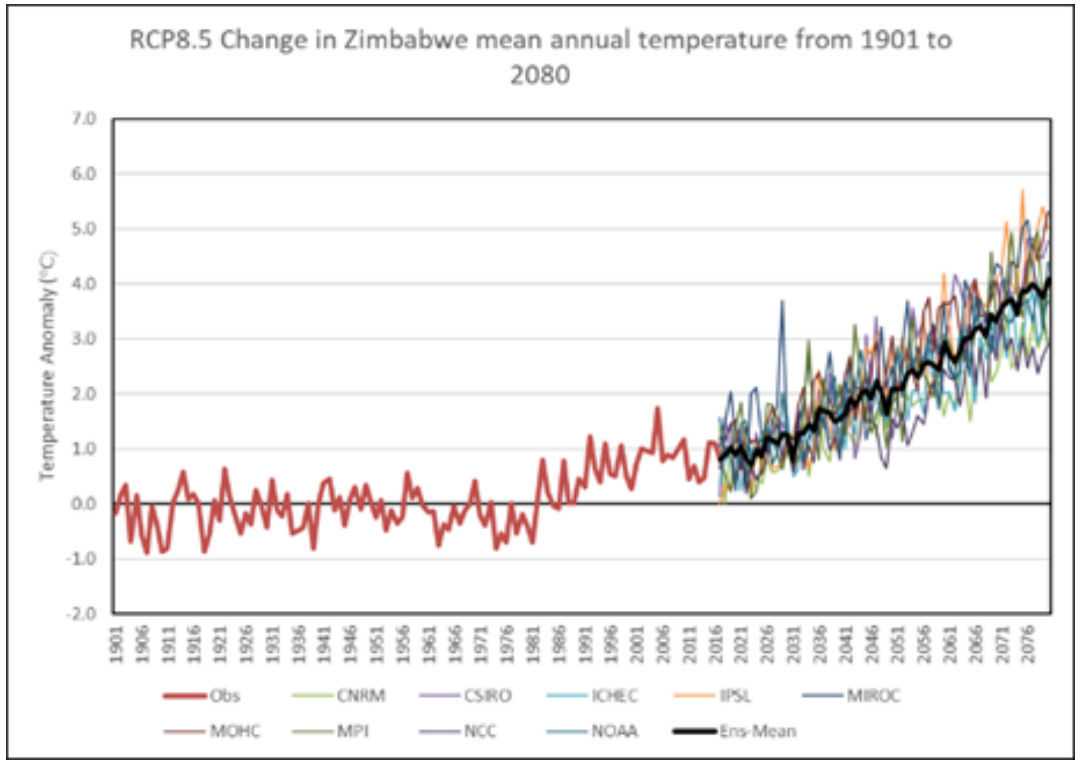
SMHI-RCA4	ECMWF-ERAINT	Eval		1980-2010
	CCCma-CanESM2	45, 85		1951-2100
	CNRM-CERFACS-CNRM-CM5	45, 85		1951-2100
	MOHC-HadGEM2-ES	**26,45, 85**		1951-2099
	NCC-NorESM1-M	**26,45, 85**		1951-2100
	ICHEC-EC-EARTH	**26,45, 85**		1951-2100
	MIROC-MIROC5	**26,45, 85**		1951-2100
	NOAA-GFDL-GFDL-ESM2M	45, 85		1951-2100
	MPI-M-MPI-ESM-LR	**26,45, 85**		1951-2100
	IPSL-IPSLCM5A-MR	45, 85		1951-2100
	CSIRO_QCCCE-CSIRO-Mk3-6-0	45, 85		1951-2100
KNMI-RACMO22E	ECMWF-ERAINT	Eval		1979-2012
	ICHEC-EC-EARTH	45, 85		1950-2100
	MOHC-HadGEM2-ES	**26, 45, 85**		1951-2099
DMI-HIRHAM5	ECMWF-ERAINT	Eval		1989-2010
	ICHEC-EC-EARTH	45, 85		1951-2100
	NCC-NorESM1-M	45.85		1951-2100
CLMcom-CCLM4-8-17	ECMWF-ERAINT	Eval		1989-2008
	CNRM-CERFACS-CNRM-CM5	45, 85		1950-2100
	MOHC-HadGEM2-ES	45, 85		1951-2099
	ICHEC-EC-EARTH	45, 85		1950-2100
	MPI-M-MPI-ESM-LR	45, 85		1950-2100
CCCma-CanRCM4	ECMWF-ERAINT	Eval		1989-2009
	CCCma-CanESM2	45, 85		1950-2100
BCCR-WRF331C	ECMWF-ERAINT	Eval		1979-2013
	NCC-NorESM1-M	45, 85		1951-2100
MPI-CSC-REMO2009	ECMWF-ERAINT	Eval		1989-2008
	ICHEC-EC-EARTH	**26,45, 85**		1950-2100
	MPI-M-MPI-ESM-LR	**26,45, 85**		1950-2100
	MPI-M-MPI-ESM-LR	**26,45, 85**		1950-2100

Time series of national historic and future mean annual temperature change

RCP4.5

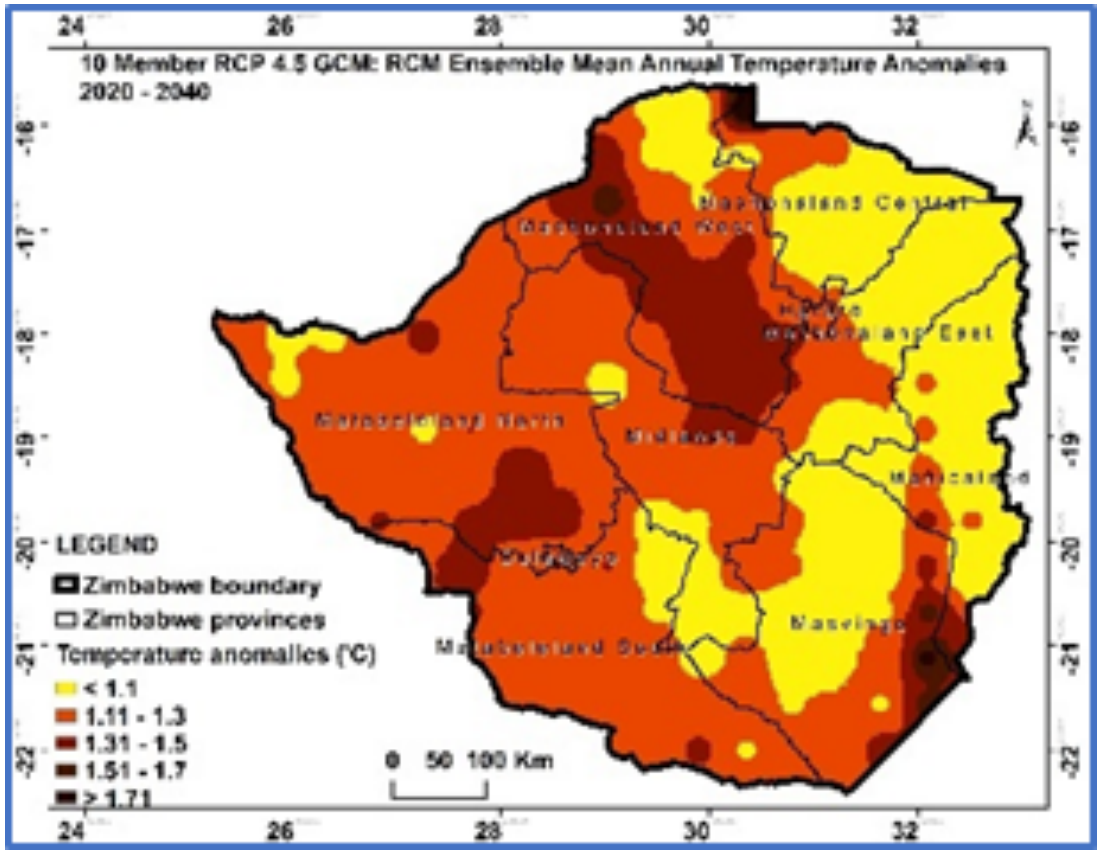


RCP8.5

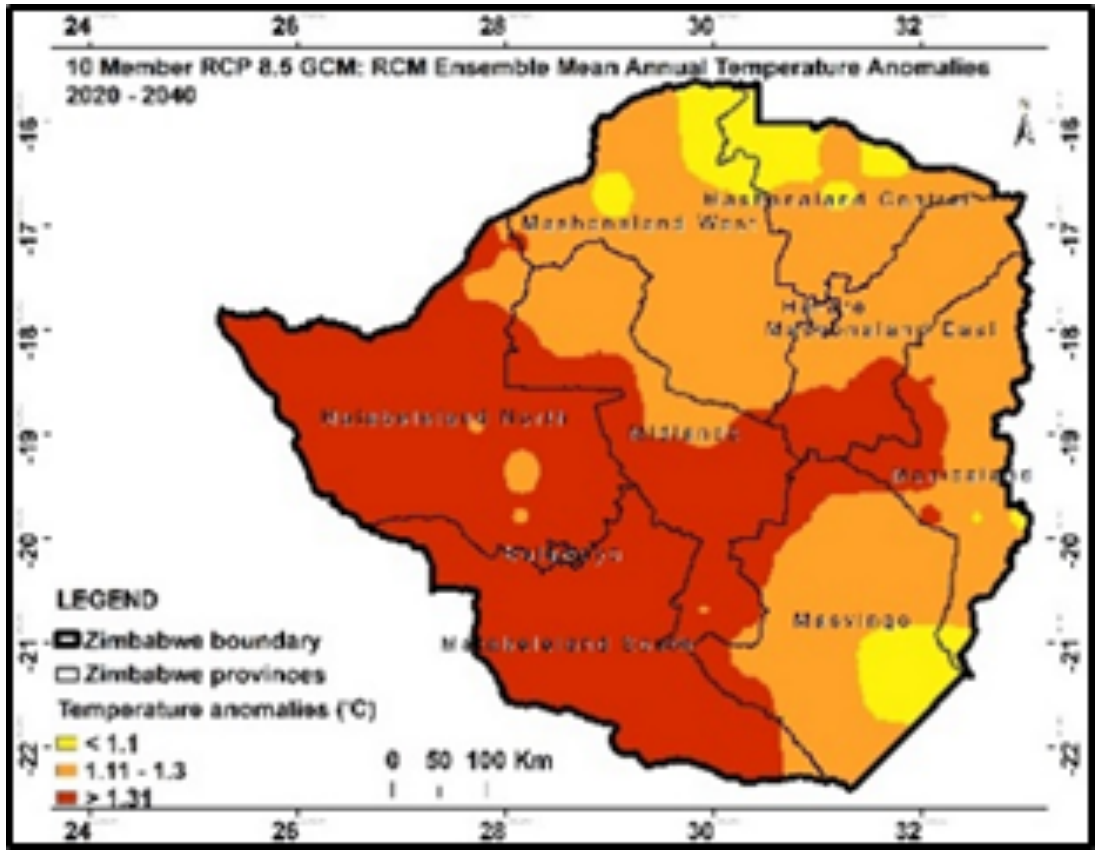


2020 – 2040 Temperature change (Ensemble Mean)

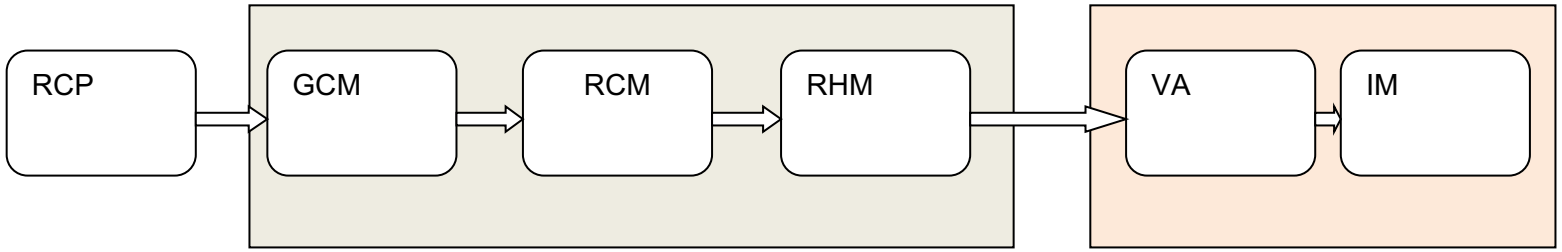
RCP4.5



RCP8.5



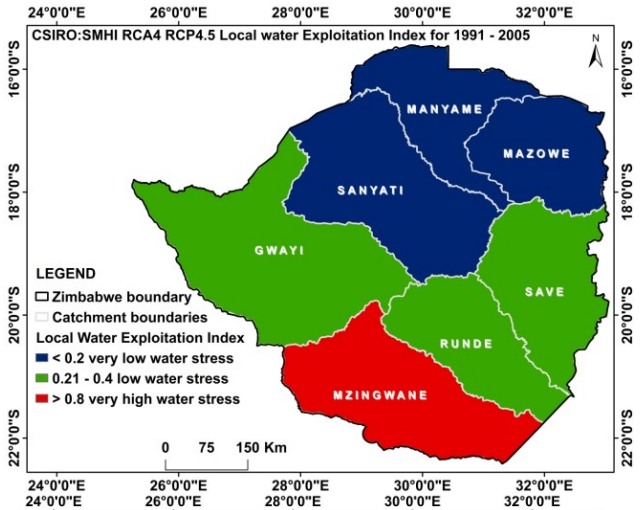
Integrated Vulnerability assessment – Example for

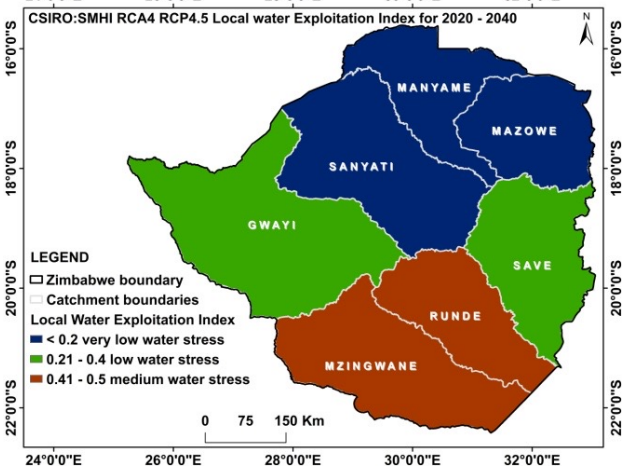


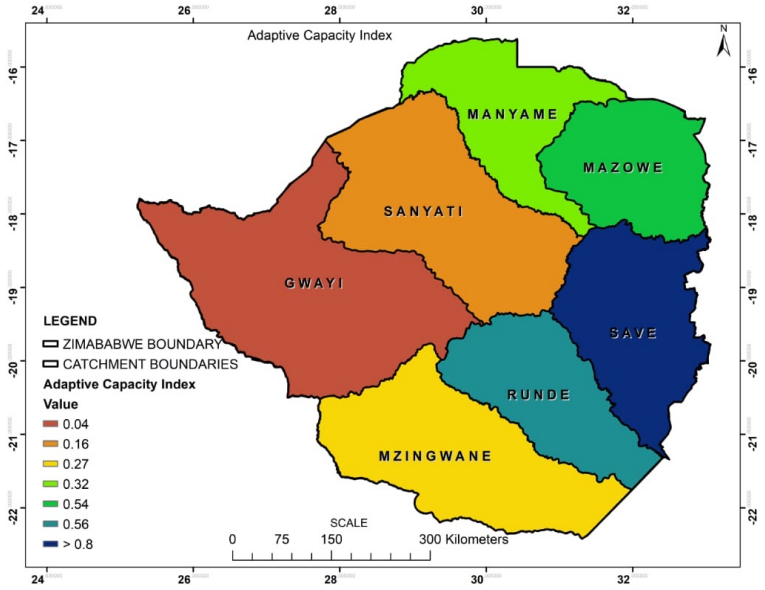
Key:
RCP – Representative Conc Pathway
GCM – Global Climate Model
RCM – Regional Climate Model
RHM – Regional Hydrology Model
VA – Vulnerability Assessment
IM – Integrated Mapping (hot-spots)

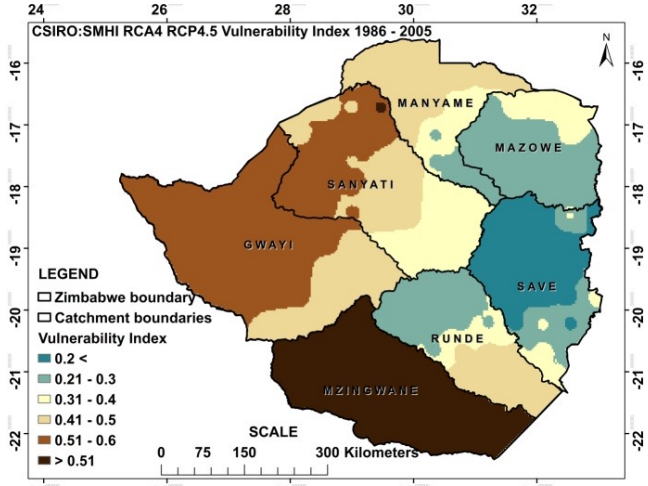
$$\text{Vulnerability Index} = 1/3(\text{Exposure} + \text{Sensitivity} + (1\text{-Adaptive capacity})).$$

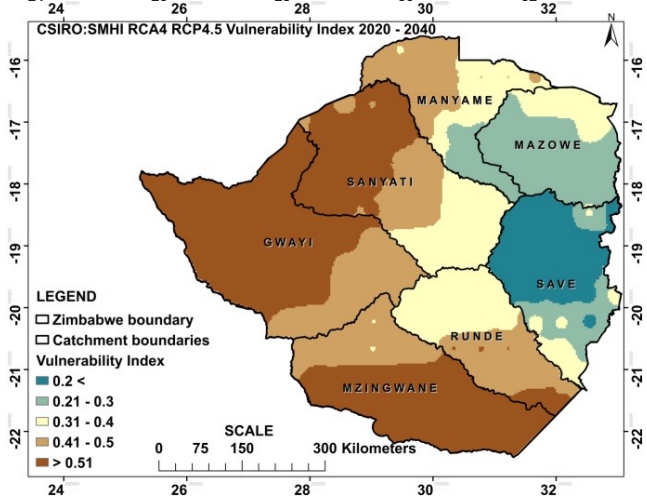
Integrated vulnerability mapping for water in Zimbabwe (Current & Future -2020-2040)











Conclusions

- With climate risk information and vulnerability assessment it is possible for decision and policy makers to:

- Target vulnerable sectors and prioritise
- Target vulnerability hot-spots
- Have some information on drivers of vulnerability
- Identify possible adaptation and resilience building measures

Thank You