



# WORKSHOP ON CLIMATE CHANGE AND CITY PLANNING: ESSENTIAL IMPACT ASSESSMENT TOOLS FOR CITY PLANNERS TO MITIGATE RISKS AND BUILD RESILIENCE

## Session 2: Strategic Tools for city planning

### THE GREEN BOOK: Adapting Settlements for the Future

Presenter: Melanie Lück-Vogel

CSIR Smart Places

26 September 2022 CTICC Cape Town

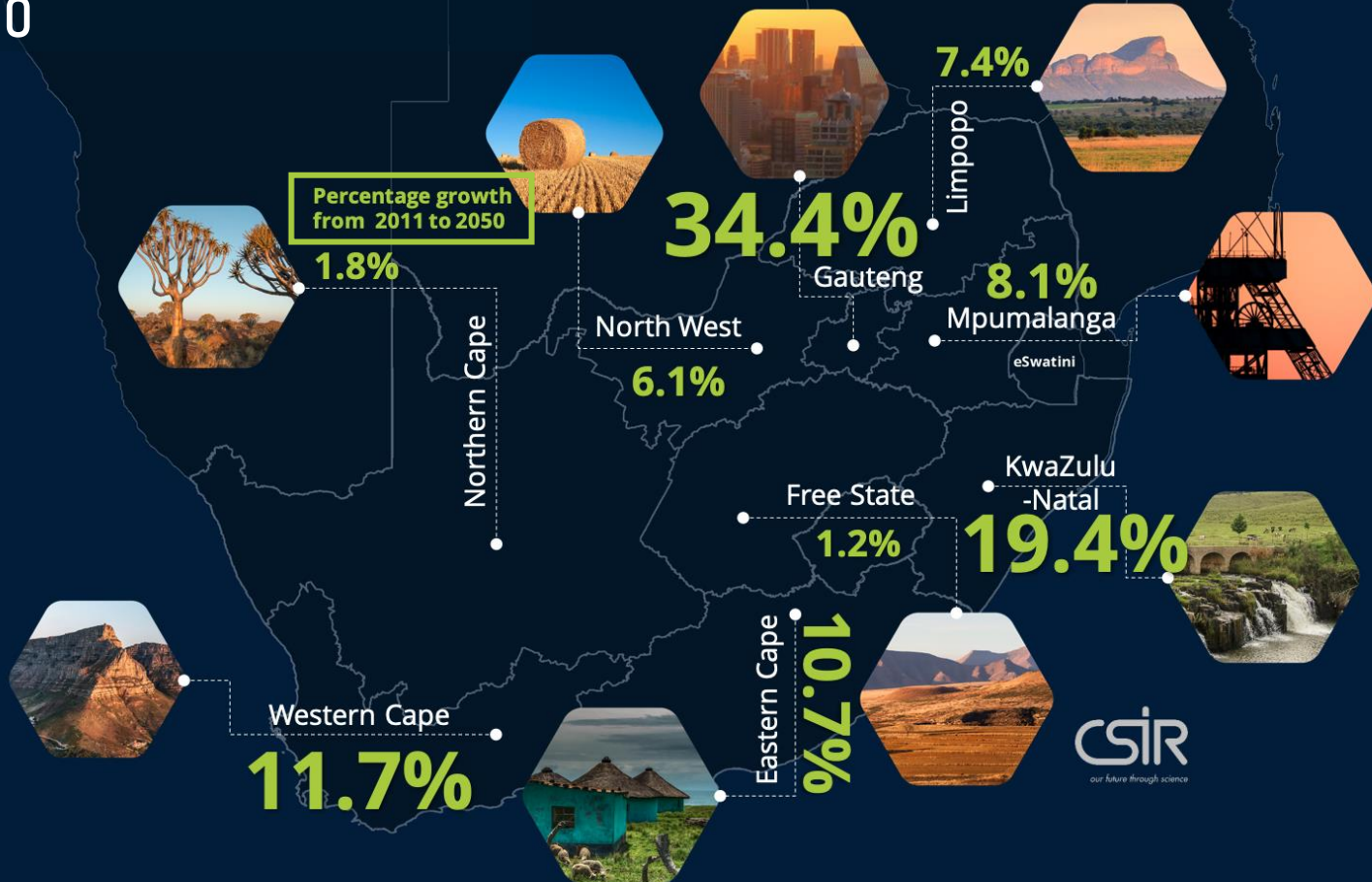
Project partners since 2016



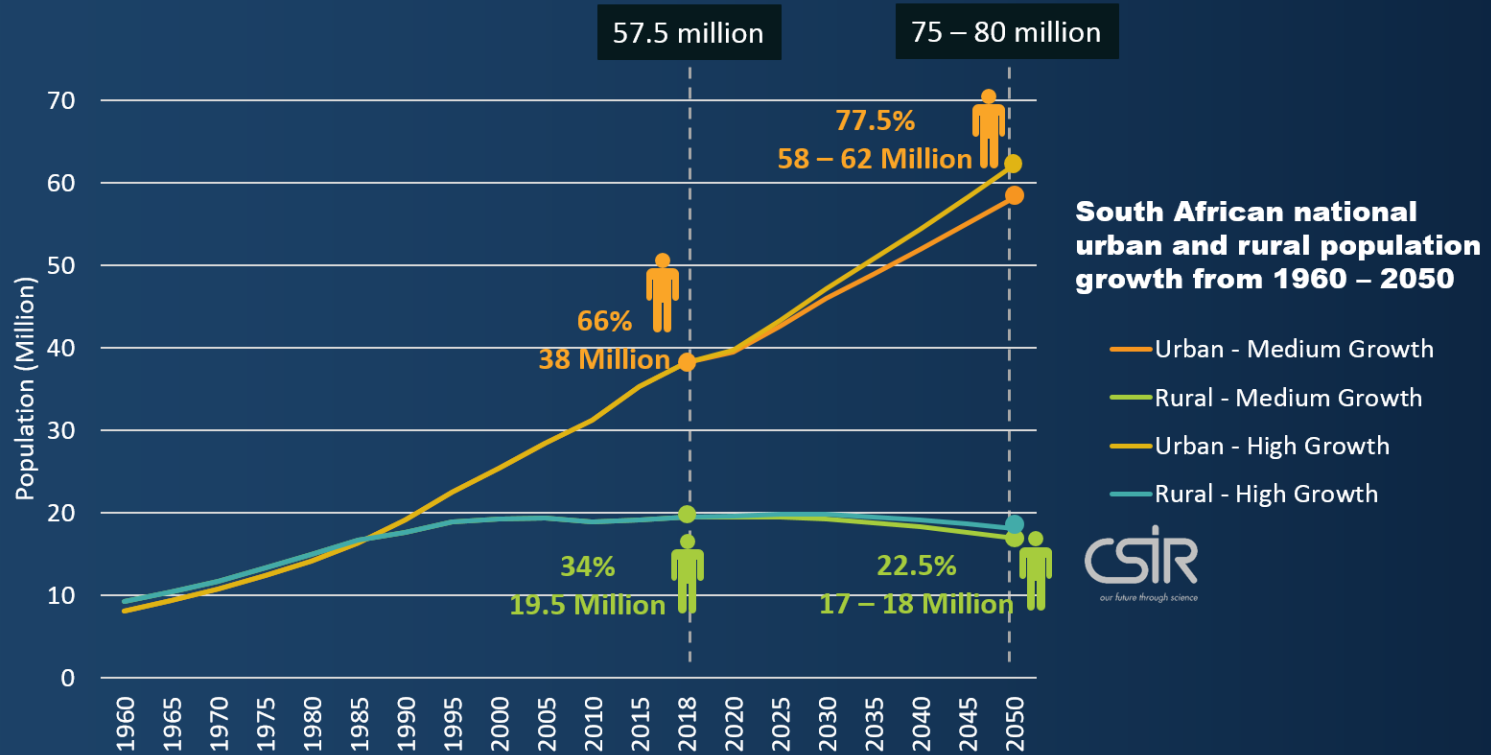
International Development Research Centre  
Centre de recherches pour le développement international



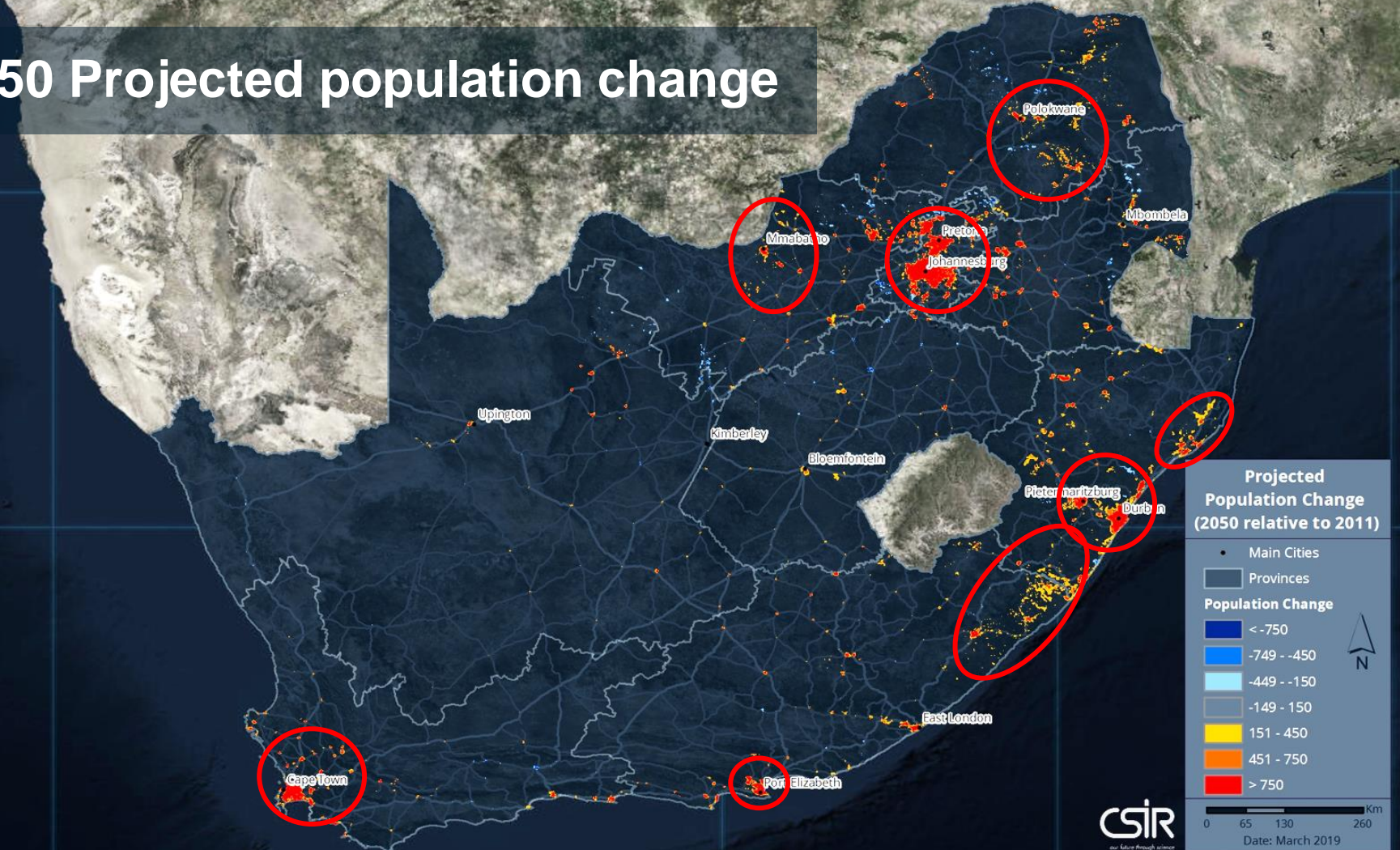
# Projected population growth 2011-2050



# Population growth 1960-2050



# 2050 Projected population change



**Projected Population Change (2050 relative to 2011)**

- Main Cities
- Provinces

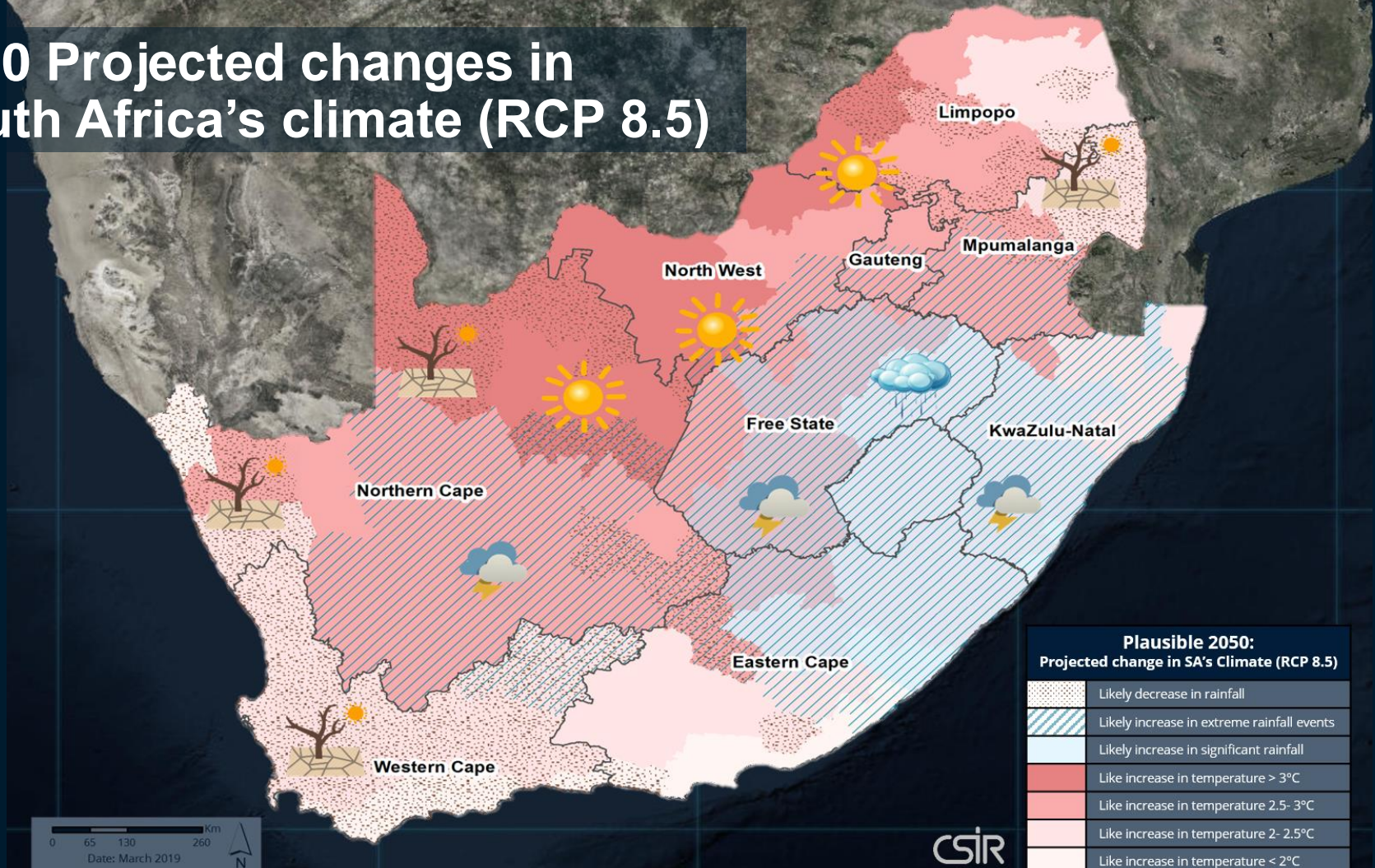
**Population Change**

- < -750
- 749 - -450
- 449 - -150
- 149 - 150
- 151 - 450
- 451 - 750
- > 750

CSIR  
and future through science

0 65 130 260 Km  
Date: March 2019

# 2050 Projected changes in South Africa's climate (RCP 8.5)





# THE URBAN CONTEXT



**Extreme weather events  
are becoming more  
frequent and intense with  
climate change**

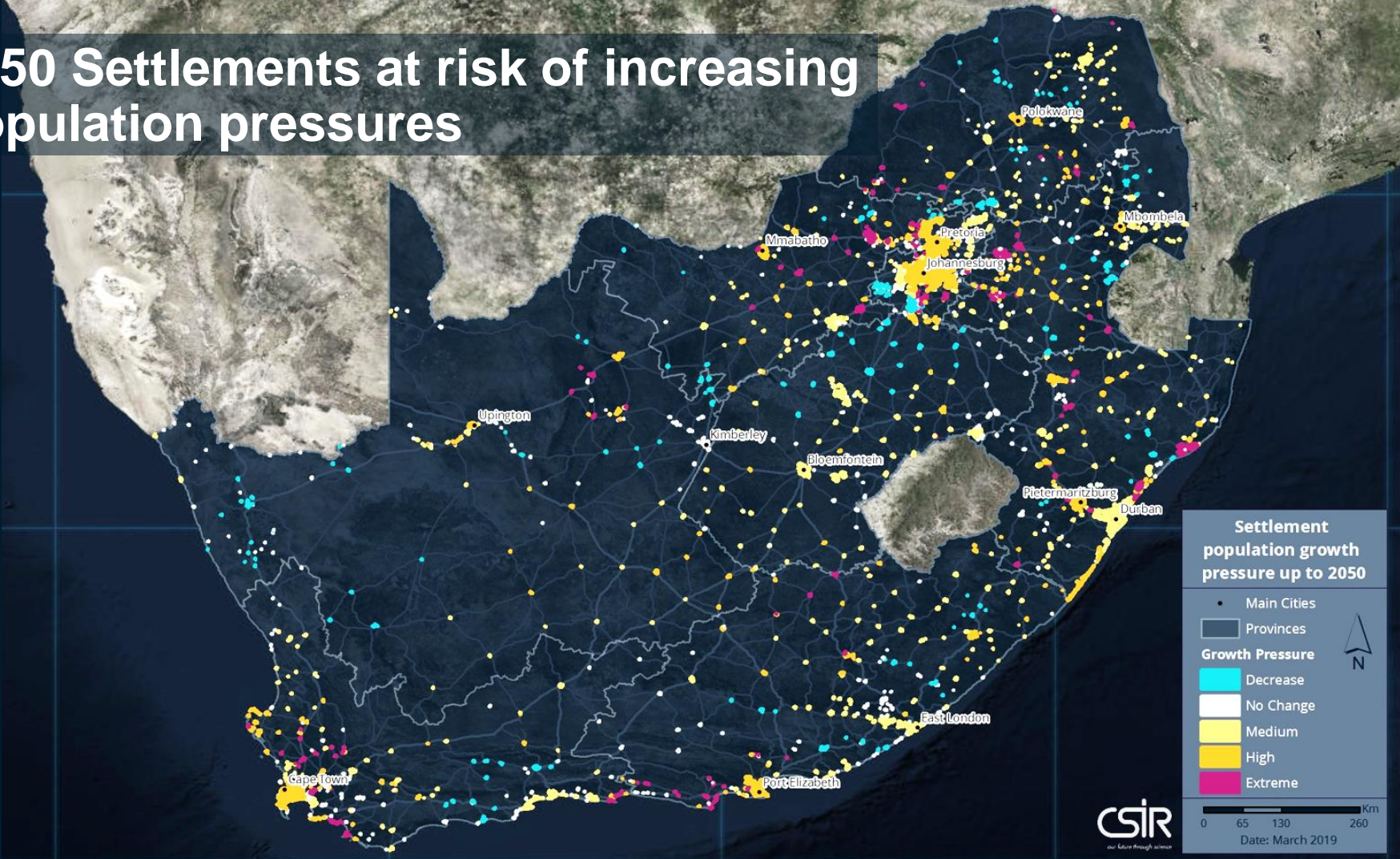


**Growing & urbanising  
population will continue to place  
pressure on cities and local  
government**



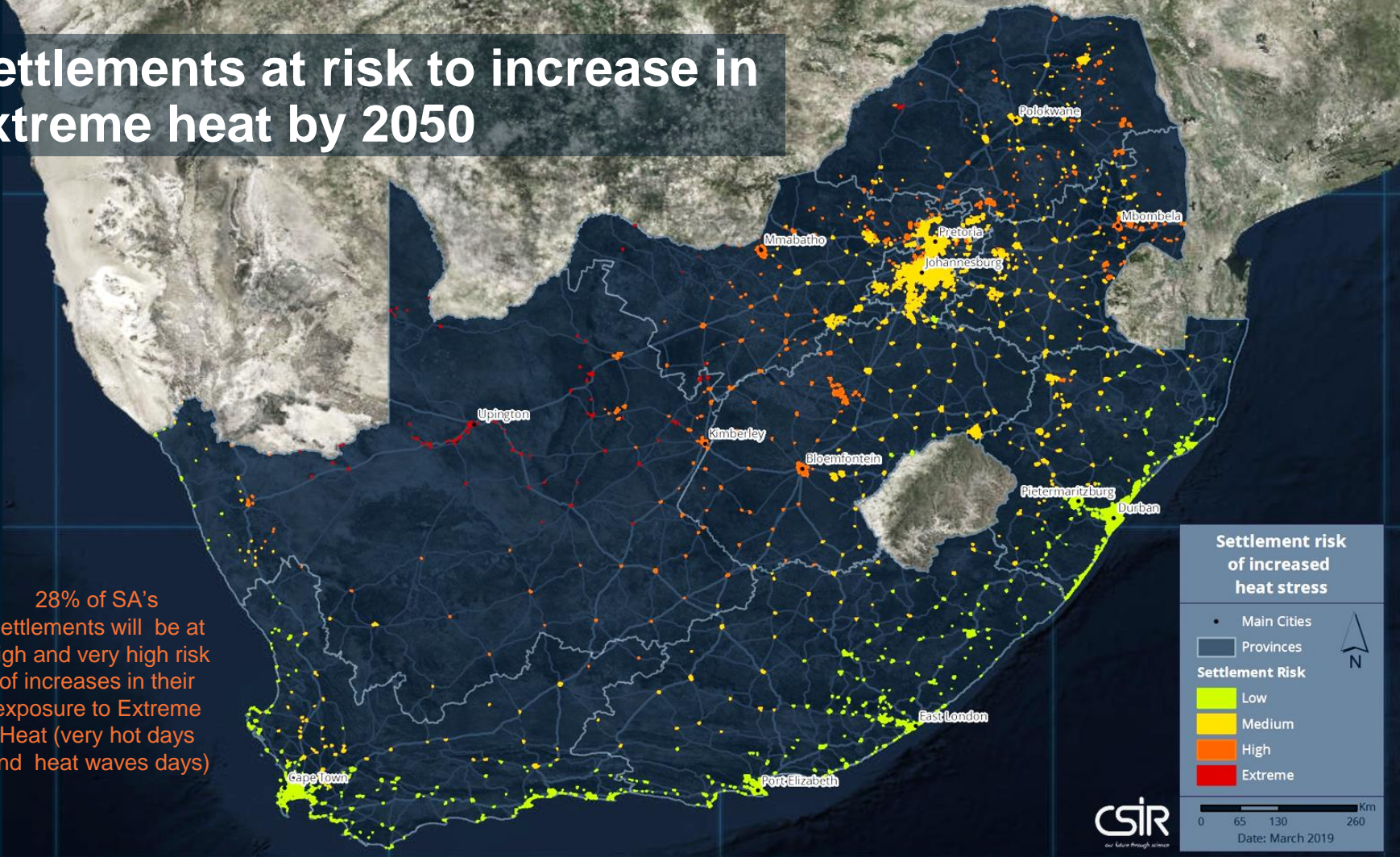
**Exacerbate vulnerabilities and  
place more people,  
infrastructure and ecosystems  
at risk**

# 2050 Settlements at risk of increasing population pressures



# Settlements at risk to increase in extreme heat by 2050

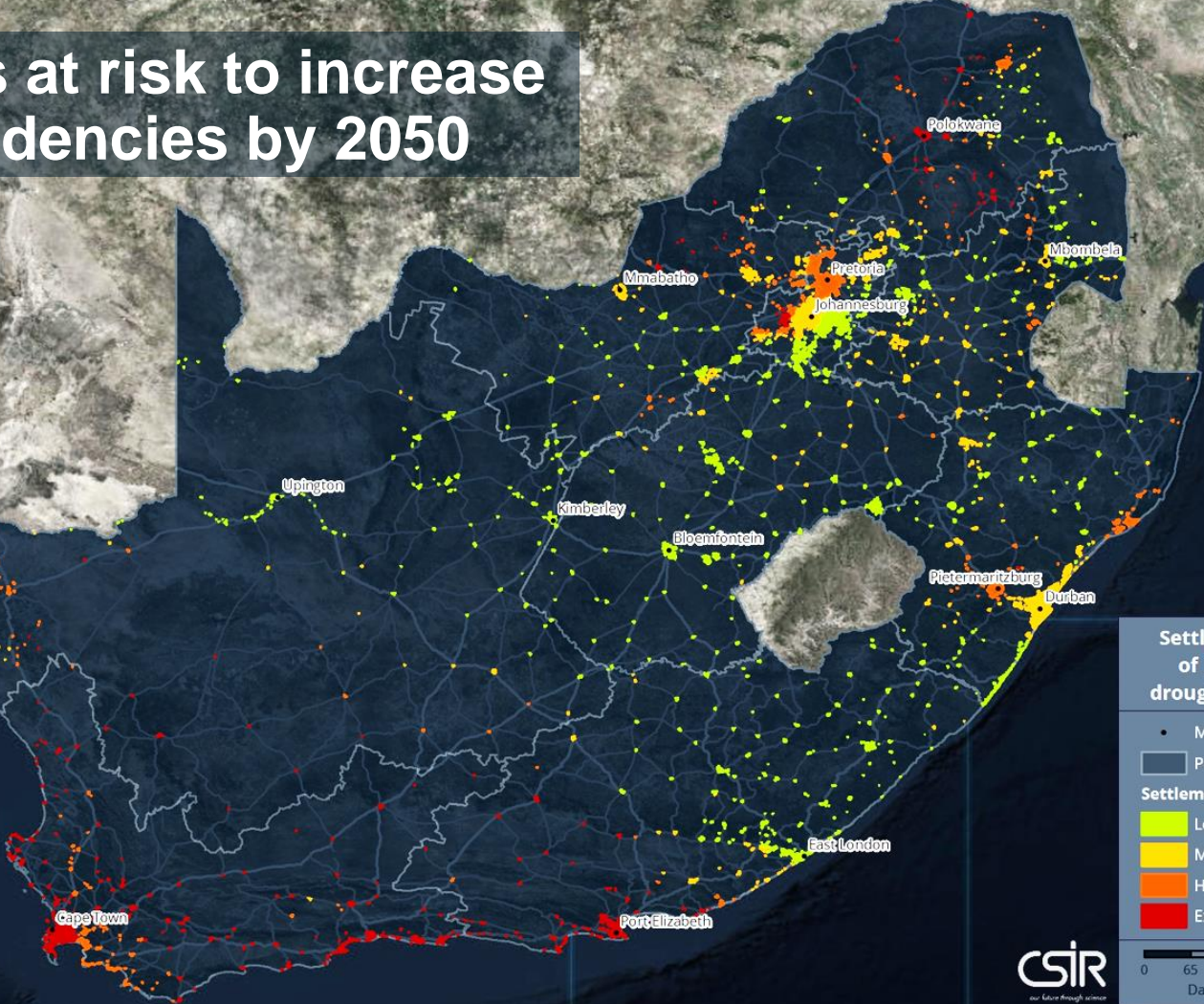
28% of SA's settlements will be at high and very high risk of increases in their exposure to Extreme Heat (very hot days and heat waves days)





# Settlements at risk to increase drought tendencies by 2050

30% of SA's settlements will be under a high and extremely high risk of increases in the frequency droughts



**Settlement risk of increased drought tendency**

- Main Cities
- ▭ Provinces

**Settlement Risk**

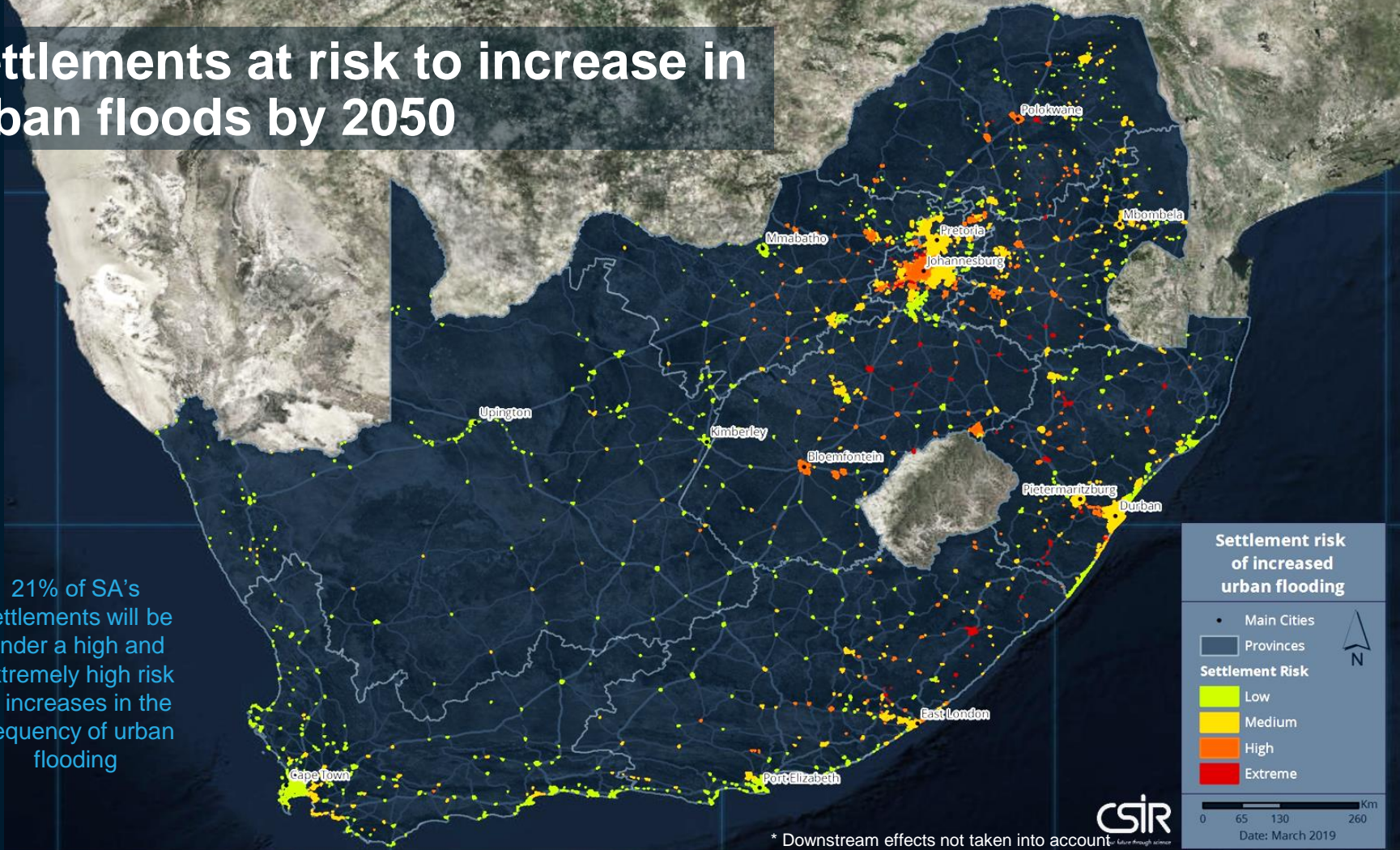
- ▭ Low
- ▭ Medium
- ▭ High
- ▭ Extreme

0 65 130 260 Km

Date: March 2019

# Settlements at risk to increase in urban floods by 2050

21% of SA's settlements will be under a high and extremely high risk of increases in the frequency of urban flooding



**Settlement risk of increased urban flooding**

- Main Cities
- ▭ Provinces

**Settlement Risk**

- Low
- Medium
- High
- Extreme

0 65 130 260 Km

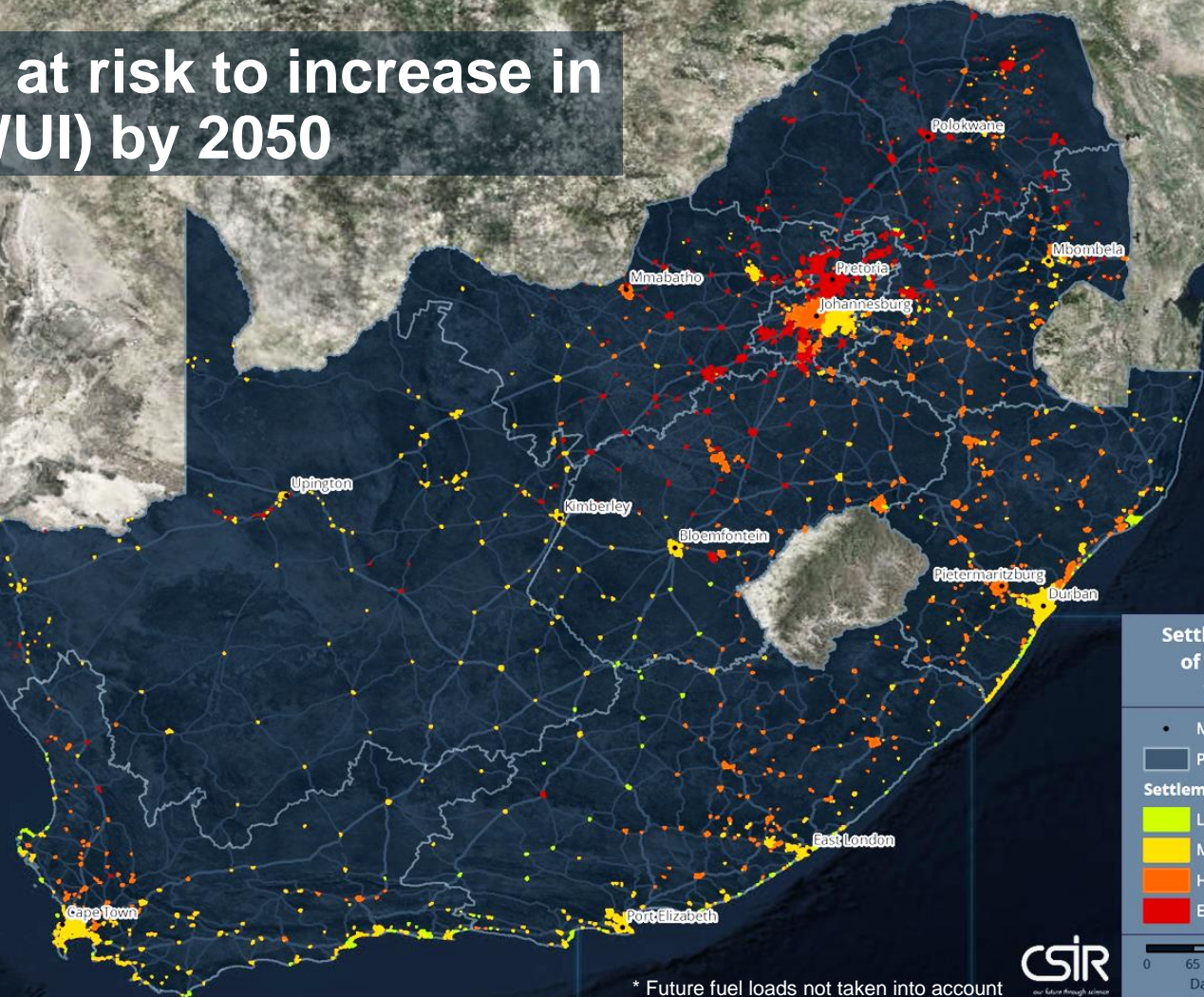
Date: March 2019



\* Downstream effects not taken into account

# Settlements at risk to increase in wild fires (WUI) by 2050

60% of SA's settlements will be under a high and extremely high risk of increased exposures to wild fires



**Settlement risk of increased wildfire**

- Main Cities
- ▭ Provinces

**Settlement Risk**

- Low
- Medium
- High
- Extreme

0 65 130 260 Km

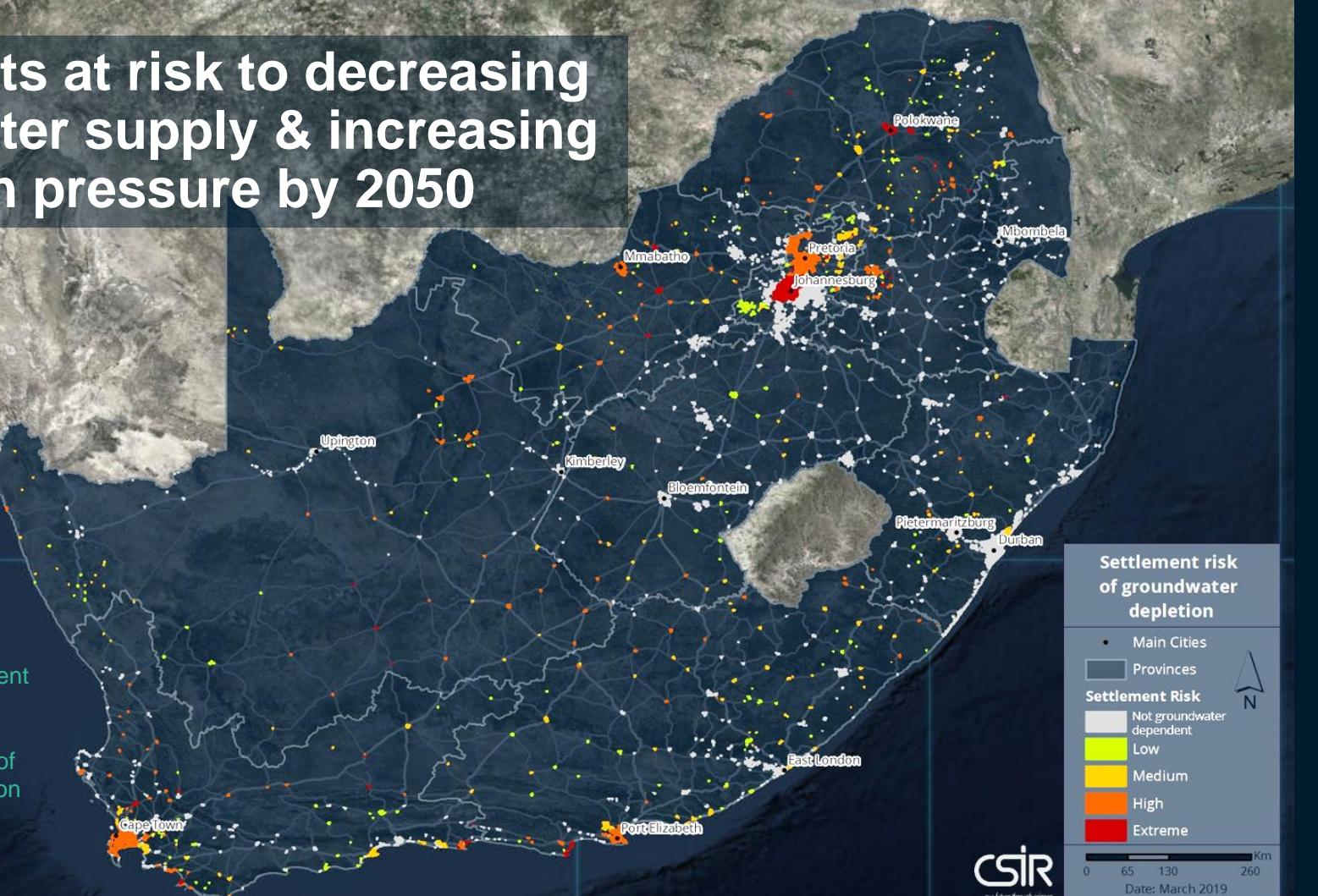
Date: March 2019



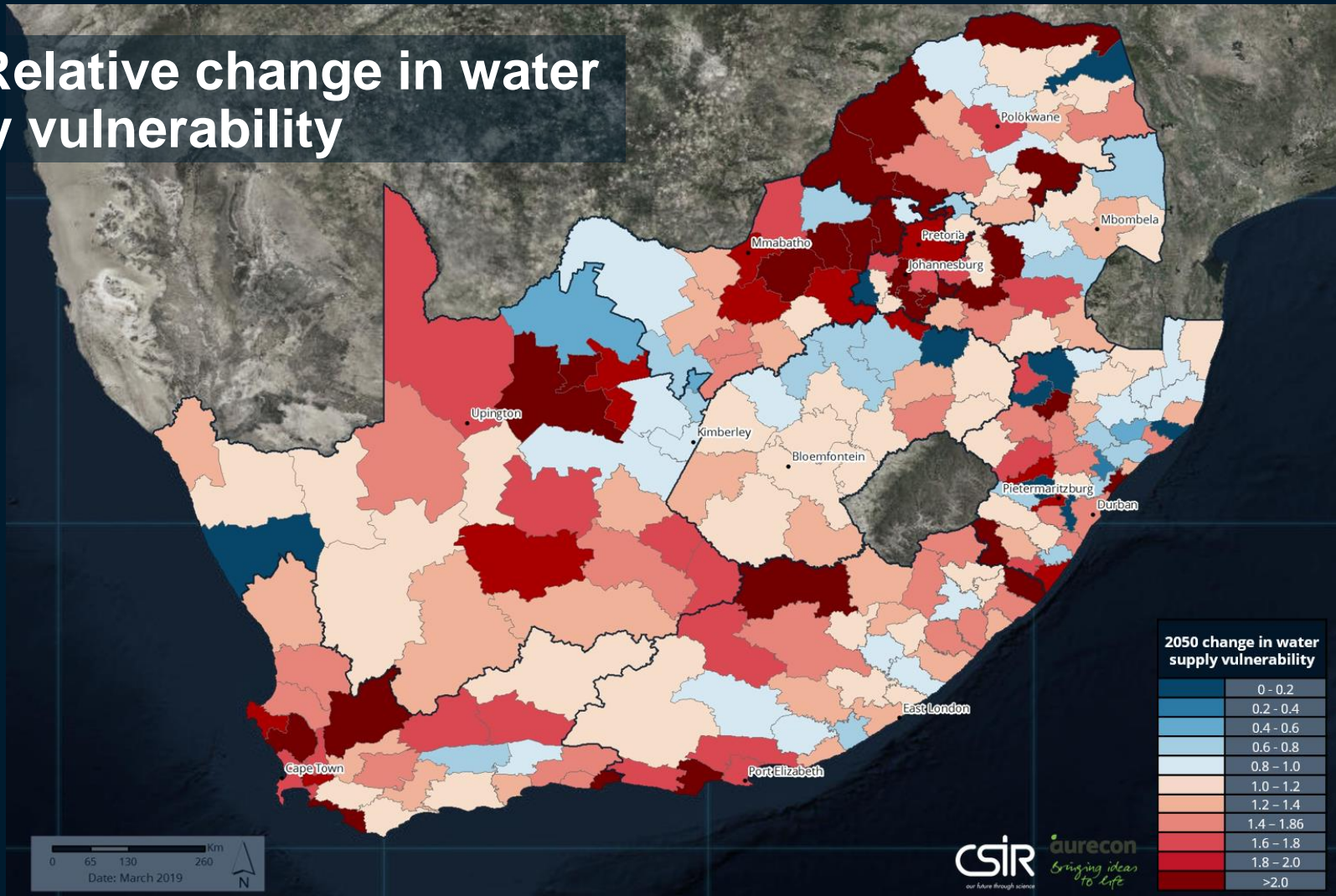
\* Future fuel loads not taken into account

# Settlements at risk to decreasing groundwater supply & increasing population pressure by 2050

29% of SA's groundwater dependent settlements will be under a high and extremely high risk of groundwater depletion



# 2050 Relative change in water supply vulnerability





<https://greenbook.co.za/>

# GREEN BOOK ONLINE PLANNING SUPPORT SYSTEM

## GREENBOOK

*adapting settlements for the future*

The Green Book online tool supports municipal planning with the development of climate resilient settlements. It ultimately facilitates the mainstreaming of climate change adaptation into local government planning instruments and processes.

[YOUR GUIDE TO THE GREEN BOOK](#)

[A CALL TO ACTION](#)



[ABOUT](#)

[STORY MAPS](#)

[RISK TOOL](#)

[ADAPTATION TOOL](#)

[TRAINING](#)

[CONTACT](#)

# BACKGROUND TO THE GREENBOOK

- The GreenBook is a multi-disciplinary, open-access **planning support system** that provides **evidence** to South African municipalities to adapt their **cities and towns** to current and future climate change impacts based on their risk assessment.
- Initially co-funded by the IDRC and the CSIR (2016-2019), and in partnership with the NDMC. With more partners coming on board since 2019.

213

In-depth, current, and future (2050) climate risk and vulnerability profile for every municipality in the country

81

Planning-related climate change adaptation actions

11

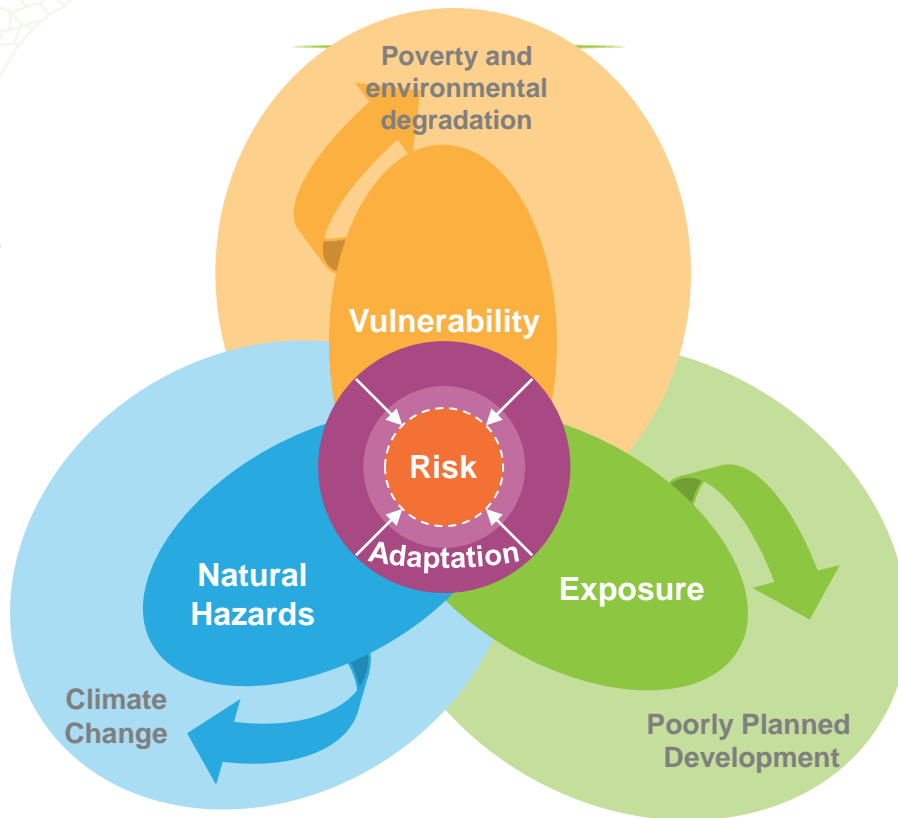
National climate change impacts contextualised in narrated story maps





# INTERDISCIPLINARY RESEARCH DESIGN

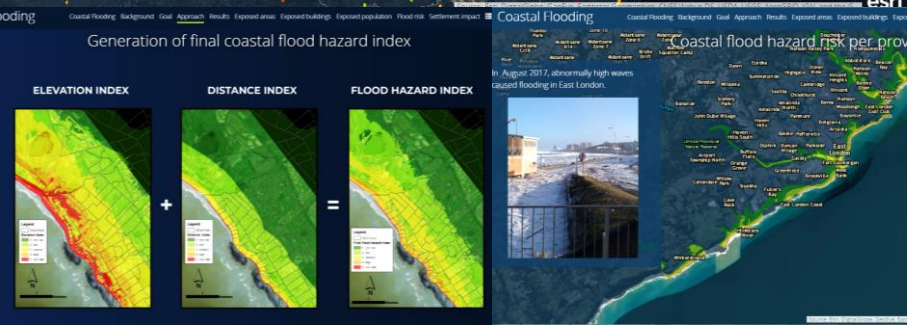
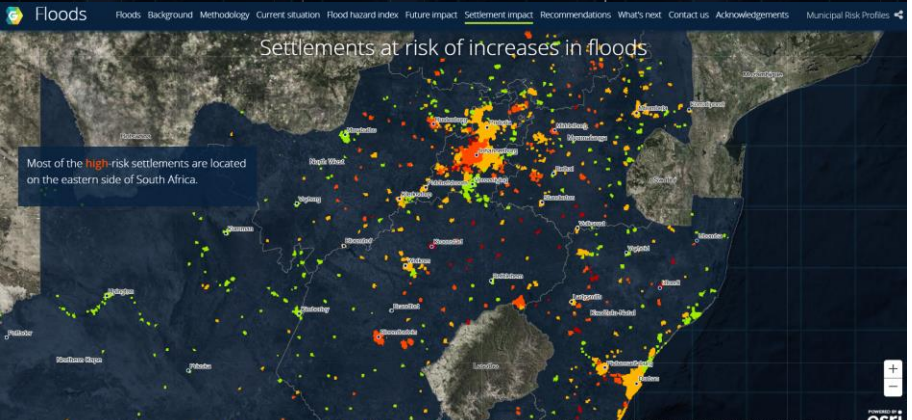
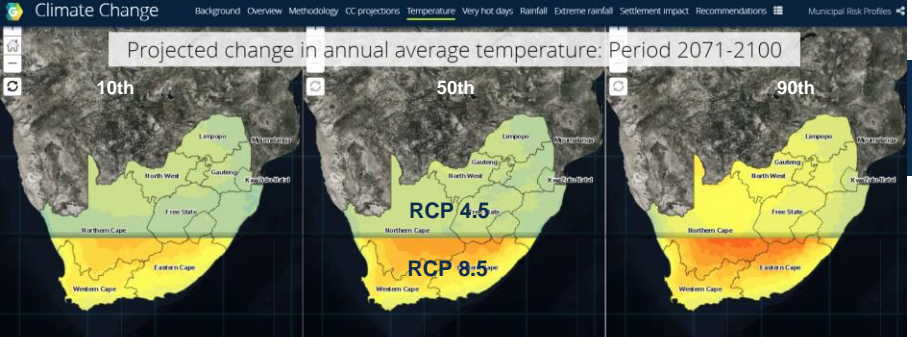
More than 50 scientists  
of difference disciplines  
involved.





# Elements of the GREENBOOK



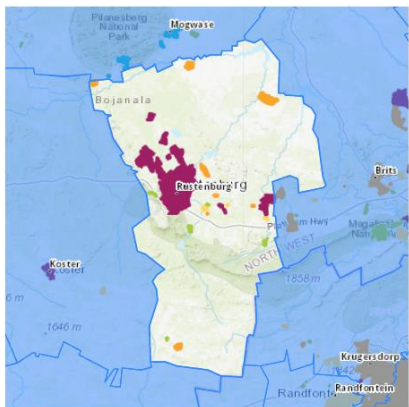


# STORY MAPS

- 11 Interactive story maps to communicate the research methodologies and main findings from the research streams.
- Developed using the ESRI Story Map application which allowed a narrative around scientific findings to be supported by custom maps, images and statistics.
- Story maps for climate change, flooding, wildfire, coastal flooding, urban growth, settlement vulnerability, surface water, groundwater, drought, the economy, and agriculture.

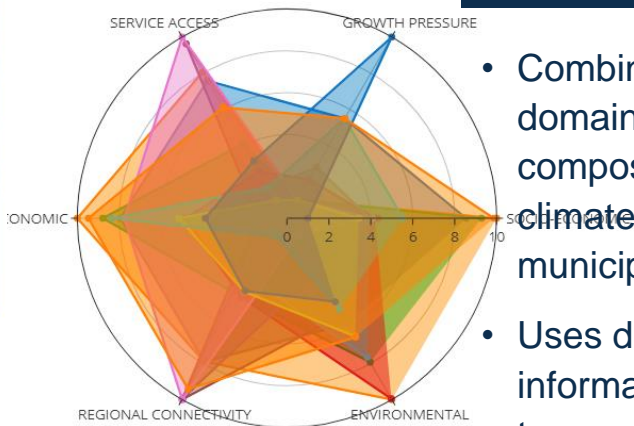
# RISK PROFILE TOOL

## POPULATION GROWTH PRESSURE

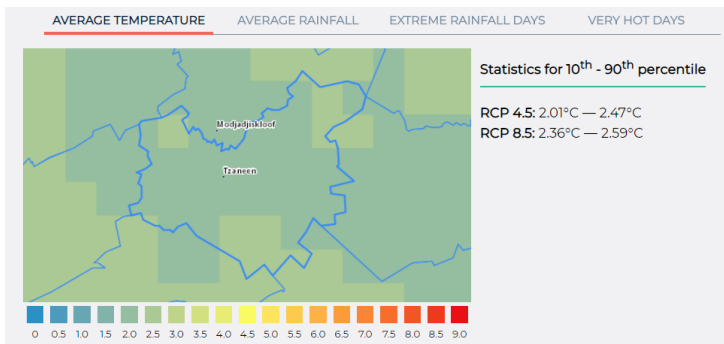


Decrease  
No Change  
Medium  
High  
Extreme

## SETTLEMENT VULNERABILITY



- Combines scientific evidence produced from multiple domain-specific research streams into interactive, composite profiles covering current and future (2050) climate risks, impacts and vulnerabilities for all municipalities in South Africa and their settlements.
- Uses different data communication methods to distil information to be relevant to local municipal actors, and to support evidence-based planning and decision-making.



# ADAPTATION ACTIONS TOOL

- Provides 81 different planning and design actions for municipalities to adapt their settlements and environments.

**GREENBOOK**

**FILTERS** Search for an adaptation action

**HAZARDS & CLIMATE IMPACTS**

- Coastal Flooding
- Inland Flooding
- Heat Stress
- Wildfire
- Increased Wind Speed
- Drought
- Groundwater Depletion
- Surface Water Depletion
- Biodiversity Loss

**PLANNING FUNCTION**

**STRATEGY**

**HAZARDS & CLIMATE IMPACTS**      **MUNICIPAL PLANNING FUNCTION**

 <p>Determine urban edge</p>	 <p>Identify all open spaces</p>	 <p>Identify all key ecosystems and protected areas</p>
 <p>Connect open spaces</p>	 <p>Identify areas where vegetation coverage can be increased</p>	 <p>Identify areas for vegetated windbreaks</p>

## HAZARDS & CLIMATE IMPACTS



COASTAL  
FLOODING



INLAND  
FLOODING



HEAT  
STRESS



SURFACE WATER  
DEPLETION



INCREASED  
WIND SPEED



DROUGHT



GROUNDWATER  
DEPLETION

## MUNICIPAL PLANNING FUNCTION



SPATIAL  
PLANNING



LAND USE  
MANAGEMENT



LANDSCAPE  
DESIGN



ENVIRONMENTAL  
PLANNING



ENGINEERING  
SERVICES

This includes water, energy and ICT, stormwater, sanitation, solid waste, and mobility and transport).

# ADAPTATION ACTIONS TOOL

- Provides 81 different planning and design actions for municipalities to adapt their settlements and environments.
- Users can filter through the list of adaptation actions by climate risk, impact, adaptation strategy, or planning function.

# ADAPTATION ACTIONS TOOL

Implement water conservation measures

Design a water pressure management system



DESCRIPTION GOALS BENEFITS COSTS EXAMPLE CREDITS LINKS

Water conservation interventions reduce the demand on water resources. Interventions include pressure management; replacing non-functional water meters; re-using treated effluent; installing flow-limiting devices; and increased water storage. Other water conservation measures (such as clearing alien invasive vegetation from infested catchments) can increase the amount of surface water run-off and also the recharge to groundwater sources, whilst rainwater harvesting in agriculture and homes (especially those in rural areas) could reduce reliance on municipal/formal water supplies by optimising rainfall. There is significant potential in the domestic and agricultural sectors for minimising inefficient water use by reducing leakages from piped and open channel distribution systems.

GREENBOOK

- Provides access to 81 different planning and design actions for municipalities to adapt their settlements and environments.

- Users can filter through the list of adaptation actions by climate risk, impact, adaptation strategy, or planning function.

- Descriptive information on what the adaptation action entails, its benefits and co-benefits, possible costs and implications, and an image is provided for each adaptation action.

SUPPORTING ACTIONS

- Interlinkages between adaptation actions are highlighted and users are able to identify multiple actions that are able to support each other when implemented.

<https://adaptationactions.greenbook.co.za/>

CLIMATE RISK ZONE | Multiple

SEARCH for a region, ward or address

CLIMATE RISK ZONE | Multiple

CURRENT AT A GLANCE 2050

The map shows the multiple hazard climate risk zones for the City of Tshwane. The graph on the right shows the relevant climate actions for the combined climate risks that the city can implement to mitigate and adapt to climate change. These link through to the City of Tshwane Climate Action Tool.

READ MORE

MULTIPLE HAZARD CLIMATE RISK ZONES

PROPOSED CLIMATE ACTIONS

LOSS OF LIFE & LIVELIHOOD

REDUCING EXPOSURE

BUILDING RESILIENCE

Identify and assess climate risks and impacts, as well as appropriate actions to improve resilience and adapt to climate change.

Promote climate-resilient local food production to improve food security.

Develop an enabling regulatory environment that promotes climate-smart urban land-use schemes and development controls.

Amend and enforce climate-smart urban & township design and landscaping guidelines.

Identify city infrastructure and assets located in climate risk zones and hotspot areas and manage risks.

Establish an effective maintenance programme to ensure the sustainability and resilience of infrastructure and assets.

Ensure all infrastructure and assets are climate resilient.

VULNERABILITY | Ward 51

CURRENT 2050

VULNERABILITY HAZARDS

DOWNLOAD THIS REPORT

REGION NAME: PRETORIA  
WARD ID: 51  
REGION: REGION 3

TOTAL POPULATION 2018: 15 745  
PEOPLE PER HA: 56  
TOTAL HOUSEHOLDS 2018: 6 923

64% FORMAL DWELLINGS  
36% INFORMAL DWELLINGS

SOCIO-ECONOMIC VULNERABILITY

Household Composition

Income Composition

Education

Health

Socio-Economic Vulnerability

SETTLEMENT FABRIC VULNERABILITY

Housing Type

Basic Services

Density

Settlement Fabric Vulnerability

ENVIRONMENTAL VULNERABILITY

Human Influence

Ecological Infrastructure

Water Resources

Sensitive Features

Environmental Governance

Environmental Vulnerability

FILTERS

SELECT A VIEW: MULTIPLE, HAZARD, VULNERABILITY

GO TO REGIONAL DATA

GO BACK

CLIMATE ACTIONS TOOL

FILTERED ACTIONS

Plan and develop enabling mechanisms for renewable energy generation within the City's formal area.

Read More

Ensure energy efficiency of all non-municipal homes and other buildings.

Read More

Ensure resource efficiency and climate resilience of all non-municipal buildings and homes.

Read More

Ensure that municipal facilities and city-owned buildings are energy efficient and net-zero carbon.

Read More

# METROVIEW

- GreenBook MetroView provides spatialised and quantified climate risk, vulnerability, and demographic evidence, linked to place-based climate response measures.
  - Climate Risk & Vulnerability Profile
  - Climate Actions Tool
- Supports communication and analysis of evidence to assist practitioners, policymakers, and decision-makers to effectively inform and add value to climate change adaptation.
- Openly accessible through an online planning support system.
- City of Tshwane pilot.

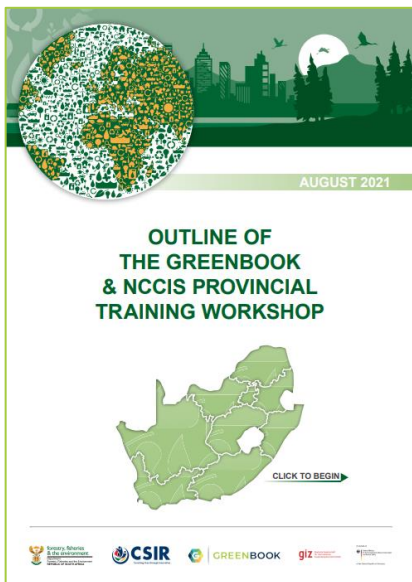
Risk & Vulnerability Profile: <https://tshwane-riskprofile.greenbook.co.za>

Climate Actions Tool: <https://tshwane-climateactions.greenbook.co.za/>

# GREENBOOK TRAINING

Green Book training events aim to build enduring capacity in all spheres of government (and beyond) to proactively adapt South African settlements to the impacts of hydro-meteorological hazards. Mainstreaming climate change adaptation into sector plans and policies are critical to build resilience, and reduce the exposure of people, infrastructure, buildings, and the environment to the long-term impacts of climate change and severe weather events.

[GO TO EVENTS & RESOURCES](#)



## TRAINING

- Duration: 2 days, is paid for by clients and partners.
- Focusses on awareness raising about the climate risks associated with a changing climate, and the need for adaptation.
- The GreenBook planning support tools are demonstrated in detail.
- The concept of mainstreaming is explained, and obstacles and guidelines toward mainstreaming are provided.

Alfred Nzo  
District Municipality

Amathole  
District  
Municipality

Buffalo City  
Metropolitan  
Municipality

Sarah Baartman  
District Municipality

Chris Hani  
District Municipality

Joe Qqabi  
District Municipality

Nelson Mandela Bay  
Metropolitan  
Municipality

O.R. Tambo  
District Municipality

<https://greenbook.co.za/green-book-training.html>



# GREENBOOK 3.0: THE FUTURE STORY

- Several gaps have been identified and will be addresses in the future:
  - changes in the underpinning science of climate models (i.e., IPCC AR6);
  - probabilities of extreme event occurrences under different scenarios;
  - coastal flood risk and erosion modelling;
  - the impact of climate change on health, food security and the energy sector;
  - green infrastructure as adaptation strategy;
  - and a decision-model around adaptation efforts based on evidence.





**GREENBOOK**  
*adapting settlements for the future*

**Thank you**

Melanie Lück-Vogel  
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on behalf of the Green Book Team

