



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





# GREEN BOOK

National Climate Change Information Systems Training Workshop  
Northern Cape  
*6 – 7 August 2019, Kimberley*

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CSIR Smart Places

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*Project partner*



*Funded by*



International Development Research Centre  
Centre de recherches pour le développement international





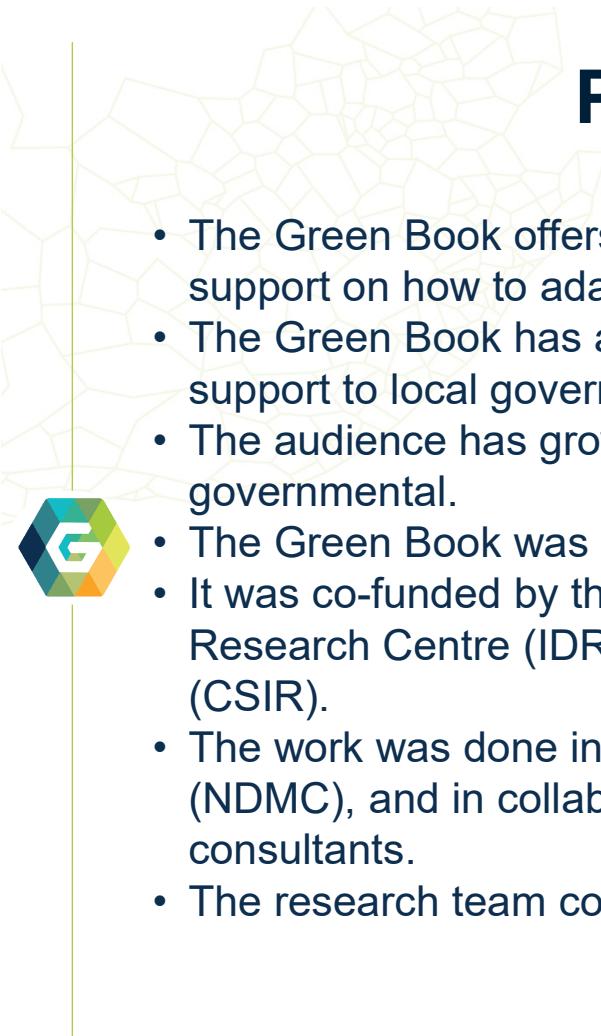
# STRUCTURE

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1. Project overview
  2. Rationale and research design
  3. Green Book components
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1.

# PROJECT OVERVIEW

GREENBOOK



# PROJECT OVERVIEW

- The Green Book offers information on what climate changes to adapt for and support on how to adapt.
- The Green Book has a specific goal: the intention is for the Green Book to lend support to local government in adapting settlements to climate change.
- The audience has grown much wider: it is multidisciplinary, multi-sectoral, and intra-governmental.
- The Green Book was a 3-year project.
- It was co-funded by the Canadians through the International Development Research Centre (IDRC) and the Council for Scientific and Industrial Research (CSIR).
- The work was done in partnership with the National Disaster Management Centre (NDMC), and in collaboration with various stakeholders, peer-reviewers and consultants.
- The research team consisted of more than 50 people from multiple disciplines.

2.

## RATIONALE & RESEARCH DESIGN

GREENBOOK

# RATIONALE



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



Growing & urbanising population  
will continue to place pressure  
on infrastructure & service  
delivery.



Municipalities are already under  
tremendous pressures to  
address complex urban  
challenges.



## PURPOSE

Knowing **what** change to **adapt** for and **how** to adapt for this change is of critical importance to **decision makers** involved in the **planning** and **design** of human **settlements**.

The aim of the Green Book is to propose a suite of climate change adaptation actions for every settlement in South Africa, based on their individual risk profiles.

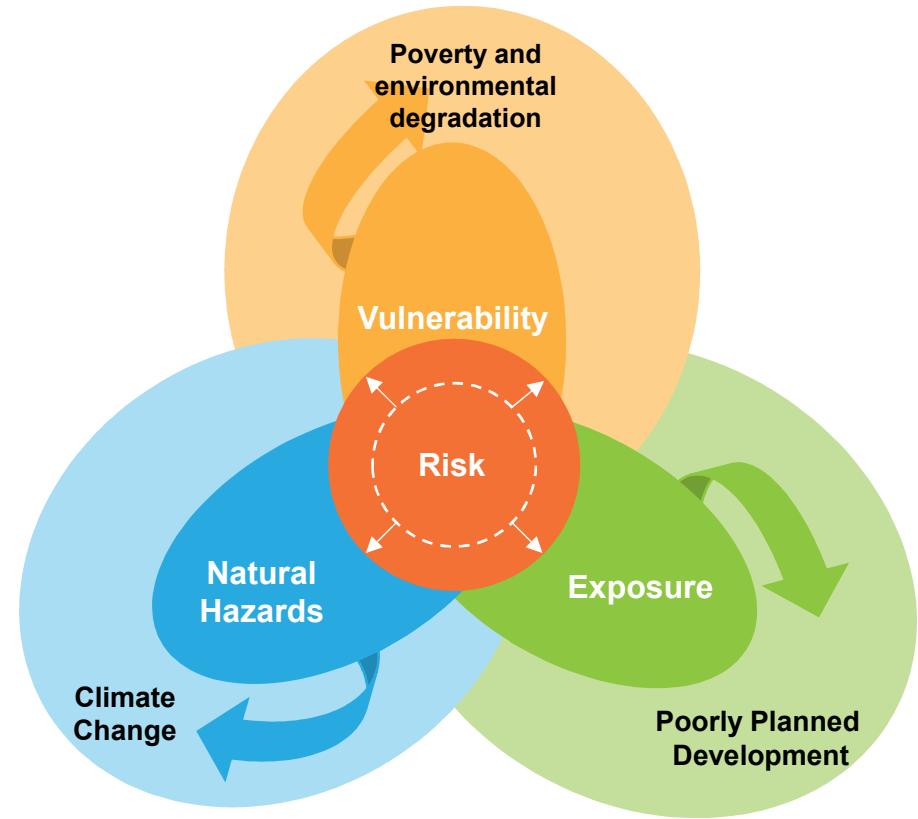
# RESEARCH DESIGN

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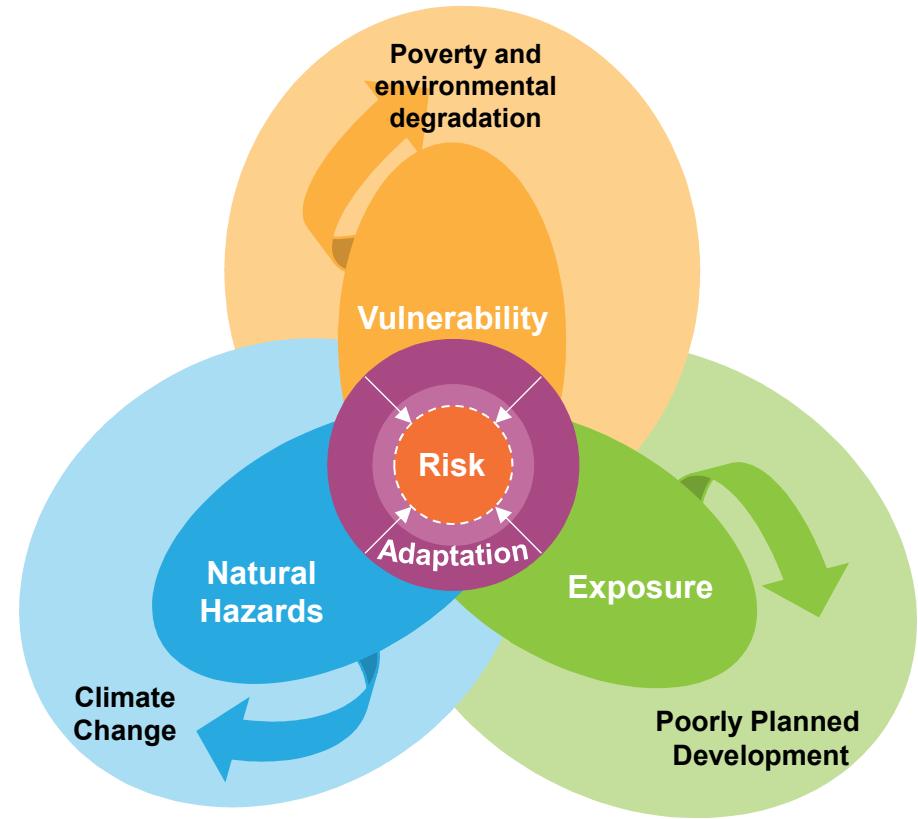
# RESEARCH DESIGN

GREENBOOK



# RESEARCH DESIGN

GREENBOOK





## **INTERDISCIPLINARY RESEARCH DESIGN**

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## **CO-DEVELOPMENT APPROACH**

**GREENBOOK**

**The Green Book is a novel and unique undertaking of interdisciplinary, applied research.**

It combines the expertise of more than 50 researchers in the fields of **climatology, demography, disaster risk sciences, environmental sciences, geography, informatics, urban planning, economics, ecology, architecture, anthropology, hydrology and statistics**.

Strong focus on collaboration, engagement and co-production through partnerships, multiple stakeholder engagements, reference groups and peer-reviewers

The multidisciplinary nature of the Green Book, combined with the high resolution scientific evidence produced, makes this one of the most novel, innovative and information dense research platforms about disaster risk and climate adaptation planning on the African continent.

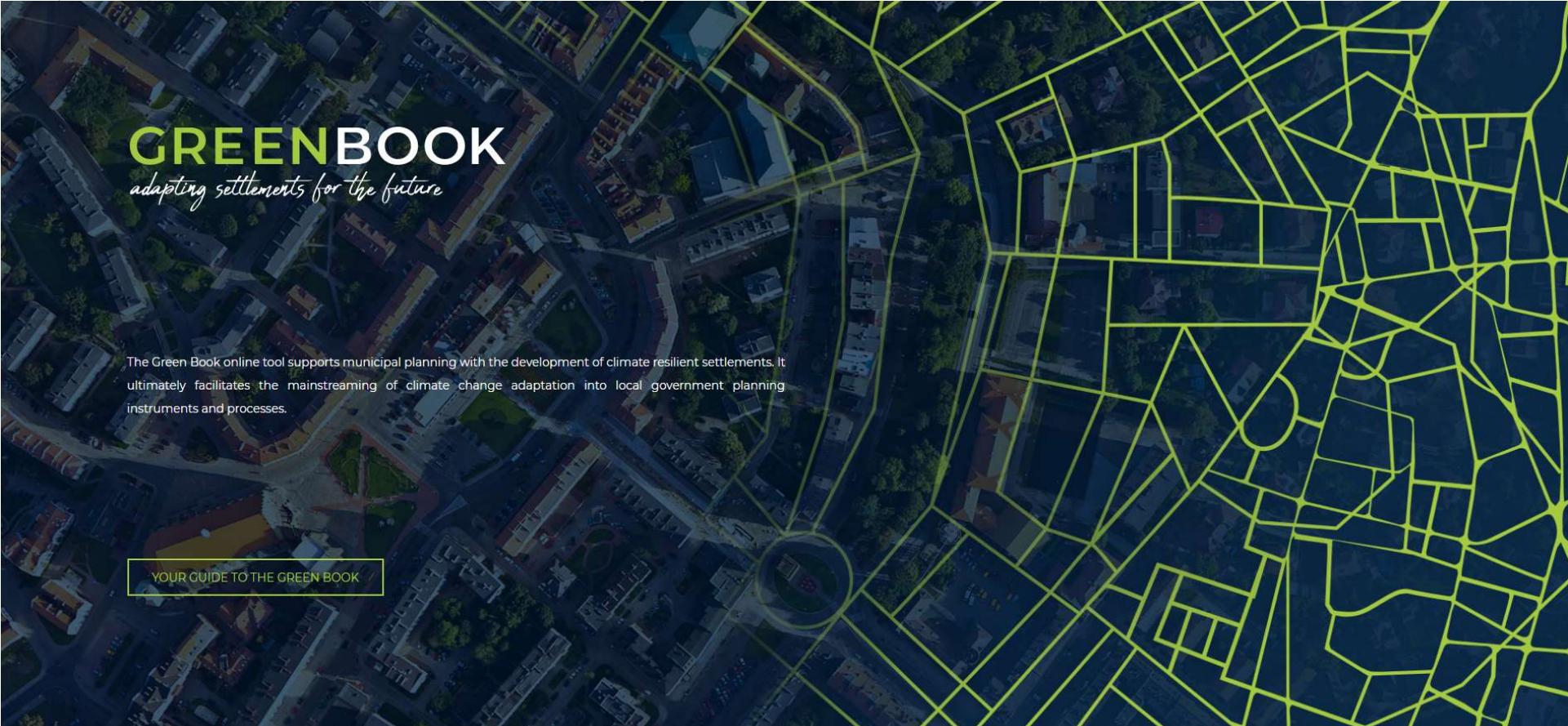
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## GREEN BOOK COMPONENTS

GREENBOOK



# WWW.GREENBOOK.CO.ZA



## 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

# WWW.GREENBOOK.CO.ZA

## 01 OUR STORY MAPS

Find out more about the research and development done as part of the Green Book and see a story unfold about urban growth, the socio-economic vulnerabilities of local municipalities, settlements and neighbourhoods, the likely climatic shifts we can expect, and the impacts of these shifts on some of South Africa's hydro-meteorological hazards and resources.

[VIEW STORY MAPS](#)



## 02 ! MUNICIPAL RISK PROFILES

A temporally dynamic composite risk profile for each municipality and its settlements in South Africa, detailing vulnerability profiling, population projections, exposure to climate hazards, and the impacts of climatic changes on some of our key resources. Discover what your municipality might look like in 2050.

[GO TO TOOL](#) [ABOUT THE TOOL](#)



## 03 ♦ ADAPTATION ACTIONS

Responding to growth pressures and climate change requires action. Select a range of planning and design actions to be integrated with local planning instruments to adapt settlements to the likely impacts of climate change and reduce their exposure to hazards.

[GO TO TOOL](#) [ABOUT THE TOOL](#)



## ADAPTATION PLANNING

Climate change and its related impacts are mostly felt at a settlement level, requiring local government to respond through adaptation. Climate change adaptation can be facilitated through municipal planning functions such as infrastructure and services provision, infrastructure maintenance, spatial planning, land-use management and integrated development planning.

[WHY IT MATTERS](#) [ADAPTATION SUPPORT](#)



SIGN UP TO OUR NEWSLETTER  enter your email address [SIGN ME UP](#)

## CONTACT US

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Leave us a message and one of our team members will get back to you as soon as possible.

Name & Surname

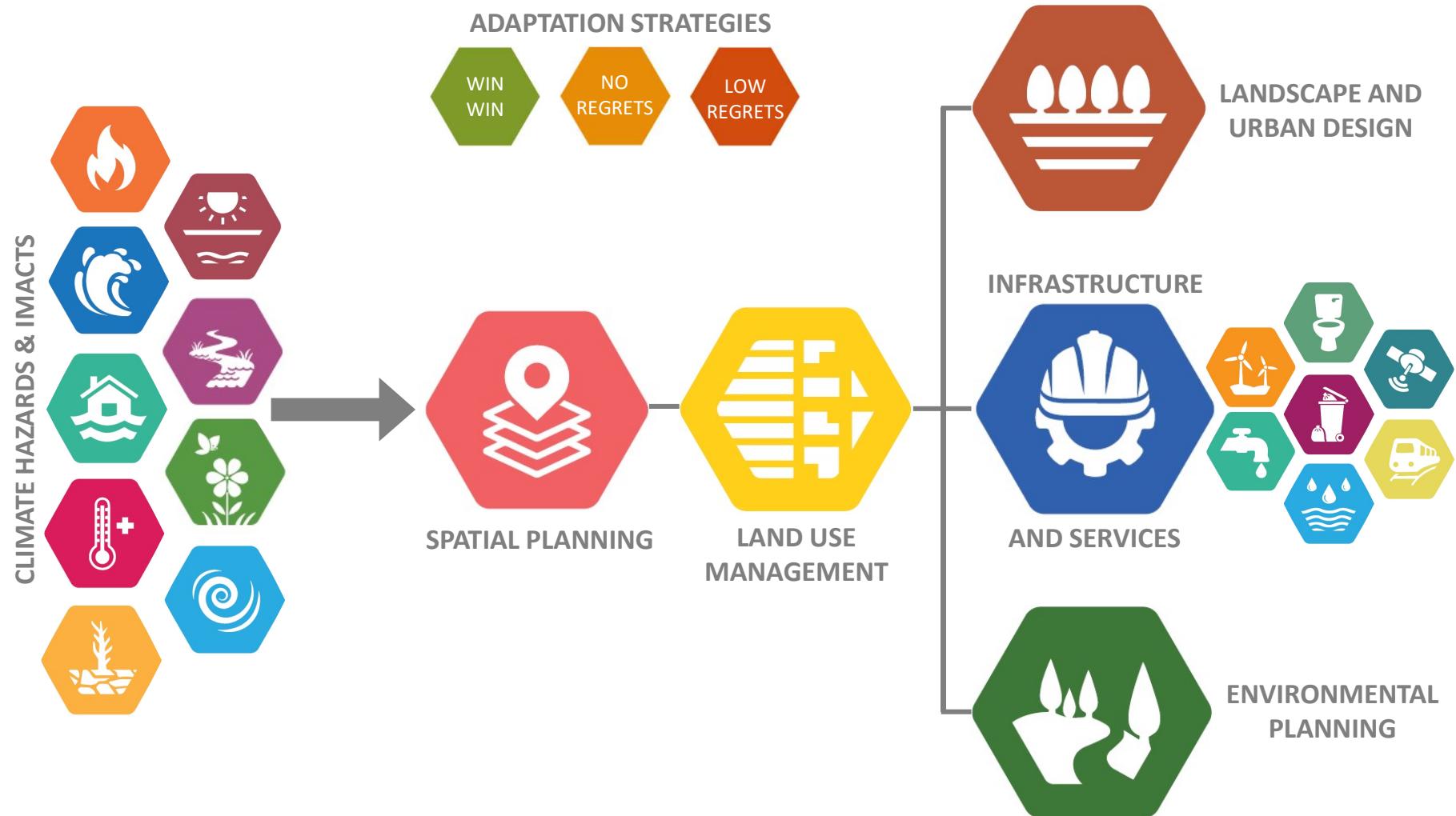
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## GREEN BOOK VIDEO

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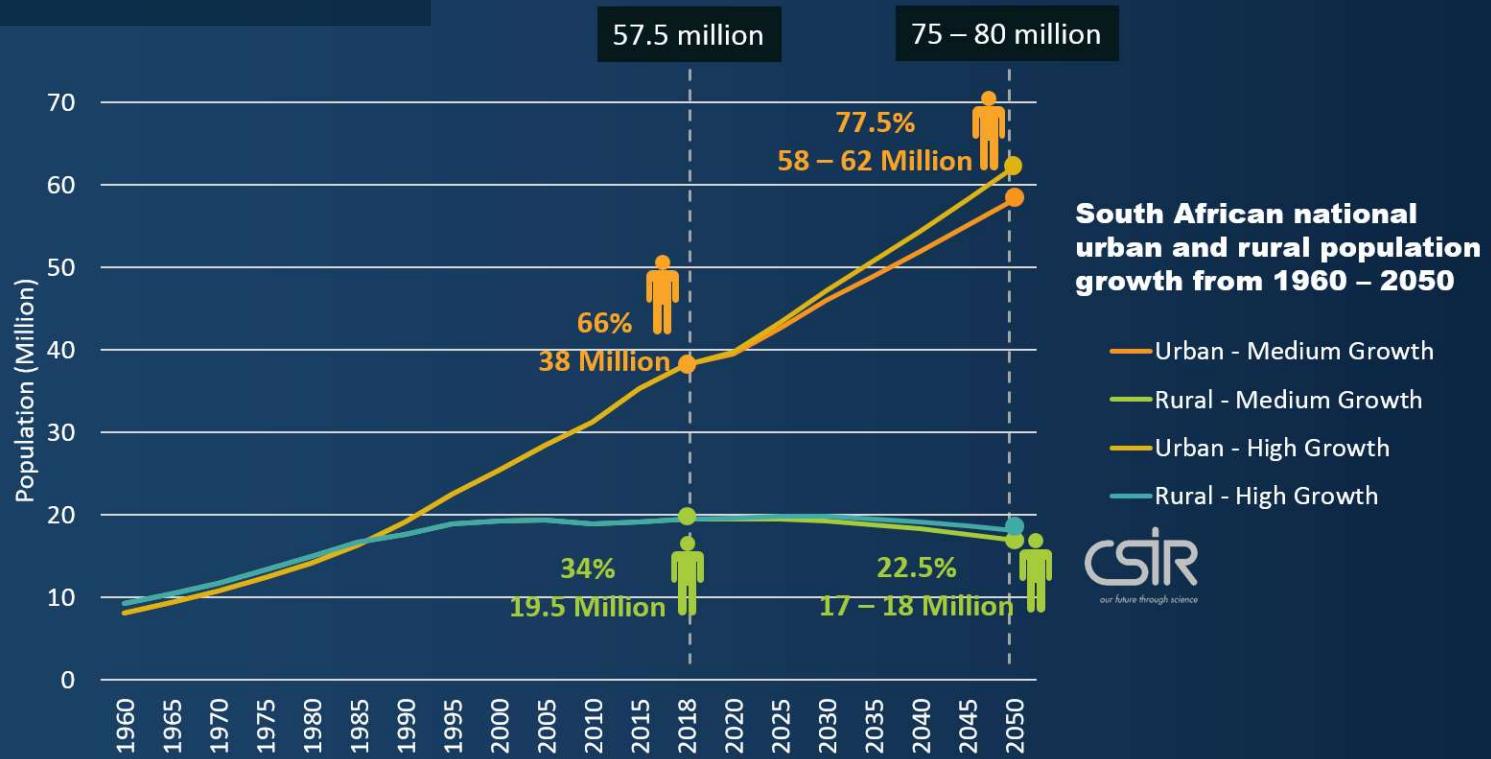
**2050**

# A LIKELY 2050 FUTURE UNDER A LOW-MITIGATION SCENARIO

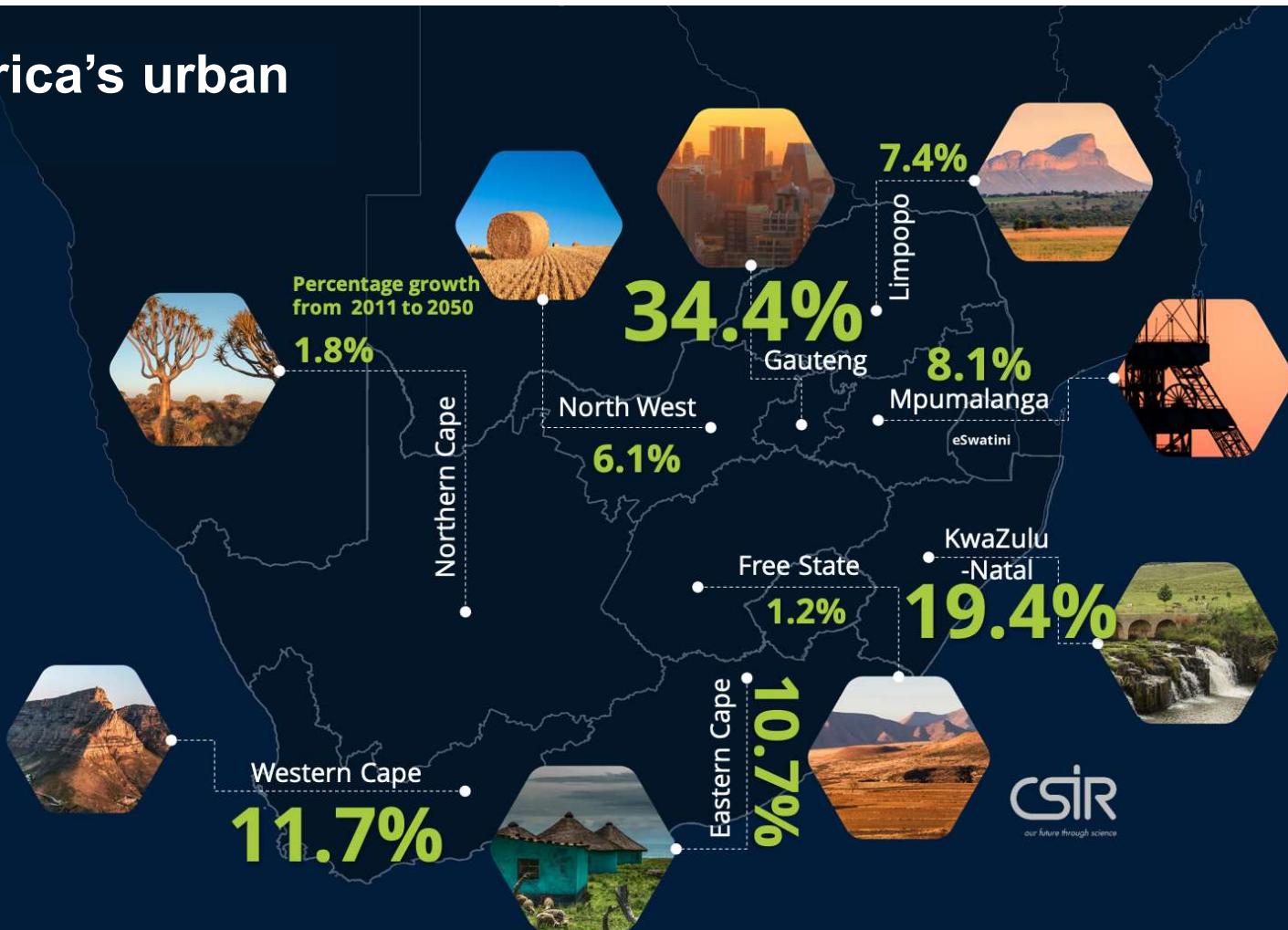
Northern Cape

**GREENBOOK**

# South Africa's urban future

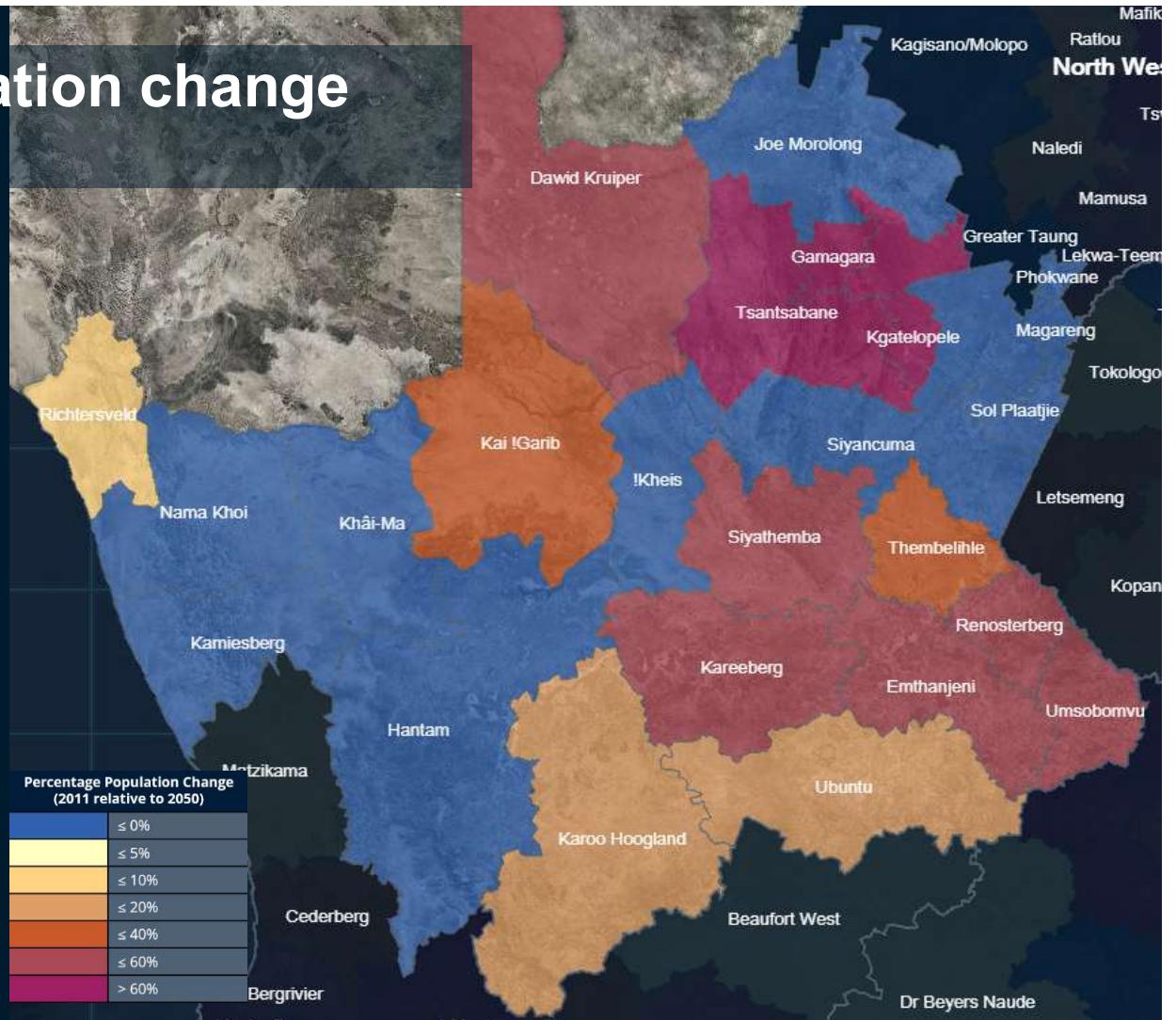


# South Africa's urban future



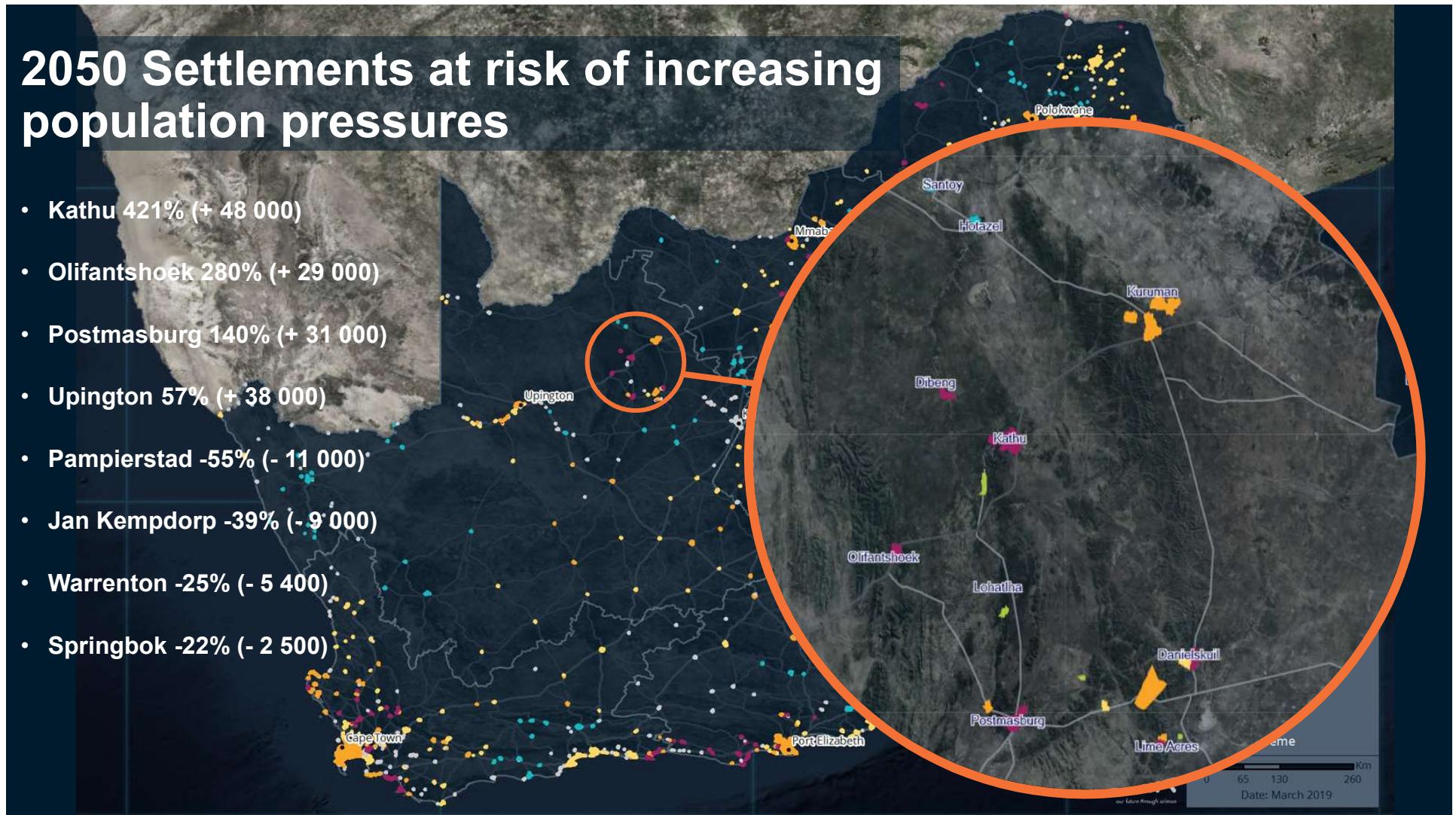
# 2050 Projected population change Northern Cape

- Population projected to reach 1.3 – 1.4 million people by 2050.
- Gamagara LM to grow by 273% (113 000 more people) by 2050.
- 11 of 26 LMs projected to experience population decline.
- Decline ranges from -2% (1000 less people) in Dikgatlong to -63% (56 000 less peoples) in Joe Morolong

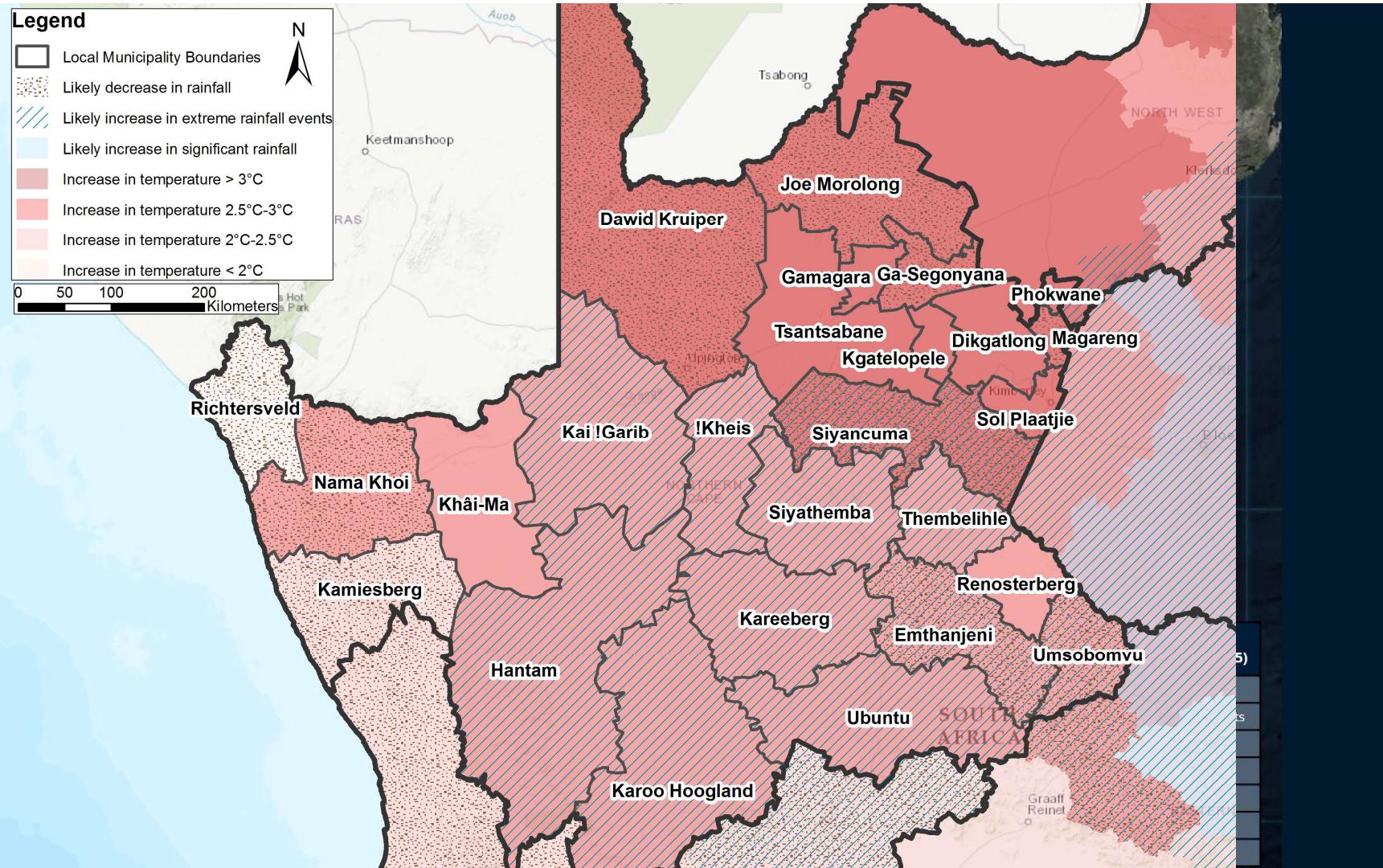


## 2050 Settlements at risk of increasing population pressures

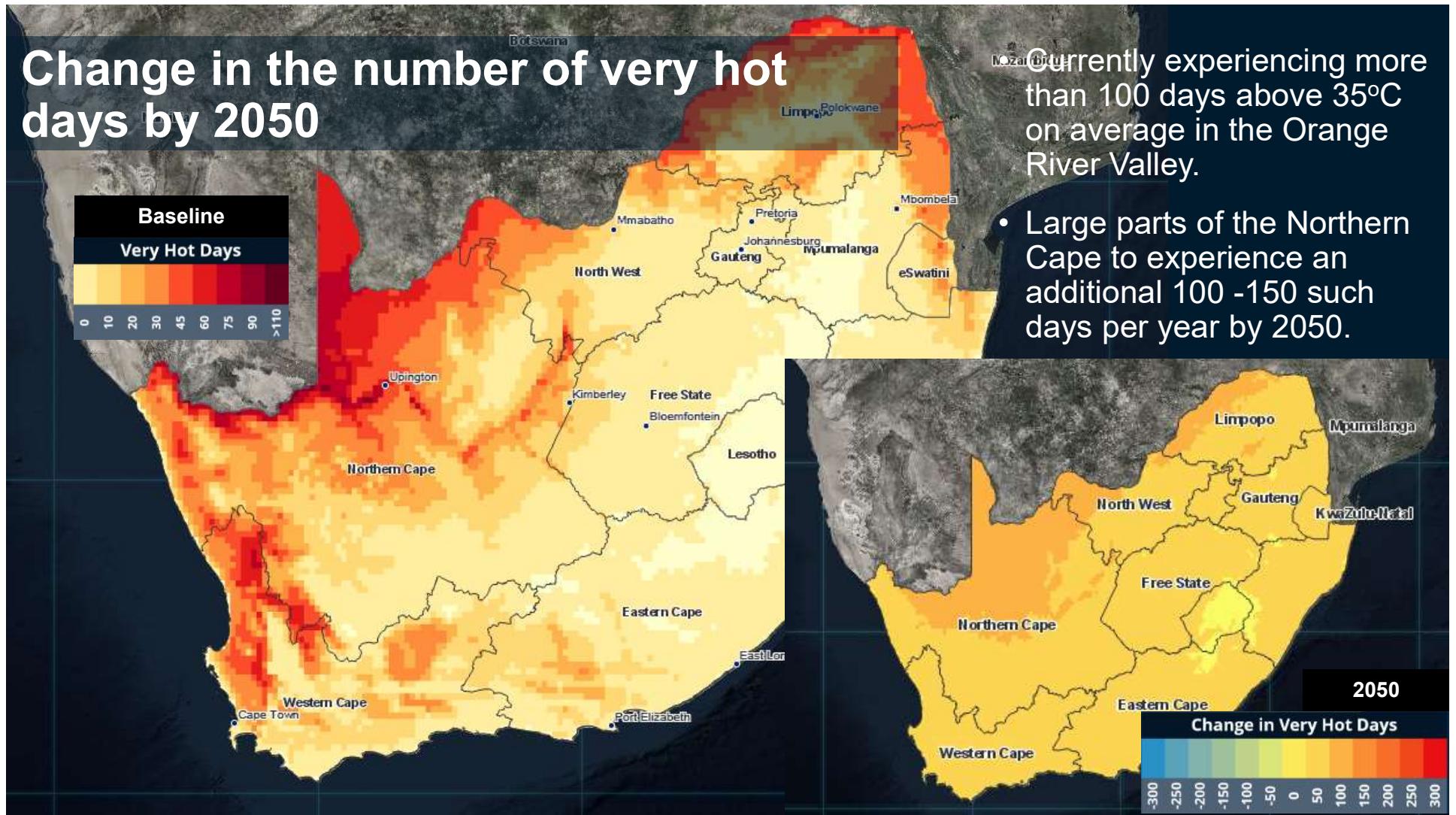
- Kathu 421% (+ 48 000)
- Olifantshoek 280% (+ 29 000)
- Postmasburg 140% (+ 31 000)
- Upington 57% (+ 38 000)
- Pampierstad -55% (- 11 000)
- Jan Kempdorp -39% (- 9 000)
- Warrenton -25% (- 5 400)
- Springbok -22% (- 2 500)



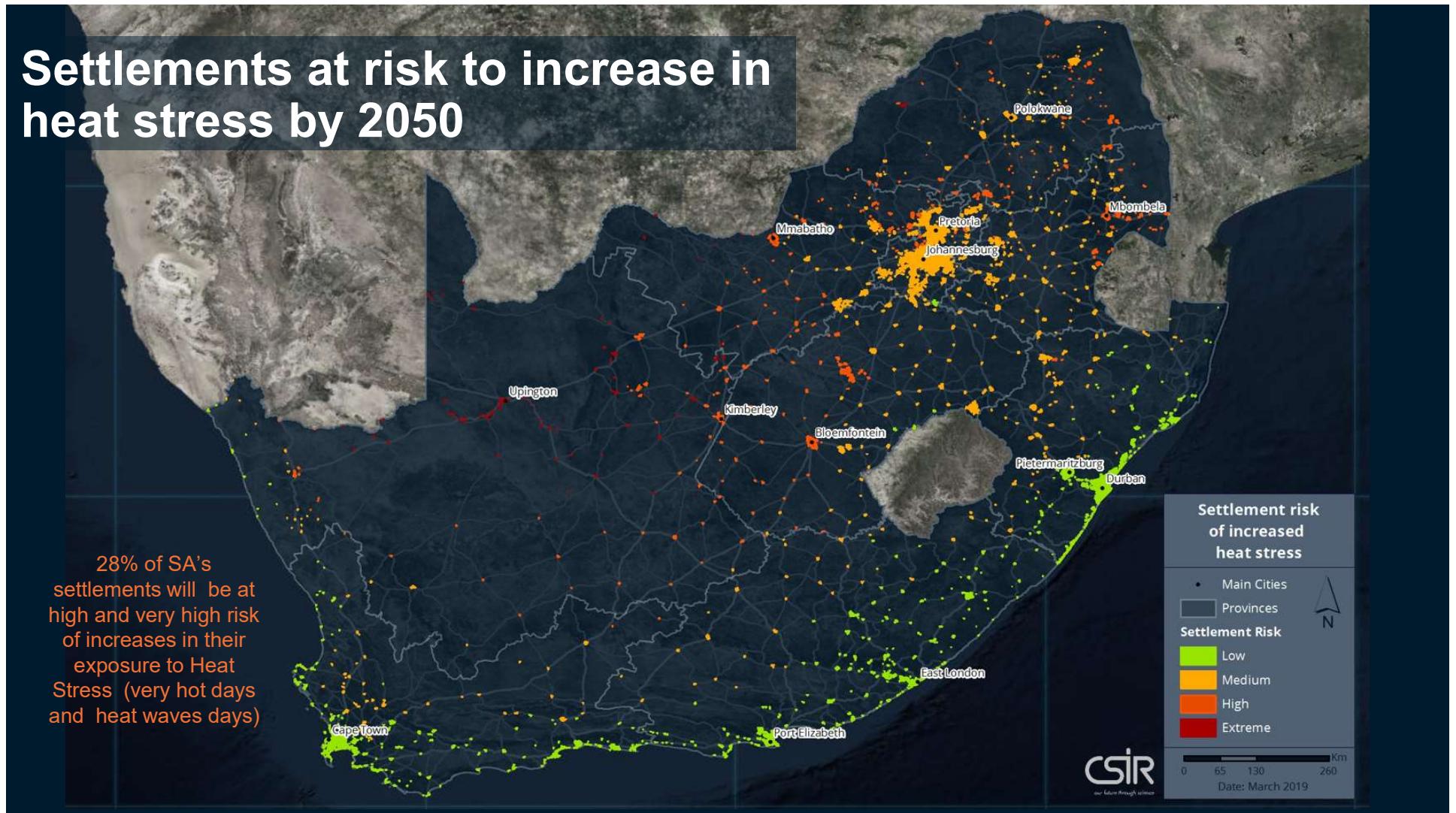
**2050  
South**



# Change in the number of very hot days by 2050

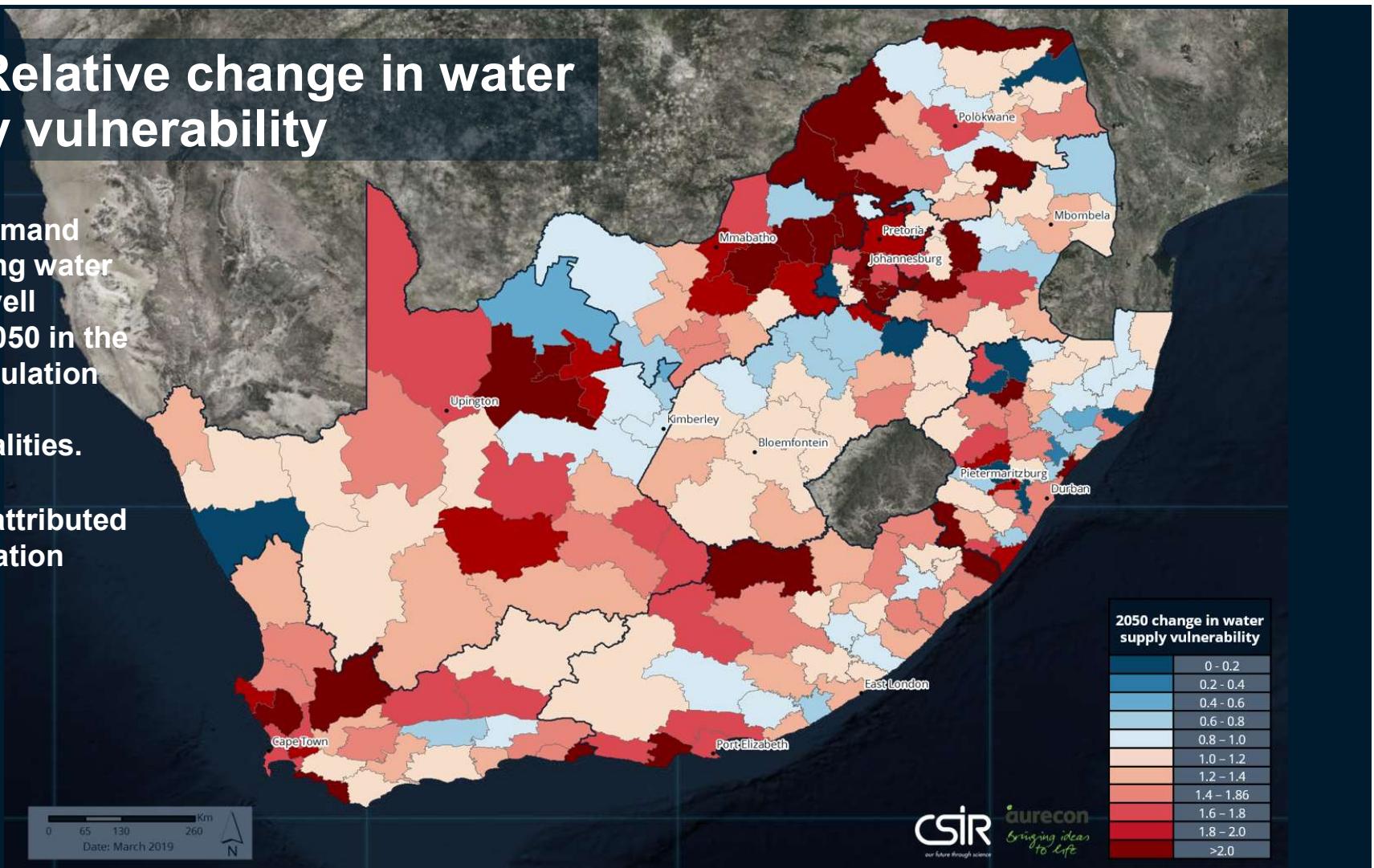


# Settlements at risk to increase in heat stress by 2050

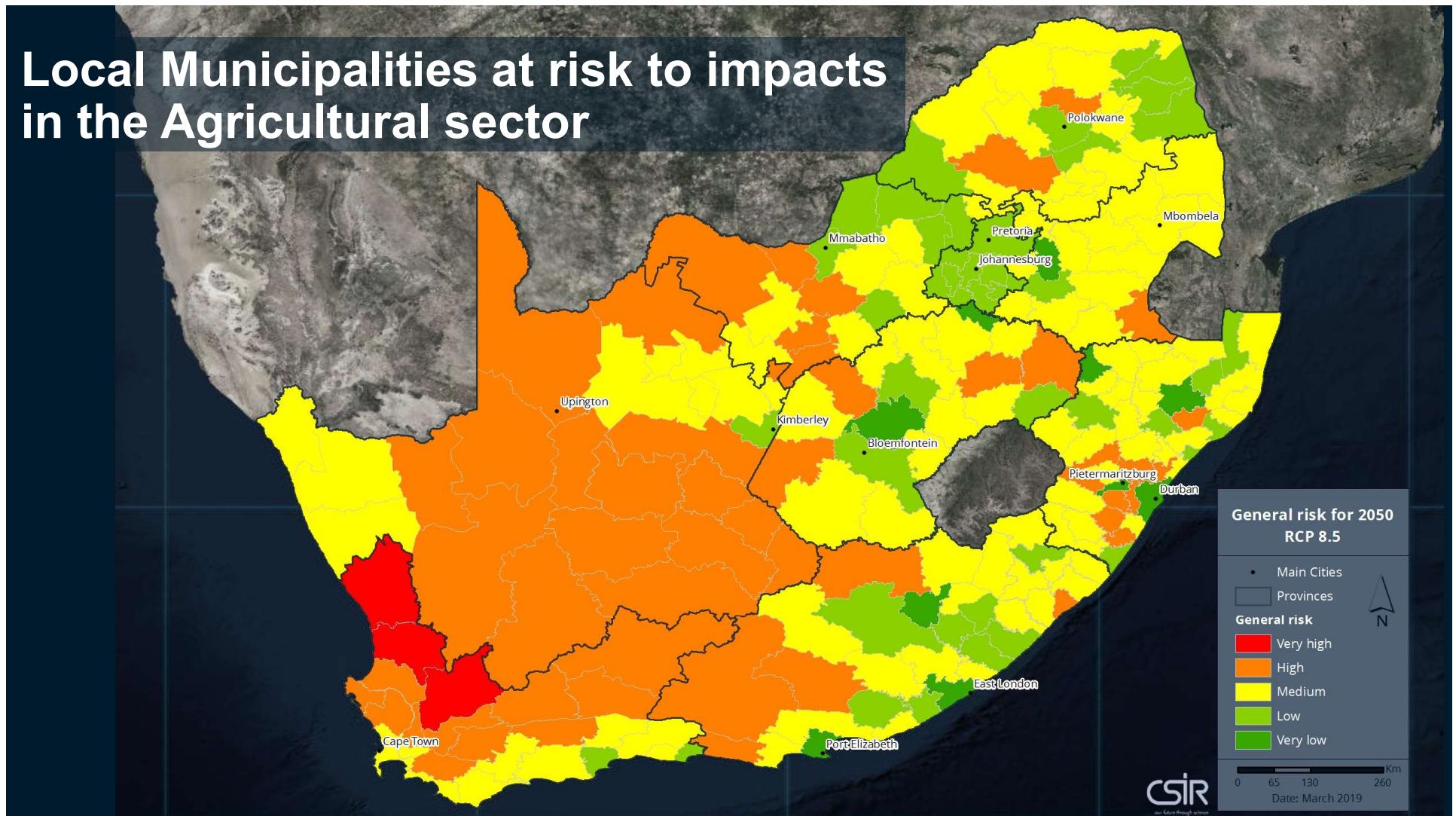


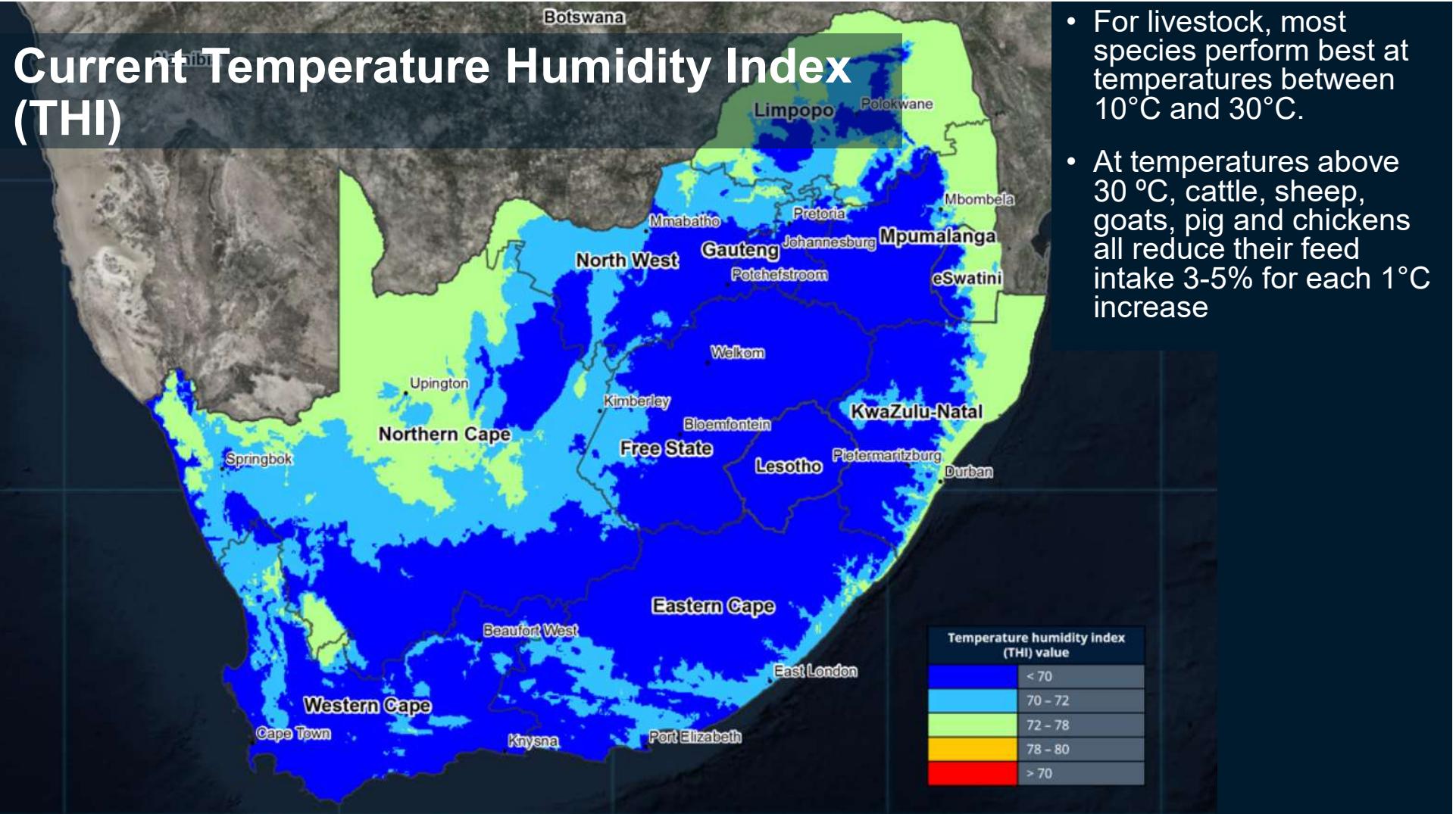
## 2050 Relative change in water supply vulnerability

- Water demand overtaking water supply well before 2050 in the high population growth municipalities.
- Largely attributed to population growth

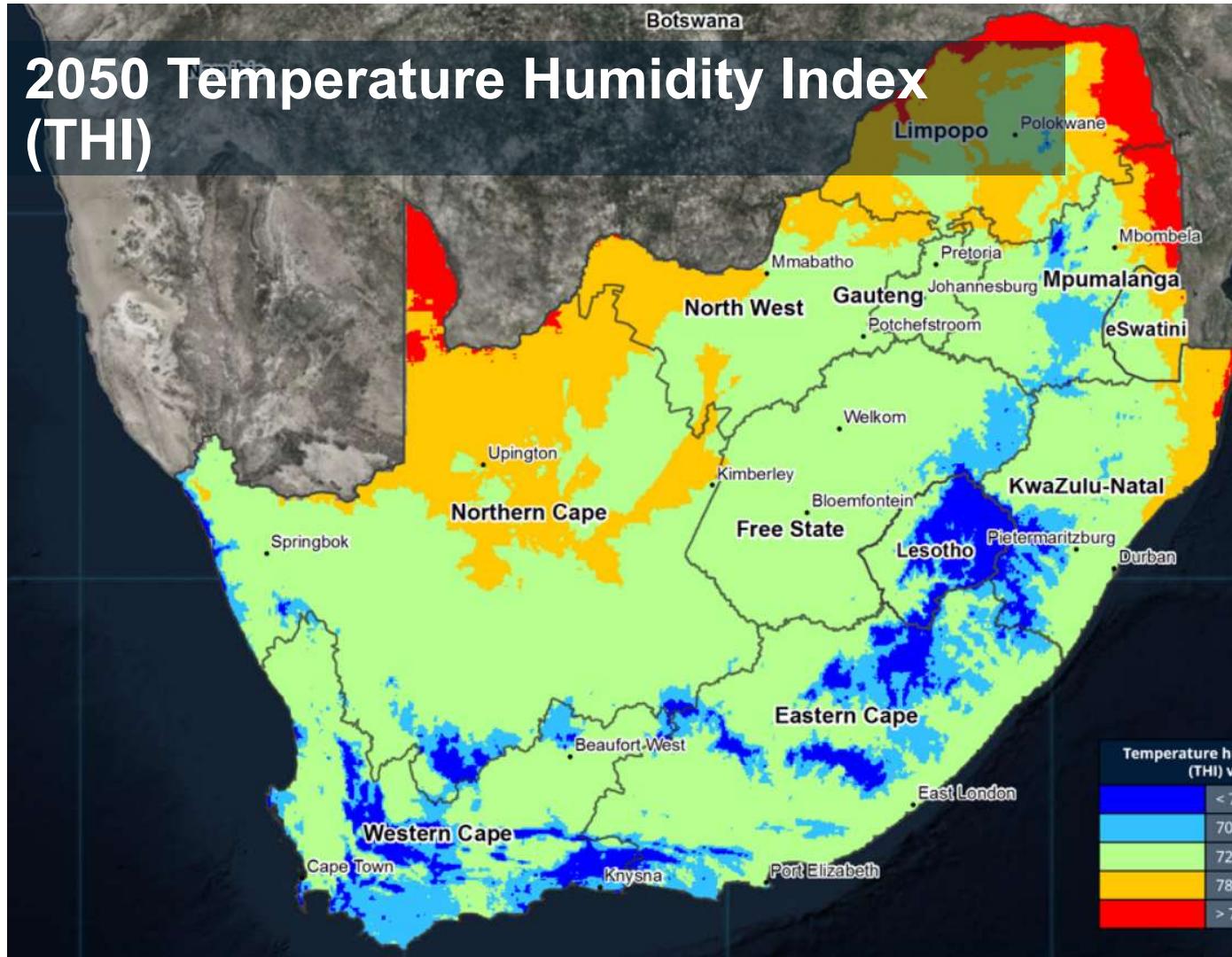


# Local Municipalities at risk to impacts in the Agricultural sector





# 2050 Temperature Humidity Index (THI)



- Heat stress could affect production through reduced growth and reproduction performance, reduced meat yield and quality, reduced wool production and quality, and increased deaths and illnesses due to heat and nutrition stress.
  - Settlements such as **Calvinia, Carnarvon, Fraserburg, Loxton, Noupoort, Petrusville, Richmond and Victoria West** could be especially vulnerable as they depend almost wholly on the livestock sector.

## Top 10 AFF Municipalities

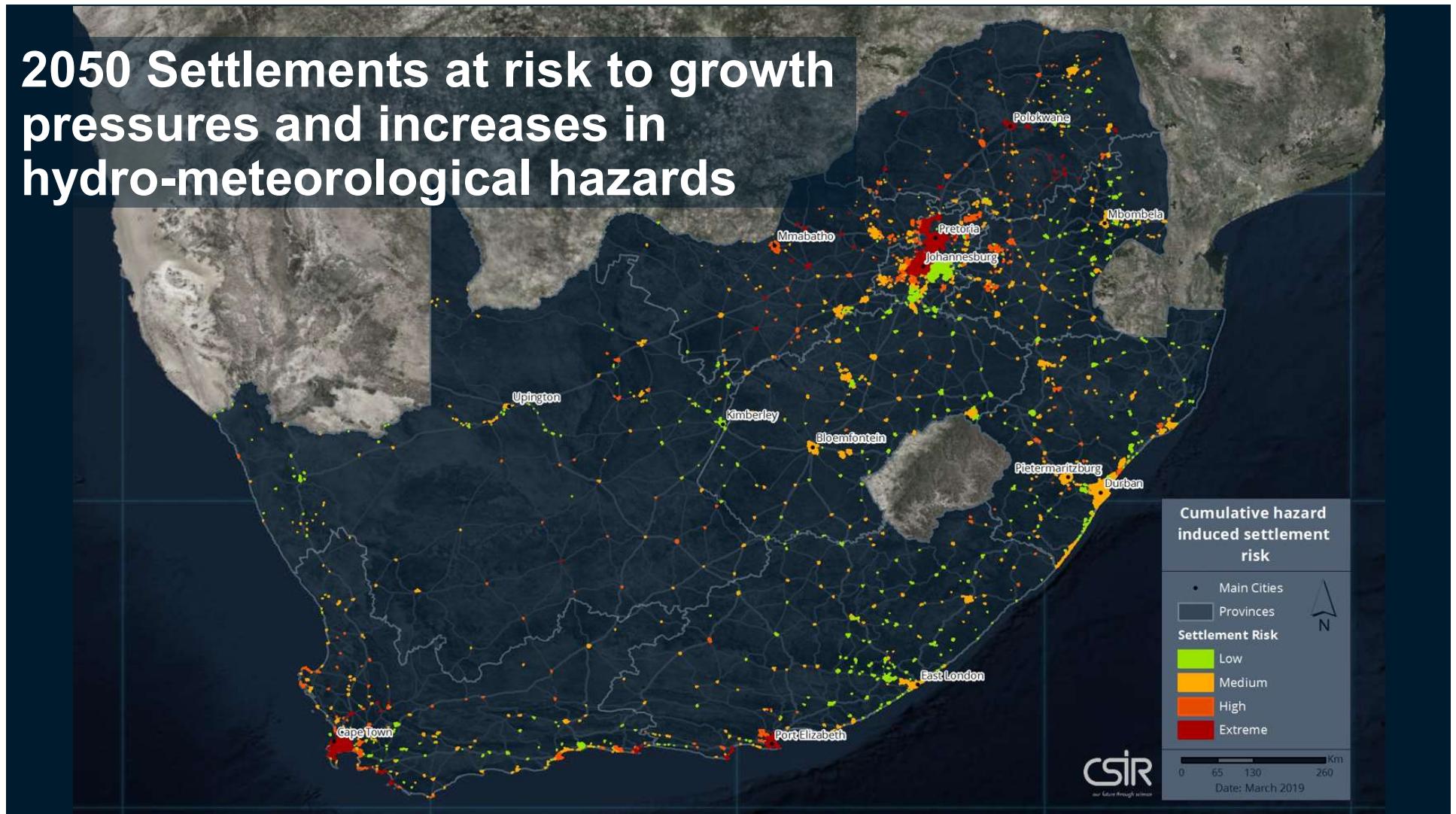
Municipality	GVA	Employment
1. Kai !Garib	37.51%	64.34%
2. Impendle	37.34%	34.63%
3. Richmond	37.13%	40.36%
4. Mkhambathini	35.20%	48.88%
5. Mpofana	34.07%	37.42%
6. uMshwathi	33.73%	45.04%
7. !Kheis	31.23%	55.74%
8. Karoo Hoogland	30.80%	42.52%
9. Bergvlier	29.92%	52.09%
10. Mthonjaneni	29.74%	30.40%

Current AFF contributions

RCP 8.5			
Municipality	Agriculture	Forestry	Fishery
1. Kai !Garib	-8.52%	-4.22%	-1.71%
2. Impendle	-4.29%	-3.47%	0.00%
3. Richmond	0.00%	0.00%	0.00%
4. Mkhambathini	-10.66%	-9.62%	0.00%
5. Mpofana	0.03%	0.02%	0.02%
6. uMshwathi	0.00%	0.00%	0.00%
7. !Kheis	-10.90%	-4.34%	0.00%
8. Karoo Hoogland	-7.17%	0.00%	-1.45%
9. Bergvlier	1.78%	-2.94%	0.35%
10. Mthonjaneni	-6.32%	-4.70%	0.00%

2050 Economic Impacts

# 2050 Settlements at risk to growth pressures and increases in hydro-meteorological hazards





6.

## ADAPTING OUR SETTLEMENTS

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# Adaptation Actions to address heat stress



DESCRIPTION GOALS BENEFITS COSTS EXAMPLE CREDITS LINKS

Sharing of multi-use facilities can save on land costs and reduce trips. It can also contribute to better service delivery and financial sustainability. Multi-use facilities with air-conditioning can act as cooling centres to reduce the risk of heat-related illness during heat-waves. They can also provide access to safe drinking water and electricity access during no service cut-offs or delays. Community centres will also assist with social cohesion where for example groups often isolated (e.g. elderly or immigrants) from society can meet.

## Plan for multi-use public facilities



Win-Win

LAND USE MANAGEMENT



## SUPPORTING ACTIONS

Identify critical disaster response infrastructure

Identify critically vulnerable communities

Design permeable settlement layouts

Design adequate turning circles and emergency access

Protect critical infrastructure

Ensure water for fire-fighting

# Adaptation Actions to address heat stress



DESCRIPTION GOALS BENEFITS COSTS EXAMPLE CREDITS LINKS

During layout planning, plots should be orientated north-south to encourage buildings that promote passive heating and cooling. Settlement layout can promote passive heating and cooling by having plots orientated on a north-south axis and roads running east-west, as far as the slopes and gradients allow. If the long side of the plot faces north, the building could be orientated towards the sun, and this could potentially reduce the need for heating and cooling, and make it easier to install solar panels.

Design north-south orientated plots



Win-Win

LANDSCAPE & URBAN DESIGN



SUPPORTING ACTIONS

Mimic the natural landscape in layout planning

Design permeable settlement layouts

Design to facilitate the flow of prevailing winds

# Adaptation Actions to address heat stress



DESCRIPTION GOALS BENEFITS COSTS EXAMPLE CREDITS LINKS

Increase the surface area coverage of natural vegetation by planting trees, shrubs and other vegetation. Urban vegetation and forests play an important part in the defence of cities against climate change. By increasing the area covered by natural vegetation, surface temperatures in settlements can be significantly reduced. Vegetation provides cooling through evapotranspiration, reflectance (vegetation has a much higher albedo, which means that less energy is absorbed and stored to warm the local environment), and the direct shading of man-made urban surfaces. Vegetation indigenous to South Africa generally requires far less irrigation and indigenous, water-wise vegetation should be used for greening. Identified areas should be highlighted in the Spatial Development Framework.

## Increase vegetation coverage



Win-Win

ENVIRONMENTAL PLANNING



## SUPPORTING ACTIONS

Identify all key ecosystems and protected areas

Identify areas where vegetation coverage can be increased

Protect key ecosystems and protected areas

Green and shade public spaces

Clear invasive alien plants and prevent invasions

Use indigenous plant species

Maintain and rehabilitate dunes

Rehabilitate ecosystems and maintain ecological infrastructure

# Adaptation Actions to address heat stress



DESCRIPTION GOALS BENEFITS COSTS EXAMPLE CREDITS LINKS

It is important to protect critical infrastructure as much infrastructure (such as bridges and sewer systems) entails significant investment and must serve for decades. Local, and sometimes regional, development patterns also flow from infrastructure. So it is critical that any infrastructure is designed to be able to withstand climate-related hazards specific to its locality. Critical infrastructure is identified based on its exposure to climate risks and the importance of that infrastructure to the functioning of the settlement. Critical infrastructure relating to transportation, potable water, sanitation systems, energy systems, information and communication technology, and solid waste management needs to be sufficiently protected from climate risks. Protection measures include, but are not limited to: fortifying and/or elevating vulnerable critical infrastructure; constructing levees or seawall; and, developing natural buffer zones around critical infrastructure. Where possible, designs should allow for flexibility to incorporate future augmentations as required by changing climate conditions.

Protect critical infrastructure



No Regrets  
Low Regrets

ENGINEERING SERVICES



SUPPORTING ACTIONS

Identify critical disaster response infrastructure

Identify existing vulnerable infrastructure

Plan for multi-use public facilities

Protect and maintain ICT infrastructure

Protect and maintain road and public transport infrastructure

Protect and maintain electricity networks



The purpose is to highlight **settlements** that need to start thinking **creatively** about how **adaptation** actions can **strategically** be woven into the **design** of these settlements in order to **protect** the lives of its occupants and ensure a **sustainable resilient future**.



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*adapting settlements for the future*

## GET IN TOUCH

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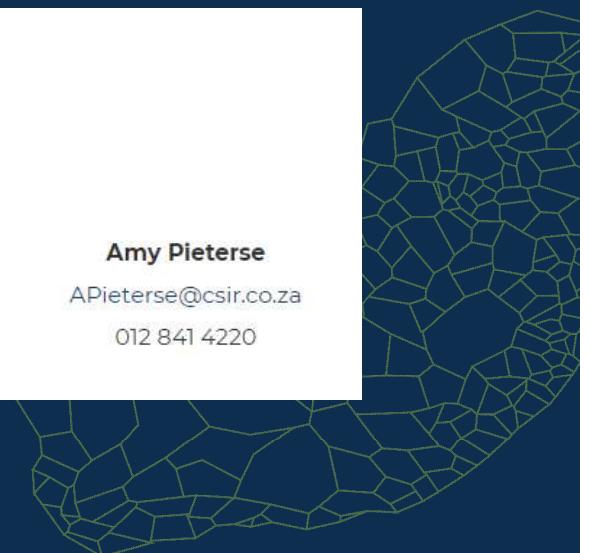
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## References

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