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CSIR launches novel online climate risk profiling and adaptation tool: The Green Book

The Council for Scientific and Industrial Research (CSIR) has recently launched a state-of-the-art online climate risk profiling and adaptation tool to assist municipalities across South Africa to assess their risk and vulnerabilities, and respond by adapting settlements to climate change. The Green Book looks forwards to the year 2050 by projecting settlement growth combined with quantitative, scientific evidence of the likely impacts that climate change will have on South African towns and cities and its key resources. The tool provides appropriate adaptation measures to be considered for implementation towards the development of climate resilient settlements. The ultimate goal of the Green Book is to contribute to resilient, sustainable and liveable South African settlements through climate change adaptation. Co-funded by the Canadian International Development Research Centre and the CSIR and produced in collaboration with South Africa's National Disaster Management Centre, the Green Book is the result of a 3-year initiative. More than 50 researchers and numerous stakeholders and reviewers were involved in producing the Green Book and reviewing its findings.

There has been a proliferation of weather-related disasters globally and an increase in associated damage in terms of geographical extent, size of affected population and economic costs.¹ The rapidly changing climate is a key global challenge that needs action from all spheres of society. Environmental risks – namely extreme weather events, climate change mitigation and adaptation policy failure, and natural and anthropogenic environmental disasters – are currently ranked among the top ten global risks in terms of likelihood and impact.²

South Africa has not been spared from the impacts of climate-related disasters in recent years (Figure 1). Extreme weather events observed over the region have resulted in increased frequency and intensity of fires, floods, hailstorms and droughts.³ The severe drought that threatened to leave more than 4.2 million residents and businesses in Cape Town without water between April and June 2018 is an indication of the vulnerability of the country to climate change. The economic cost associated with the drought for the 5-month period from January to May 2018 was in excess of ZAR1.2 billion,⁴ while damages from the Knysna fires and storm-related flooding in Cape Town in the 5-month period from June to October 2017 is estimated to have cost more than ZAR4 billion. Other parts of South Africa were also gripped by the multi-year drought between 2015 and 2018. Vegetation greenness indices derived from satellite data revealed that six of the nine provinces were experiencing drought conditions in 2015.⁵

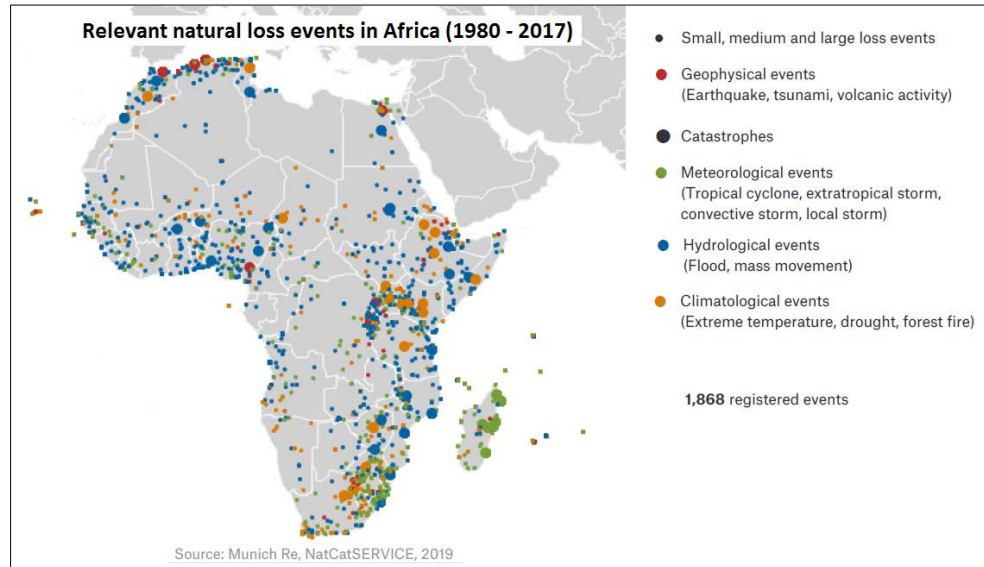


Figure 1: Loss incidents in Africa as a result of natural disasters, 1980–2017.⁶

The current development trajectory of many settlements in South Africa is one of urbanisation combined with poor economic performance and growth. This tendency diminishes the coping capacity of many municipalities to deal with climate change and its impacts, and exacerbates the vulnerability and exposure of people and places to social, economic and environmental shocks. The increase in the intensity and frequency of hydrological, meteorological and climatological hazards is furthermore threatening the livelihoods of many vulnerable people as well as the development gains made by local government. Disregarded, these factors have the potential to significantly increase the risk of loss of lives, livelihoods and economic assets.⁷ The role of adaptation planning is thus vital in reducing the exposure of municipalities, settlements, neighbourhoods and infrastructure to the potentially devastating impacts of climate-induced hazards.

The Green Book made a number of novel and groundbreaking scientific advances in the fields of climate change, risk and vulnerability. Key advances and significant research findings include: (1) a set of detailed projections of future climate change covering South Africa at an 8x8 km² resolution – the most detailed projections of future climate change available for the entire country; (2) new models to quantify the impact of climate change on the exposure of South African

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settlements to various hazards (including drought, wildfires, inland floods and coastal flooding); (3) a vulnerability assessment framework and set of indicators to profile all 213 local municipalities in South Africa based on four unique statistically developed indicators, 1637 settlements based on six unique indicators, and two spatial multi-criteria indicators that capture vulnerability on a neighbourhood level; (4) a population potential growth model to forecast settlement growth across South Africa at a 1x1 km² resolution – the first settlement population growth model to be developed on the African continent; (5) risk profiles that provide temporally dynamic risks for each municipality and settlements in South Africa for the present and a 2050 future; and (6) a menu of customisable adaptation actions that brings together mutually reinforcing planning and design actions appropriate for the South African context and local planning function.

The research was conceptualised from a strong disaster risk reduction and climate change adaptation science base, grounded in the conceptual framework and definitions of the Fifth Assessment Report of the United Nations Intergovernmental Panel on Climate Change Working Group 2.⁸ A framework, approach and set of terminologies that places the concept of disaster risk at its centre (Figure 2).

The Green Book combines several research techniques, analysis methods, models and approaches from various domain disciplines into a coordinated and coherent product, capable of responding to the impending impacts that a shifting climate and urbanising population will have on settlements and key resources. The interdisciplinary nature of the Green Book, which combines high-resolution scientific evidence with adaptation solutions, makes this one of the most novel, innovative and information-dense research platforms about disaster risk and climate adaptation planning on the African continent.

The main output is the Green Book online interactive tool to support long-term municipal planning with the development of climate-resilient settlements, available at www.greenbook.co.za. The Green Book website is structured into three main components:

1. The first component is a series of interactive national story maps for coastal flooding, floods, wildfires, drought, settlement vulnerability, urban growth, climate change, the economy, agriculture, forestry and fisheries, surface water and groundwater. Users are able to browse through these story maps to learn more about the research methodology, findings and recommendations, as well as to access the technical reports and interactive data sets. The 11 story maps can be accessed at <https://greenbook.co.za/story-maps.html>.

2. The second component is the municipal Risk Profile Tool – an interactive tool that grounds the adaptation process in scientific evidence of the risks each local municipality in South Africa is likely to face under a changing climate by 2050. The Risk Profile Tool provides temporally dynamic risk profiles for each municipality and its settlements in South Africa. These profiles provide information on vulnerabilities, population projections, exposure to climate hazards, and the impacts of climate change on some of South Africa's municipalities' key resources. The Risk Profile Tool is available at <https://riskprofiles.greenbook.co.za/>.
3. The third component is the municipal Adaptation Actions Tool – an interactive platform to support adaptation planning in local municipalities. The Adaptation Actions Tool provides a range of planning and design actions for consideration to adapt settlements to the likely impacts of climate change, to climate proof settlements, and to reduce exposure and vulnerability to hazards, and thus the risk for disaster. Guidelines for selecting and prioritising adaptation actions to the local municipal context are also provided (<https://greenbook.co.za/adaptation-support.html>). The Adaptation Actions Tool is available at <https://adaptationactions.greenbook.co.za/>.⁷

Complementary to the Green Book is *The Neighbourhood Planning and Design Guide* (the Red Book), developed by the CSIR for the Department of Human Settlements. The Red Book is aimed at built environment practitioners, and it supports the development of sustainable human settlements by providing practical information related to the planning and design of the services and infrastructure typically provided as part of a neighbourhood development project. Whereas the Green Book proposes a basket of mutually supportive adaptation interventions to be integrated into a range of local planning instruments to adapt settlements to climate change risks in the future, the Red Book provides more detailed design guidelines for some of these interventions e.g. stormwater design.

The Green Book has been received with much anticipation and enthusiasm by public, private and NGO organisations involved in the climate adaptation field. The South African Department of Environmental Affairs, the National Disaster Management Centre and Santam are committed to partner with the CSIR in Phase II of the Green Book. This phase will focus on rolling out the Green Book for implementation at municipalities most at risk, identifying gaps in research and development of this kind, and building the capacity of officials and departments to deal with climate change adaptation.

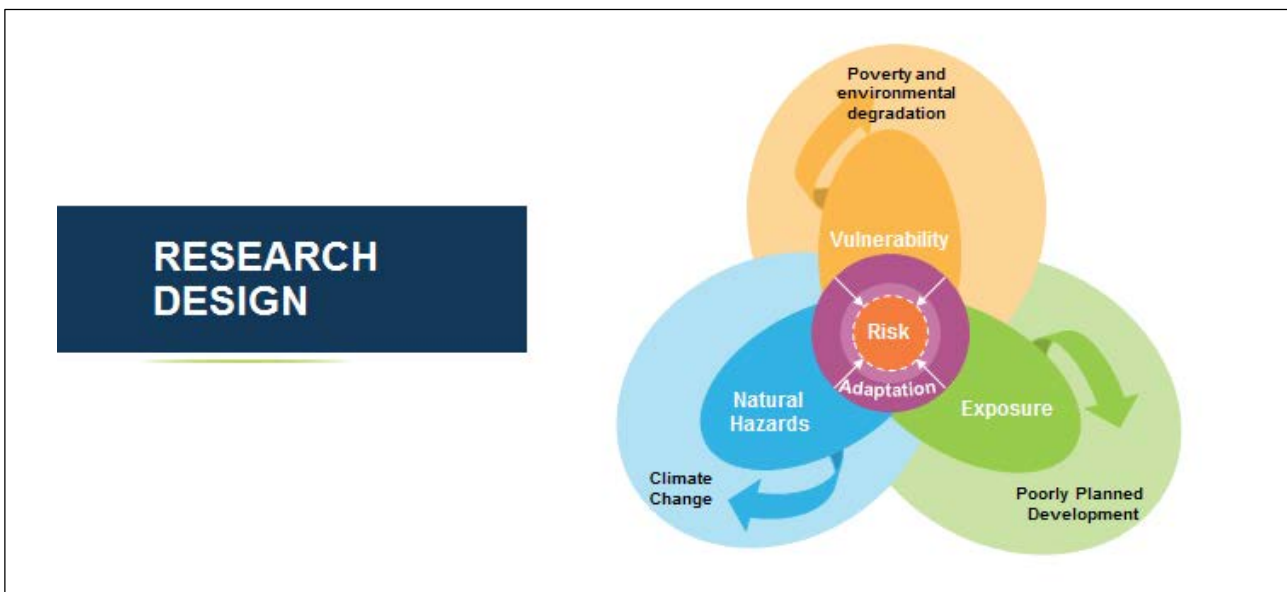


Figure 2: Green Book research design and terminologies (adapted from Niang et al.⁸).



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