RESEARCH BRIEF 2

Climate change risk and vulnerability mapping

Southern Africa will not uniformly feel the impacts of future climate change. Countries in the region have different challenges and vary in their ability to adapt to changing climate and extreme weather conditions. RCCP scientists have explored the use of mapping as a tool for identifying southern Africa's vulnerability hotspots and its readiness to deal with climate change.

Identifying vulnerable hotspots

The RCCP team carried out a geographic hotspot analysis of areas where climate change stressors currently have the greatest impact on food security and, to some extent, health.

The countries of southern Africa have differing climates and soil and water resources, diverse ecosystems, distinct land use and social systems as well as varied economic strengths and weaknesses. Smallholder farmers rely on rain to produce more than 80% of the region's food. Thus, climactic conditions directly affect household food security within the region. Climate change projections indicate further warming, increasingly erratic rainfall and more droughts and floods. This will worsen the existing food security crisis, and also heighten the risk of fatal and debilitating diseases. Effective planning for adaptation to climate change must take into account the differential vulnerabilities of people across this vast region. Mapping based on Geographical Information Systems (GIS) is a powerful tool for this purpose.

How vulnerable people are to climate change depends on how exposed they are to climate risk factors, how sensitive their natural and human systems are to these risk factors, as well as their ability to manage and respond to those risks (see Fig. 1).

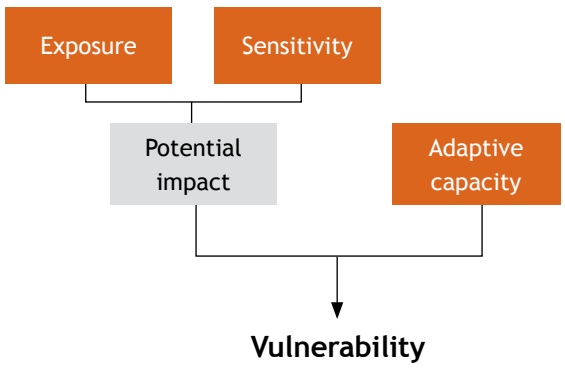

Fig. 1: The framework used for the vulnerability mapping.

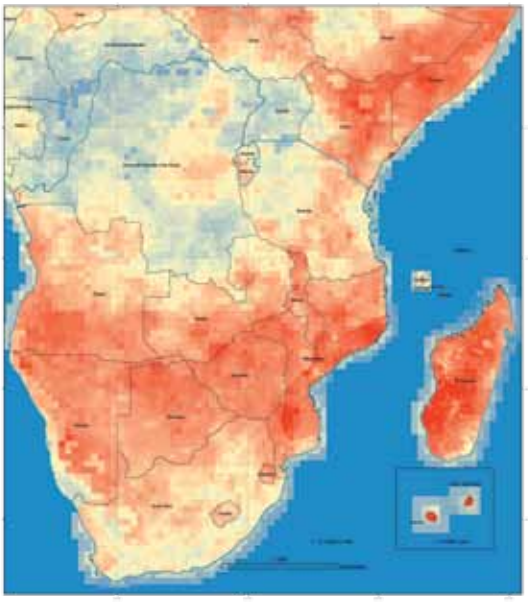

Fig. 2(a) EXPOSURE 2008: Current exposure to climate variability and extremes. Red indicates high exposure; blue indicates low exposure.

Fig. 2(b) EXPOSURE 2050: Projected exposure to climate variability and extremes by 2050. Red indicates high exposure; blue indicates low exposure.

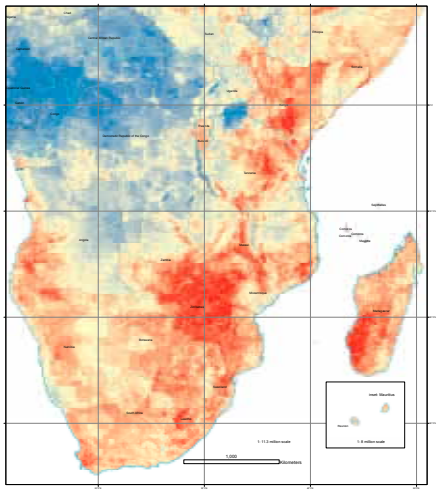

Fig. 2(c) POTENTIAL IMPACT 2008: Areas at greatest risk (sensitivity combined with exposure). Red indicates high impact; blue indicates low impact.

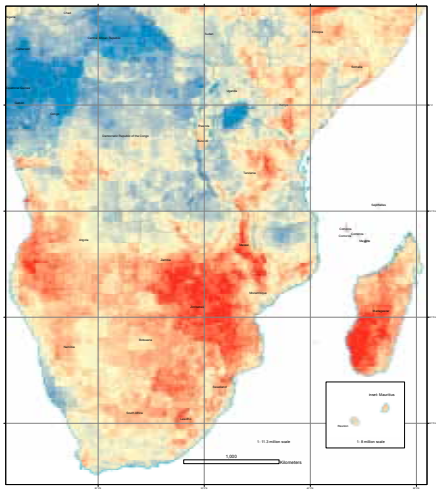

Fig. 2(d) POTENTIAL IMPACT 2050: Areas at greatest risk (sensitivity combined with exposure). Red indicates high impact; blue indicates low impact.

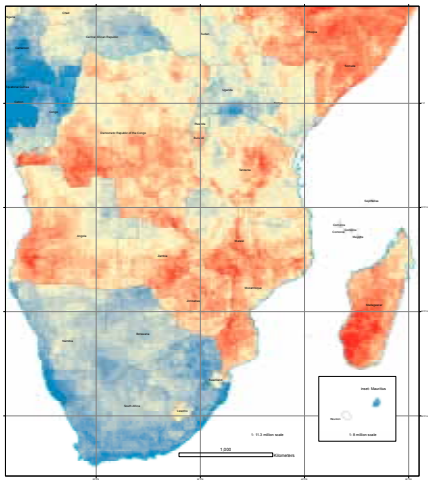

Fig. 2(e). HOTSPOTS 2050: vulnerability hotspots of southern Africa, an overlay of impact (Fig. 2(b) and adaptive capacity. Red indicates high vulnerability; blue indicates low vulnerability.

Data and methods

Datasets were chosen for their statistical reliability and geographic representation. 51 indicator databases were used, representing three categories:

- adaptive capacity (19 indicators)
- sensitivity (16 indicators)
- exposure to climate variability and extremes (16 indicators).

The status quo (2008) and future (2050) datasets were combined in weighted overlay models for each category to produce a summary layer of each (examples presented in Figs. 2(a) and (b)).

RCCP scientists combined the values from the sensitivity analysis with those of the exposure analysis to produce a single layer which represents impact. This represents the best estimate for the geographic distribution of the current and future climate-related 'problems' that people face across southern Africa (Figs. 2 (c) and (d)).

They then combined this impact layer with the values from the adaptive capacity analysis in order to reveal vulnerability hotspots where local people are in greatest need of assistance in dealing with these impacts (Fig. 2(e)).

Stressor
Something that disturbs normal functioning
Weighted overlay
A GIS technique for overlaying several datasets using a common measurement scale and weighting each according to its importance.

Key outcomes

The greatest exposure to climate risk currently follows a broad latitudinal band, roughly between about 12 and 25°S. While the eastern areas experience periodic droughts, floods and cyclones, arid regions in the south-west are also exposed to climate risk. This band is projected to extend south to about 30°S (including the South African highveld) and into the north-western parts of the SADC region by mid-century. Areas of worsening potential impact include eastern and northern Angola, parts of the Democratic Republic of the Congo (DRC), southern Malawi, parts of Madagascar and southern and western Zambia.

Regions of current high climate vulnerability are likely to remain highly vulnerable into the future unless adaptive capacity can be substantially improved. By mid-century, climate- and population-driven vulnerability is projected to be clustered in five major hotspots: (1) the central-eastern part of continental southern Africa (Mozambique, Malawi, Zimbabwe, Zambia); (2) north-central Tanzania; (3) Madagascar; (4) southern and north-western Angola; (5) southern and western DRC. The south-west block (South Africa, Botswana, Namibia) and Mauritius are less vulnerable on account of their higher adaptive capacity, at a national level. This is also the case, to a smaller degree, for Lesotho and Swaziland. This does not diminish the fact that highly vulnerable communities also exist in these regions, which will be in need of assistance in dealing with increased climate-related risk brought about by climate change.

By Rob Davies, Stephanie Midgley and Sabrina Chesterman

Rob Davies is a private consultant with expertise in using Geographic Information Systems (GIS) to map and analyse biodiversity and conservation priority areas.

Stephanie Midgley is a plant and crop scientist at OneWorld, with a special interest in climate change and food security, and is currently lead researcher for the RCCP.

Sabrina Chesterman is a climate change analyst at OneWorld, and a researcher for the RCCP.

UKaid from the Department for International Development

Sida

IMPLEMENTED BY: OneWORLD We build resilient futures

2nd Floor • 4 Church Square, Spin Street, Cape Town 8001
Tel: +27 21 818 2900 • Fax: +27 21 818 2932
email: info@rccp.co.za • www.rccp.org.za • www.oneworldgroup.co.za

Disclaimer: This material has been funded by UKaid from the Department for International Development. However, the views expressed do not necessarily reflect the department's official policies. While reasonable efforts have been made to ensure that the contents of this publication are factually correct, the Department for International Development does not take responsibility for the accuracy or completeness of its contents and shall not be liable for loss or damage that may be occasioned directly or indirectly through the use of, or reliance on, the contents of this publication.